**Databases of L-shell X-ray intensity ratios for various elements after photon excitation**

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**Abstract**: In this study, a comprehensive dataset of X-ray emission intensity ratios has been compiled, including , , , , , , , , , and , extracted from literature spanning the years 1971 to 2023, and encompassing 83 research papers. Over this timeframe, a total of 2603 values were collected, comprising some 680 values for , 696 values for , 617 values for , along with 132, 132, 90, 60, 70, 71, and 55 data points for ,, , , , , and , respectively. The reported values are presented with precision up to three to four decimal places, accompanied by their associated uncertainties. Additionally, the tables include calculated weighted averages , uncertainty values ∆, combined standard deviations , and average *z*-scores for these intensity ratios. The data encompasses elements ranging from 39Y to 94Pu when excited by photon bombardment. The assessment of how these experimental data values are distributed according to atomic number indicates extensive coverage across most elements. However, a few isolated instances were identified where either no data or fewer than two data values were available.

**Keywords:** X-rays, atomic parameters, intensity ratios, weighted average values.

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1. **Introduction**

Data on the L sub-shell X-ray production cross sections, fluorescence yields and intensity ratios are needed for many scientific, medical and engineering applications (Akman *et al*., 2015). Intensity ratios play a significant role in nuclear spectroscopy and atomic physics. Extensive research across different disciplines has been dedicated to these quantities, resulting in their summarization in several comprehensive review articles. Investigating these parameters for elements on the periodic table has been a primary focus of various experiments, along with growing theoretical interest, in recent years. This interest stems from their potential applications in non-destructive elemental analysis in fields such as medical physics, surface chemistry, environmental sciences, nuclear safeguards, materials accountancy, and industry. Numerous efforts have been made to determine L-shell intensity ratios across a diverse set of elements, either through the application of theoretical models or by fitting experimental data using empirical and semi-empirical formulas.

Scofield (1974) performed a Hartree-Slater calculation, including relativistic effects, to determine L X-ray emission rates for elements ranging from *Z* = 5 to *Z* = 104. Subsequently, Campbell and Wang (1989) presented a comprehensive collection of ( *i*= 1-3) subshell X-ray emission rates for all elements with *Z* =18-94, obtaining these values through interpolation from the tabulated Dirac-Fock (DF) model based data originally provided by Scofield (1974). Theoretical L-shell intensity ratios for elements with atomic number 36 ≤ *Z* ≤92 were calculated by (Kumar *et al*., 2010) using the Dirac-Hartree-Slater model for incident photon energies in the range .

In 2014, Puri (2014) compiled intensity ratios, specifically (*k* = l, η, , , , , , , , , , , , ), and (*j* = β, γ), for all elements with atomic numbers ranging from 35 to 92. These ratios were evaluated for incident photon energies starting from the sub-shell (*i* = 1–3) binding energy, with the calculations based on the Dirac–Fock model. The aim of that work was to provide a comprehensive dataset of intensity ratios for various elements and photon energies, which is valuable for understanding the behavior of X-rays in different materials.

Several researchers and research groups have determined experimentally the values of the L-shell X-ray intensity ratios. The photon-induced relative intensities of L-shell X-rays, including and for 79Au (Chang and Su, 1978), and for 79Au, 82Pb, 90Th and 92U (Shatendra *et al*., 1983), were measured in the energy range 17 ≤ E ≤ 60 keV. Yalçin *et al*. (2008) determined intensity ratios for elements 66Dy, 67Ho, 70Yb, 74W, 80Hg, 81Tl, and 82Pb by radioactive decay and photo-ionization. Demir and Sahin, (2008) calculated intensity ratios for some elements spanning 73 ≤ *Z* ≤ 92 using 59.54 keV excitation photons in an external magnetic field with intensities ±0.75 T. In the study of Aylikci *et al*., (2015), new interpolations (empirical and semi-empirical) of L X-ray intensity ratios of elements have been performed in the range 50 ≤ *Z* ≤92.

Researchers have employed a multitude of experimental techniques and diverse conditions to investigate intensity ratios. There are over a thousand measured data points in the technical literature. Extracting valuable and crucial insights from this vast dataset necessitates a comprehensive analysis. In the present paper, new databases containing L-line intensity ratios , , , , , , , , , and were obtained directly from various sources. These databases comprise a total of 2603 published values from 1971 to April 2023 and cover elements with atomic numbers in the range 39 ≤ *Z* ≤ 94. The weighted mean values, average *z*-scores, and combined standard deviations have been calculated for each element and ratio and are also presented in the databases.

1. **Review of calculation errors (standard deviation)**

In the current research, we carried out an in-depth analysis of ten databases and their calculation methodologies. It is worth noting that the data consolidated in this study can be categorized into five different groups:

1. X-ray intensity ratios are given and their related uncertainties (standard deviation are indicated as a percentage (*p*%) in the texts by ( Singh *et al*., 1987a; Singh *et al*., 1987b; Singh *et al*., 1987c; Singh *et al*., 1989; Al-Salah and Saleh, 1999; Saad, 2003; Cengiz *et al*., 2010a; and Duggal *et al*., 2022). In this context, the (absolute) standard deviation is computed as follows:

|  |  |
| --- | --- |
|  | (1) |

where *i* = β, γ, η, l, , , and ; *j* = α, β, and γ.

1. Intensities and their corresponding uncertainties are provided for and , as reported in the works of (Mehta *et al*., 1985; Mehta *et al*., 1986; Mehta *et al*., 1987a; Mehta *et al*., 1987b; Chand *et al*., 1989; Chand *et al*., 1992a; Chand *et al*., 1992b; Demir *et al*., 2008). In these instances, the target ratio is computed directly by dividing by .

The standard deviation of the ratio is determined by applying the following expression:

|  |  |  |  |
| --- | --- | --- | --- |
| here *i* = β, γ, η, l, , , and ; *j* = α, β, and γ.   |  |  | | --- | --- | | 1. The text of the research paper provides information on the X-ray intensity ratios and their associated uncert ainties ∆(). These data are sourced from multiple references, including works by (Rao *et al*., 1971; Shatendra *et al*., 1982; Shatendra *et al*., 1983; Bahan *et al*., 1987; Raghavaiah *et al*., 1987; Tan *et al*., 1990; Darko and Tetteh, 1992; Ertuǧrul, 1996; Ertuǧrul *et al*.,1997; Dogan *et al.,* 1998; Ismail and Malhi, 2000; Simsek, 2000; Baydas *et al*.,2001; Durak and Özdemir, 2001; Tirasoglu *et al.,* 2003; Küçükönder *et al*.,2004; Öz *et al.,* 2004; Sӧǧüt *et al*., 2005; Karabulut and Gürol, 2006 ; Demir and Sahin, 2007a; Demir and Sahin, 2007b; Yalçin *et al*.,2008; Kaçal *et al*.,2011; Porikli, 2011; Porikli, 2012; Cesareo *et al*.,2013; Durdagi, 2013; Akman *et al*.,2015; Wang *et al*.,2015; Krishnananda *et al*., 2016; Bansal *et al*., 2017; Porikli, 2017; and Hiremath *et al.,* 2019). In these cases, the calculation of the ratio is performed as follows: |  | | (2) |
|  | (3) |
| Furthermore, the standard deviation linked to the ratio ∆() is determined  through the following formula: |  |
|  | (4) |

for *i* = β, γ, η, l, , , and ; *j* = α, β, and γ.

1. The reporting authors provide the X-ray intensity ratios, and they express in their text the associated uncertainties as a percentage (*p*%), as observed in (Raghavaiah *et al*., 1990). Consequently, the standard deviation for the ratio ∆() is determined using equation:

|  |  |
| --- | --- |
|  | (5) |

In this context, the calculation of ∆() is performed according to:

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | (6) |
| for *i* = β, γ, η, l, , , and ; *j* = α, β, and γ.   1. Regarding the other reviewed articles, the uncertainties (expressed as standard deviations) ∆() for the X-ray intensity ratios are explicitly stated in the text of (Salem and Winchell, 1974; Chang and Su, 1978; Garg *et al.,* 1984; Verma *et al*.,1985; Garg *et al.,* 1986; Saleh *et al.,* 1988; Rao and Gigante, 1993; Rao *et al.,* 1993; Dhal and Padhi, 1994; Rao *et al.,* 1995; Ertuǧrul, 1996; Ertuǧrul, 1997 ; Sӧǧüt *et al.,* 1997; Küçükönder, 2002; Salah,2004; Turgut and Ertuǧrul, 2004; Salah and Al-Jundi, 2005; Zou *et al.,* 2006; Aylikci *et al.,* 2007; Demir and Sahin, 2008; Han *et al.,* 2008; Cengiz *et al.,* 2010b; and Puri, 2011; Aksoy *et al.,* 2012; Durdu and Küçükönder,2012; Kumar and Puri, 2012; Alqadi *et al.,* 2013; Aylikci *et al.,* 2015; Dogan *et al.,* 2015; Kaur *et al.,* 2016; Kaur *et al.,* 2018; Ayri *et al.,* 2021; Fernandez-Ruiz, 2021and; Alqadi *et al.,* 2023), making them immediately applicable without further calculation. |  |

1. **Survey of the experimental works**

Table 1 gives an extensive overview of (*i* = β, γ, η, l, , , and ;  *j* = α, β and γ) intensity ratio measurements collected between 1971 and 2023. These measurements were carried out using a variety of experimental techniques and under various experimental conditions. The table includes atomic parameters for elements spanning from 39Y to 94Pu, along with the corresponding references, excitation sources employed, target sample types, and X-ray spectrometers used. Regarding excitation sources, they encompass photons. Photon sources commonly involve the use of 59.5 keV γ-rays emitted from a 241Am radioactive source whenever feasible, although 122 keV γ-rays 57Co and 22.69 keV X-rays from 109Cd are also frequently employed. Numerous other radioactive sources are also used. As for target samples, they come in the form of pure elements, alloys, or compounds, and can be found as powder samples, foils, pellets, or circular discs. Various detectors types are employed to measure the X-ray emissions, with the most prevalent ones being single crystal semiconductors such as Si(Li) and Ge(Li) detectors. The resolution of these detectors may vary depending on the manufacturer and model.

1. **Data analysis**

(i = β, γ, η, l, , , and ; j= α, β, and γ) intensity ratio data, sourced from referenced papers, have been tabulated in a four-digit format, accompanied by measurement error estimates at the standard deviation level. The compilation of these ratios is meticulously summarized in 10 tables (Table 2-11), encompassing elements within the atomic number range of 39Y to 94Pu. Each table includes not only the ratio data but also references to their origin. Additionally, comprehensive statistical analyses were conducted for each item and ratio, leading to the determination of weighted mean values , mean *z*-scores , and combined standard deviations , thereby enhancing the dataset's reliability and comprehensiveness. The formula employed for computing the weighted average values in this study is as follows:

|  |  |
| --- | --- |
|  | (7) |

In Eq. (7),  represents the *n*th experimental intensity ratio, *N* stands for the count of experimental data points, and denotes the uncertainty associated with the *n*th experimental value.

A natural way to visually present the deviation of the individual experimental points from the corresponding weighted mean for the element is to plot the signed deviation in multiples of the combined standard deviation defined by:

(8)

where and refer to the *n*th experimental and corresponding elemental weighted average intensity ratio (*i* = β, γ, η, l, ,, and ; *j* = α, β, and γ), respectively, and ∆ and ∆ are the associated asserted standard deviations.

The average *z*-score is calculated as:

|  |  |
| --- | --- |
|  | (9) |

where represents the number of experimental points for each element.

We note that Padhi (1994) refers values from Shatandra *et al*. (1985) for the intensity ratios , , and for the elements 82Pb and 83Bi. However, it is important to note that Shatandra *et al*. (1985) did not provide calculated values for these ratios. Instead, the focus of the article was on calculating cross sections.

Figures 1 to 10 illustrate the distribution of experimental intensity ratio values, encompassing ratios such as , , , , , , , , , and , for elements of atomic number39 ≤ *Z* ≤ 94. These data were compiled within the scope of this study and are plotted against the atomic number *Z* of the target element.

The distribution of the number of data points for experimental intensity ratios as a function of atomic number *Z* (39 ≤ *Z* ≤ 92) is illustrated in Fig. 1. The analysis of this figure enables us to draw the following conclusions:

* Most of the elements from 39Y to 92U are included, except for 43Tc, 44Ru, 45Rh, 46Pd, 48Cd, 51Sb, 52Te, 84Po, 85At, 86Rn, 87Fr, 88Ra, 89Ac, and 91Pa, because data have not been reported for them yet due to the complexities associated with their handling. This presents a research opportunity.
* In certain isolated cases, the data contain fewer than two values, specifically 39Y, 40Zr, 54Xe, 55Cs, and 61Pm. Additional measurements are needed to strengthen the data base.
* It is noteworthy that gold (79Au), lead (82Pb), and dysprosium (66Dy) are the most commonly measured materials, collectively representing 18.8% of the entire dataset, with 41, 44, and 43 data points allocated to them, respectively. The scatter of results for these elements is therefore, in a sense, indicative of the quality of such ratio measurements. Future measurements could well include one of more of these elements as an internal reference standard to help gauge quality.
* The elements within the lanthanide series, falling within the atomic number range 57 ≤ *Z* ≤ 71, tend to have comprehensive data coverage, typically featuring between seventeen and forty-three experimental values per element. However, it is important to note that 61Pm is an exception, with only a single reported value. This is a prime candidate for redetermination.

We have compiled an extensive database comprising 696 values for the experimental intensity ratios , and these data have been graphically shown in Fig. 2, with atomic number *Z* as the independent variable. To gain a comprehensive understanding of the insights conveyed by this figure, it is necessary to offer some commentary, including the following points:

* With the exception of specific cases where data are unavailable (43Tc, 44Ru, 45Rh, 46Pd, 48Cd, 51Sb, 52Te, 84Po, 85At, 86Rn, 87Fr, 88Ra, 89Ac, and 91Pa), our coverage extends to all targets within the range of 39Y to 92U.
* In certain instances, there exists just a solitary value, as seen in 39Y, 40Zr, 54Xe, 55Cs, and 61Pm, while for others, there are merely two values available, notably for 41Nb, 42Mo, and 77Ir. Again this suggests a need for new and improved experimental campaigns.
* Elements like 62Sm, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 70Yb, 73Ta, 74W, 80Hg, 81Tl, and 83Bi are associated with a substantial amount of data. Additionally, it is worth highlighting that the elements 79Au, 82Pb, 90Th, and 92U have a notable significant quantity of data, specifically 47, 48, 53, and 51 data points, respectively.

Fig. 3 illustrates the distribution of data points concerning experimental intensity ratios across the atomic number range from 39Y to 94Pu. These data points have been extracted from a compilation of 66 cited research papers. Analyzing this figure provides us with the opportunity to offer some observations:

* Almost all the elements, ranging from 39Y to 94Pu, are included in the dataset, with the exception of eight elements: 43Tc, 84Po, 85At, 86Rn, 87Fr, 88Ra, 89Ac, and 91Pa. The absence of data for these elements can be attributed to their radioactive nature, which makes them challenging to work with and study.
* For some elements there is only a single value (39Y, 40Zr, 44Ru, 45Rh, 46Pd, 48Cd, 54Xe, 61Pm, 93Np, and 94Pu) while others have only two values, including 41Nb, 42Mo, 51Sb, 52Te, and 55Cs.
* The number of measurements for the following elements is between two and twenty: 47Ag, 49In, 50Sn, 53I, 56Ba, 57La, 58Ce, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 67Ho, 68Er, 69Tm, 70Yb, 71Lu, 72Hf, 75Re, 76Os, 77Ir, and 78Pt.
* The extensively studied elements are primarily found within the atomic number range of 62 ≤ *Z* ≤ 92, encompassing a notable group of elements, including 66Dy, 73Ta, 74W, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U. It is worth noting that three elements, 79Au, 82Pb, and 92U, particularly stand out with the highest number of data points, featuring 47, 54, and 42 data values, respectively. Remarkably, these three elements are the focus of approximately 41 publications, collectively constituting 62.1% of all the cited references.

The distribution of the number of experimental intensity ratios data points for , , and as a function of the atomic number *Z* (54 ≤ *Z* ≤ 92) is presented in Figs. 4, 5, and 6, respectively. Analyzing these figures leads us to the following conclusions:

* The majority of targets are included in the dataset, with only a few isolated cases having either no data or fewer than two available data points.
* The elements listed below have a measurement count ranging from two to ten: 59Pr, 66Dy, 67Ho, 68Er, 69Tm, 70Yb, 72Hf, 73Ta, 74W, 79Au, 80Hg, 81Tl, 82Pb, and 83Bi (for ), as well as 66Dy, 67Ho, 68Er, 69Tm, 70Yb, 71Lu, 72Hf, 73Ta, 74W, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, and 83Bi (for ), and similarly, for 63Eu, 66Dy, 67Ho, 68Er, 69Tm, 70Yb, 71Lu, 72Hf, 73Ta, 78Pt, 79Au, 81Tl, 82Pb, 90Th, and 92U (for ).
* Thorium (90Th) holds the largest number of experimental data points, with 33 values for and 25 values for . In the case of , the elements 74W, 80Hg, and 83Bi each have the largest number of experimental data points, with 7 values.

We compiled a database comprising three research papers for and forteen for , which we have presented in Figs. 8 and 9, respectively, as a function of atomic number *Z* (50 ≤ *Z* ≤ 92). These figures warrant some comments, specifically:

* For only ten elements lack published values, while for some elements, there is just a single recorded value (50Sn, 51Sb, 52Te, 53I, 56Ba, 57La, 58Ce, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 69Tm, 71Lu, 72Hf, 73Ta, 74W, and 75Re).
* 76Os, 77Ir, 78Pt, 79Au, 81Tl, 82Pb, 83Bi, 90Th, and 92U, with more than two and less than ten intensity ratio measurements per element for
* 66Dy, c, 70Yb, 71Lu, 72Hf, 73Ta, 74W, 76Os, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi,  90Th, and 92U, with more than two and less than five intensity ratios measurements per element for .

The distribution of experimental intensity ratio data points for and as functions of atomic number *Z*, within the respective ranges of 56 ≤ *Z* ≤92 and 66 ≤ *Z* ≤ 92, is depicted in Figs. 7 and 10. The analysis of these figures allows us to make some comments:

* The lanthanides (56 ≤ *Z* ≤ 71) are sparsely documented, with only one experimental value per element, except for 61Pm and 70Yb, which lack any recorded values for.
* For, elements 72Hf, 73Ta, 74W, 76Os, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U exhibit a range of experimental data values between two and five. Additionally, for , 66Dy, 68Er, 70Yb, 71Lu, 73Ta, 74W, 76Os, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U display a range of experimental data values between two and six.

The data distribution study for all intensity ratios as a function of atomic number *Z* concludes that there is an important amount of data for the lanthanides (56 ≤ *Z* ≤ 71). However, it is especially important to draw attention to the absence of published data on these elements: 84Po, 85At, 86Rn, 87Fr, 88Ra, 89Ac, and 91Pa.

Figs. 11 to 20 present histograms representing the count of articles that contain experimental data. There are 64 publications for , 61 for , 66 for , 14 for , 13 for , 12 for , 11 for , 3 for and , and 6 for . These histograms are organized based on the publication year of the original work. Studying these figures, we can discern that:

* The publication years for span from 1978 to 2023: In the initial decade, starting in 1978, the average number of intensity ratio measurements ranged from 3 to 46, with a peak of 91 values observed in 1987. However, between 1989 and 2010, there was a substantial increase in the number of measurements, accounting for roughly 50% of all published data. It is worth noting that 1991 and 2009 were exceptions, with no recorded experimental values for this parameter during those years. Moving forward to the period from 2011 to 2023, there has been a significant reduction in the availability of experimental data. Specifically, in 2011 and 2013, there were 69 experimental values for the intensity ratios , distributed as 31 and 38, respectively. In contrast, in 2021 and 2022, only one value was reported for each of those years. Furthermore, in the most recent year, 2023, a single paper was published containing 19 values.
* The publication years for span from 1978 to 2023: In the decades 1978–1990 there was a gradual increase in the number of measurements, with a total of 226 data points published. There were no new values published in the years 1979, 1980, and 1981, while the maximum number of data points, 75 in total, were reached in 1987. In the two decades following 1990 (from 1991 to 2010), there was an exponential growth in the number of measurements, accounting for approximately 50.9% of all published data. The only exception was in 2009 when no new publications were recorded. The remarkable growth rate in the 2000’s and early 2010’s peaked in 2007, with a total of 175 data points. This substantial increase was mainly attributed to the works of Demir and Sahin (Demir and Sahin, 2007a, 2007b). Specifically, these authors contributed 59, 50, 32, and 66 experimental data points, respectively, during this year. In the recent period from 2011 to 2023, the number of data points gradually started to decrease. We can observe years with only one data point. Notably, in the last year, particularly in the month of April, there is one article (Alqadi et al. 2023), while in 2014 and 2018, no new data are mentioned.
* The publication years for span from 1971 to 2023: During the period from 1971 to the end of 2000, there are an important number of published data, but during the years 1972, 1973, 1975, 1976, 1977, 1979, 1980, 1981, 1991 there are no published data. Also, we note that the two years 1983 and 1987 contain the largest number of published data with values of 42 and 50 respectively. In the decades 2001–2023, 317 data points were published with a maximum in the year 2007 (64 data points).
* For , articles spanning 1985 to 2015 reveal a slight gap in this intensity ratio, featuring a single value for the years 1998 and 1992. Nevertheless, between 1996 and 2015, there are a notable surge in measurements, constituting 92.4% of the total published values. As for and , data are available from 1985 to 2017. The early years (1985-1992) show limited values, but starting in 1996, there is a significant increase, peaking at 44 in 2007 for and 33 in 2017 for . Concerning the ratio, articles are spread across the years 1985 to 2022. Notably, 71.8% of the total values are concentrated in 2011 and 2015, while other years typically provide 1 to 5 data points.
* For , , and , the values have been published from 2006 to 2015. It is evident that these intensity ratios have garnered attention from several authors in the past decade.

Following the calculation of the weighted average value *()W* for all elements and intensity ratios using Eq. (7), we proceeded to determine the ratio of experimental intensity ratios relative to their corresponding weighted averages values for each element. This ratio, denoted as , was then graphed as a function of the atomic number *Z*, as illustrated in Fig. 21 for , Fig. 22 for , Fig. 23 for , Fig. 24 for , Fig. 25 for , Fig. 26 for , Fig. 27 for , Fig. 28 for , Fig. 29 for , and Fig. 30 for .

For : It is important to note that the majority values of *S* ratio are close to the range , and it should be noted that some values show a remarkably high disparity compared to the weighted values, particularly the values of Singh *et al.* (1987a), Al Salah and Saleh (1999), Salah and Al-Jundi (2005) and Kumar and Puri (2012) for the 66Dy element, as well as the values of Garg *et al.* (1986), Kaçal *et al.* (2011) and Alqadi *et al.* (2023) for the 68Er and the value of Salah and Al-Jundi (2005) for 57La, where the *S* ratio exceeds the range . Additionally, the *S* ratios of Baydaş *et al*. (2001) for Z=56, 58 and 64, as well as those of Saad (2003) for 70Yb, lie outside the range . This notable variation is due to the large number of experimental values published for these elements.

For : It is noticeable that a few values have an unexpectedly large disparity when compared to the weighted values, especially the values obtained by Shatendra *et al.* (1983) for the elements 56Ba, 57La, 58Ce, 62Sm, and 64Gd; Garg *et al.* (1986) for 67Ho; Ertugrul (1996) for 71Lu, 75Re; Singh *et al.* (1987c) for 71Lu; Salah (2004) for 57La; Kumar and Puri (2012) for 66Dy, in which the ratio *S* is outside the range , and also with a few other values (Singh *et al*., 1987a; Singh *et al*., 1987b; Darko and Tetteh, 1992; Al-Saleh and Saleh, 1999; Karabulut and Gurol, 2006; Kaçal *et al*., 2011; Alqadi *et al*., 2023). In addition, the ratio *S* of the values of Garg *et al.* (1986) for 70Yb, Mehta *et al.* (1987a) for 56Ba, Saleh *et al.* (1988) for 73Ta, Raghavaiah *et al.* (1990) for 70Yb, and 74W, Dogan *et al.* (1998) for 73Ta, and 74W, Baydaş *et al.* (2001) for 70Yb, Öz *et al.* (2004) for 74W, Alqadi *et al.* (2013) for 80Hg, and Alqadi *et al.* (2023) for 74W, are below the range . Nevertheless, it is evident that most of the *S* values (ranging from 0.8 and 1.4) are close to unity, which would be expected for consistent data (unbiassed with a reasonable uncertainty assignment).

For : It is clear that the vast majority of *S* values (in the range of 0.8 to 1.2) are near unity. Furthermore, the surprisingly notable difference in certain values from the weighted values should be highlighted. This is particularly apparent in the research of Shatendra *et al.* (1983) for 56Ba, 57La, Ismail and Malhi (2000), Durak and Özdemir (2001), Cengiz *et al.* (2010b), Kaçal *et al.* (2011), and Kaur *et al.* (2016) for 76Re, and in the work of Aylikci *et al.* (2015) for 50≤ *Z* ≤ 53 and 71 ≤ *Z* ≤ 92, where the ratio *S* is over the range . Also, in Salem and Wichell (1974) for 49 ≤ Z ≤ 53, Mehta *et al.* (1986) for 76Re, and Mehta *et al.* (1987a) for 56Ba, the values of *S* are outside the range .

Concerning , which has been studied in 13 different papers, it is clear that the majority of the *S* ratio values fall within a very close range of . And when we turn to , most of the *S* values are found in , it should be mentioned that some studies vary from the norm such as those by Ertuǧrul (1996) for 69Tm, 71Lu, and 90Th, Öz *et al.* (2004) for 74W, and 90Th, along with a few others (Salem and Shahin, 2007a; Yalçin *et al.,* 2008; Bansal *et al.,* 2017). In what concerns , in general the majority of the *S* values falls within , but some deviations are noted in the work of Ertuǧrul (1996) for the elements 71Lu, 73Ta, and 74W, and also in the work of Akman *et al.* (2015) for 73Ta, and 74W. In nearly all of the *S* values for , , and , which are have been reported in 3, 14, and 6 publications respectively, most of the *S* values tend to be within . However, there is a remarkable exception in the research of Aylikci *et al.* (2015), where the results depart considerably from this range. Regarding it is noteworthy that the values of *S* reported by Karabulut and Gürol (2006) for 74W, 82Pb, 83Bi, and 92U, and Kaçal *et al.* (2011) for the elements 66Dy, 68Er, 78Pt, and 90Th, as well as Aylikci *et al.* (2015) for 71Lu, 73Ta, 74W, 76Os, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi and 90Th are significantly outside of the range . The considerable dispersion in experimental data can be attributed in part to the extensive use of papers for data collection without taking in account variations in experimental conditions and methods.

Plotting the signed deviation in multiples of the combined standard deviation calculated using formula (8), which is the divergence of the individual experimental points from the associated weighted mean for the element.

For each ratio, the distribution of Eqs. (8) and (9) as a function of the atomic number *Z* are represented in Figs. 31 to 40. The values of and the average are also mentioned in the ten databases in the last two columns. Based on the published experimental uncertainties of certain atomic elements, the analysis of these figures shows a scatter that is far larger than expected. For instance, considering the ratio we observe that the values of standard deviation vary between -9.5 for the element 64Gd (Baydaş *et al.*, 2001) to 12.8 for 70Yb (Yalçin *et al.*, 2008) and the majority of the values are located in the range with some exceptions (Mehta et al., 1985; Raghavaiah et al., 1990; Ertuǧrul et al., 1997; Yalçin et al., 2008), where the values of range from 0 to 4. Then, moving on to the ratio, where the values are from -36.3 (Ertuǧrul et al., 1997) to 36.6 (Yalçin et al., 2008), it is important to note there are a few values that appear to be significantly different from the rest and fall outside the range (Garg et al., 1986; Baydaş et al., 2001). After analyzing Fig. 33 for the ratio, it is evident that the average *z*-score values range from 0 to 4.9, with for the combined standard deviation the majority of values falling in the range. The two points observed which are located very far from this range are -13.8 and 14.2 for 92U (Ertuǧrul *et al*. 1997). With a few notable exceptions (Mehta *et al*. 1985; Ertuǧrul *et al*., 1997; Yalçin *et al*., 2008; Bansal *et al*., 2017), almost all of standard deviation values for the , , and ratios are in the range . Except for Aylikci *et al*., 2015 data, all other values for the , , , and ratios are inside the range .

This dispersion means that the experimenters reported uncertainties may not be well evaluated and may include contributions from hidden errors. Figs. 31 to 40 indicate that in order to help resolve inconsistencies and improve the quality of experimental guidance, further high-quality experimental data will be needed, along with accurate uncertainty evaluations, precise explanations, and uncertainty quantifications. This effort is the first step toward enabling a thorough assessment. The original publications listed in the references are available to researchers who are interested in a specific element.

1. **Conclusion**

A detailed review and presentation in the form of tables of intensity ratios data induced by photons has been completed. A total of 2603 values have been published in the period from 1971 to April 2023. To the best of our knowledge, this is the first attempt to provide a comprehensive summary of experimental data values for intensity ratios of L lines in the atomic range 39 ≤ *Z* ≤92 for and , 39 ≤ *Z* ≤ 94 for , 54 ≤  *Z* ≤ 92 for , , and , 50 ≤ *Z* ≤ 92 for , and , 56 ≤ *Z* ≤ 92 for , and 66≤ *Z* ≤92 for . Weighted means, combined standard deviations, and average *z*-score values were calculated for each element. Research gaps and needs have been identified.

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**Figure caption:**

**Fig. 1.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 2.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 3.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 4.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 5.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 6.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 7.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 8.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 9.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 10.** Distribution of the experimental values according to the atomic number *Z.*

**Fig. 11.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 12.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 13.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 14.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 15.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 16.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 17.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 18.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 19.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 20.** Histogram of data for experimental photon-induced intensity ratios. The vertical lines indicate the annual number of published intensity ratios as compiled in this work.

**Fig. 21.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1978 to 2023). ●: (Chang and Su, 1978) ; ●: (Shatendra *et al.,* 1982) ; ●: (Shatendra *et al.,* 1983) ; ●: (Garg *et al.,* 1984) ; ●: (Mehta *et al.,* 1985) ; ○: (Shatendra *et al.,* 1985) ; ○: (Verma *et al.,* 1985) ; ○: (Garg *et al.,* 1986); ○: (Mehta *et al.,* 1986) ; ~~○~~: (Mehta *et al.,* 1987a) ; ~~○~~: (Mehta *et al.,* 1987b) ; ~~○~~: (Singh *et al.,* 1987a) ; ~~○~~: (Singh *et al.,* 1987b) ; ▲: (Singh *et al.,* 1987c) ; ▲: (Saleh *et al.,* 1988) ; ▲: (Chand *et al.,* 1989) ; ▲: (Raghavaiah *et al.,* 1990) ; ▲: (Chand *et al.,* 1992a) ; △: (Chand *et al.,* 1992b) ; △: (Darko and Tetteh, 1992) ; △: (Rao and Gigante, 1993) ; △: (Rao *et al.,* 1993) ; ~~△~~: (Dhal and Padhi, 1994) ; ~~△~~: (Rao *et al.,* 1995) ; ~~△~~: (Ertuǧrul, 1996) ; ~~△~~: (Ertuǧrul *et al.,* 1997) ; ■: (Sӧǧüt *et al.,* 1997) ; ■: (Dogan *et al.,* 1998) ; ■: (Al-Saleh and Saleh, 1999) ; ■: (Ismail and Malhi, 2000) ; ■: (Baydas *et al.,* 2001) ; □: (Durak and Özdemir, 2001) ; □: (Küçükönder, 2002) ; □: (Saad,2003) ; □: (Tirasoglu *et al.,* 2003) ; ~~□~~: (Küçükönder *et al.,* 2004) ; ~~□~~: (Öz *et al.,* 2004) ; ~~□~~: (Salah,2004) ; ~~□~~: (Turgut and Ertuǧrul, 2004) ; ▼: (Salah and Al-Jundi, 2005) ; ▼: (Karabulut and Gürol, 2006) ; ▼: (Aylikci *et al.,* 2007) ; ▼: (Demir *et al.,* 2008) ; ▼: (Han *et al.,* 2008) ; ▽: (Yalçin *et al.,* 2008) ; ▽: (Cengiz *et al.,* 2010a) ; ▽: (Cengiz *et al.,* 2010b) ; ▽: (Kaçal *et al.,* 2011) ; ~~▽~~: (Kumar and Puri, 2011) ; ~~▽~~: (Aksoy *et al.,* 2012) ; ~~▽~~: (Durdu and Küçükönder,2012) ; ~~▽~~: (Kumar and Puri, 2012) ; ◀: (Porikli, 2012) ; ◀: (Alqadi *et al.,* 2013) ; ◀: (Cesareo *et al.,* 2013) ; ◀: (Durdagi, 2013) ; ◀: (Akman *et al.,* 2015) ; ◁: (Dogan *et al.,* 2015) ; ◁: (Krishnananda *et al.,* 2016) ; ◁: (Kaur *et al.,* 2018) ; ◁: (Hiremath *et al.,* 2019) ; ~~◁~~: (Fernandez-Ruiz, 2021) ; ~~◁~~: (Duggal *et al.,* 2022) ; ~~◁~~: (Alqadi *et al.,* 2023).

**Fig. 22.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1978 to 2023). ●: (Chang and Su, 1978) ; ●: (Shatendra *et al.,* 1982) ; ●: (Shatendra *et al.,* 1983) ; ●: (Garg *et al.,* 1984) ; ●: (Mehta *et al.,* 1985) ; ○: (Shatendra *et al.,* 1985) ; ○: (Verma *et al.,* 1985) ; ○: (Garg *et al.,* 1986); ○: (Mehta *et al.,* 1986) ; ~~○~~: (Mehta *et al.,* 1987a) ; ~~○~~: (Mehta *et al.,* 1987b) ; ~~○~~: (Singh *et al.,* 1987a) ; ~~○~~: (Singh *et al.,* 1987b) ; ▲: (Singh *et al.,* 1987c) ; ▲: (Saleh *et al.,* 1988) ; ▲: (Chand *et al.,* 1989) ; ▲: (Raghavaiah *et al.,* 1990) ; ▲: (Chand *et al.,* 1992a) ; △: (Darko and Tetteh, 1992) ; △: (Rao and Gigante, 1993) ; △: (Rao *et al.,* 1993) ; △: (Dhal and Padhi, 1994) ; ~~△~~: (Rao *et al.,* 1995) ; ~~△~~: (Ertuǧrul, 1996) ; ~~△~~: (Ertuǧrul *et al.,* 1997) ; ~~△~~: (Sӧǧüt *et al.,* 1997) ; ■: (Dogan *et al.,* 1998) ; ■: (Al-Saleh and Saleh, 1999) ; ■: (Ismail and Malhi, 2000) ; ■: (Baydas *et al.,* 2001) ; ■: (Durak and Özdemir, 2001) ; □: (Küçükönder, 2002); □: (Tirasoglu *et al.,* 2003) ; □: (Küçükönder *et al.,* 2004) ; □: (Öz *et al.,* 2004) ; ~~□~~: (Salah,2004) ; ~~□~~: (Turgut and Ertuǧrul, 2004) ; ~~□~~: (Salah and Al-Jundi, 2005) ; ~~□~~: (Karabulut and Gürol, 2006) ; ▼: (Aylikci *et al.,* 2007) ; ▼: (Demir and Sahin, 2007a) ; ▼: (Demir and Sahin, 2007b) ; ▼: (Demir *et al.,* 2008) ; ▼: (Yalçin *et al.,* 2008) ; ▽: (Cengiz *et al.,* 2010a) ; ▽: (Kaçal *et al.,* 2011) ; ▽: (Kumar and Puri, 2011) ; ▽: (Porikli, 2011) ; ~~▽~~: (Durdu and Küçükönder,2012) ; ~~▽~~: (Kumar and Puri , 2012) ; ~~▽~~: (Porikli, 2012) ; ~~▽~~: (Alqadi *et al.,* 2013) ; ◀: (Durdagi, 2013) ; ◀: (Akman *et al.,* 2015) ; ◀: (Wang *et al.,* 2015) ; ◀: (Krishnananda *et al.,* 2016) ; ◀: (Porikli, 2017) ; ◁: (Hiremath *et al.,* 2019) ; ◁: (Fernandez-Ruiz, 2021) ; ◁: (Duggal *et al.,* 2022) ; ◁: (Alqadi *et al.,* 2023).

**Fig. 23.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1971 to 2023). ●: (Rao *et al.,* 1971) ; ●: (Salem and Winchell, 1974) ; ●: (Chang and Su, 1978) ; ●: (Shatendra *et al.,* 1982) ; ◇: (Shatendra *et al.,* 1983) ; ○: (Garg *et al.,* 1984) ; ○: (Mehta *et al.,* 1985) ; ○: (Shatendra *et al.,* 1985); ○: (Verma *et al.,* 1985) ; ~~○~~: (Mehta *et al.,* 1986) ; ~~○~~: (Chander *et al.,* 1987) ; ~~○~~: (Mehta *et al.,* 1987a) ; ~~○~~: (Mehta *et al.,* 1987b) ; ▲: (Raghavaiah *et al.,* 1987) ; ▲: (Singh *et al.,* 1987c) ; ▲: (Chand *et al.,* 1989) ; ▲: (Singh *et al.,* 1989) ; ▲: (Tan *et al.,* 1990) ; △: (Chand *et al.,* 1992a) ; △: (Chand *et al.,* 1992b) ; △: (Darko and Tetteh, 1992) ; ~~△~~: (Rao and Gigante, 1993) ; ~~△~~: (Rao *et al.,* 1993) ; ~~△~~: (Padhi, 1994) ; ~~△~~: (Rao *et al.,* 1995) ; ■: (Ertuǧrul, 1997) ; ■: (Ertuǧrul *et al.,* 1997) ; ■: (Dogan *et al.,* 1998) ; ■: (Ismail and Malhi, 2000) ; ■: (Simsek, 2000) ; □: (Durak and Özdemir, 2001) ; □: (Küçükönder, 2002) ; □: (Tirasoglu *et al.,* 2003) ; □: (Küçükönder *et al.,* 2004) ; ~~□~~: (Öz *et al.,* 2004) ; ~~□~~: (Turgut and Ertuǧrul, 2004) ; ~~□~~: (Sӧǧüt and Küçükönder, 2005) ; ~~□~~: (Karabulut and Gürol, 2006) ; ▼: (Zou *et al.,* 2006) ; ▼: (Aylikci *et al.,* 2007) ; ▼: (Demir and Sahin, 2007) ; ▼: (Demir and Sahin, 2008) ; ▼: (Demir *et al.,* 2008) ; ▽: (Yalçin *et al.,* 2008) ; ▽: (Cengiz *et al.,* 2010a) ; ▽: (Cengiz *et al.,* 2010b) ; ▽: (Kaçal *et al.,* 2011) ; ~~▽~~: (Kumar and Puri, 2011) ; ~~▽~~: (Aksoy *et al.,* 2012) ; ~~▽~~: (Durdu and Küçükönder,2012) ; ~~▽~~: (Kumar and Puri , 2012) ; ◀: (Porikli, 2012) ; ◀: (Alqadi *et al.,* 2013) ; ◀: (Durdagi, 2013) ; ◀: (Akman *et al.,* 2015) ; ⬟: (Aylikci *et al.,* 2015) ; ◁: (Dogan *et al.,* 2015) ; ◁: (Kaur *et al.,* 2016) ; ◁: (Krishnananda *et al.,* 2016) ; ◁: (Bansal *et al.,* 2017) ; ~~◁~~: (Kaur *et al.,* 2018) ; ~~◁~~: (Hiremath *et al.,* 2019) ; ~~◁~~: (Ayri *et al.,* 2021) ; ~~◁~~: (Fernandez-Ruiz, 2021) ; ▶: (Duggal *et al.,* 2022) ; ▶: (Alqadi *et al.,* 2023).

**Fig. 24.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1985 to 2015). ●: (Mehta *et al.,* 1985) ; ●: (Mehta *et al.,* 1986) ; ●: (Mehta *et al.,* 1987a) ; ●: (Mehta *et al.,* 1987b) ; ●: (Chand *et al.,* 1989) ; ○: (Chand *et al.,* 1992) ; ○: (Ertuǧrul, 1996); ○: (Ertuǧrul *et al.,* 1997) ; ~~○~~: (Öz *et al.,* 2004) ; ~~○~~: (Demir and Sahin, 2007a) ; ~~○~~: (Demir *et al.,* 2008) ; ~~○~~: (Yalçin *et al.,* 2008) ; ▲: (Akman *et al.,* 2015).

**Fig. 25.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1985 to 2017). ●: (Mehta *et al.,* 1985) ; ●: (Mehta *et al.,* 1986) ; ●: (Mehta *et al.,* 1987a) ; ●: (Mehta *et al.,* 1987b) ; ●: (Chand *et al.,* 1989) ; ○: (Chand *et al.,* 1992) ; ○: (Ertuǧrul, 1996) ; ○: (Öz *et al.,* 2004); ○: (Demir and Sahin, 2007a) ; ~~○~~: (Yalçin *et al.,* 2008) ; ~~○~~: (Akman *et al.,* 2015) ; ~~○~~: (Bansal *et al.,* 2017).

**Fig. 26.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1985 to 2017).●: (Mehta *et al.,* 1985) ; ●: (Mehta *et al.,* 1986) ; ●: (Mehta *et al.,* 1987a) ; ●: (Mehta *et al.,* 1987b) ; ●: (Chand *et al.,* 1989) ; ○: (Chand *et al.,* 1992) ; ○: (Chand *et al.,* 1992b); ○: (Ertuǧrul,1996) ; ~~○~~: (Öz *et al.,* 2004) ; ~~○~~: (Akman *et al.,* 2015) ; ~~○~~: (Bansal *et al.,* 2017).

**Fig. 27.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 2006 to 2015).●: (Karabulut and Gürol, 2006) ; ●: (Kaçal *et al.,* 2011) ; ●: (Aylikci *et al.,* 2015).

**Fig. 28.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 2006 to 2015).●: (Karabulut and Gürol, 2006) ; ●: (Kaçal *et al.,* 2011) ; ●: (Aylikci *et al.,* 2015).

**Fig. 29.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 1985 to 2022). ●: (Verma *et al.,* 1985) ; ●: (Mehta *et al.,* 1987a) ; ●: (Mehta *et al.,* 1987b) ; ●: (Chand *et al.,* 1989) ; ●: (Darko and Tetteh, 1992) ; ○: (Tirasoglu *et al.,* 2003) ; ○: (Karabulut and Gürol, 2006) ; ○: (Demir *et al.,* 2008); ○: (Cengiz *et al.,* 2010a) ; ~~○~~: (Kaçal *et al.,* 2011) ; ~~○~~: (Kumar and Puri, 2011) ; ~~○~~: (Aylikci *et al.,* 2015) ; ~~○~~: (Fernandez-Ruiz, 2021) ; ▲: (Duggal *et al.,* 2022).

**Fig. 30.** The distribution of for each reference from which the databases are extracted according to the atomic number *Z* (from 2006 to 2015).●: (Karabulut and Gürol, 2006) ; ●: (Cengiz *et al.,* 2010b) ; ●: (Mehta *et al.,* 1987a) ; ●: (Mehta *et al.,* 1987b) ; ●: (Aylikci *et al.,* 2015) ; ○: (Dogan *et al.,* 2015).

**Fig. 31.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 32.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 33.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 34.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 35.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 36.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 37.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 38.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 39.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

**Fig. 40.** Distribution of Eqs. (8) and (9) for according to the atomic number *Z*.

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**Figure 1:**

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**Figure 2:**

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**Figure 35:**

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**Figure 38:**

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**Figure 39:**

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**Figure 40:**

**Explanation of Tables**

**Table 1.** Summary of the atomic parameters for elements ranging from 39Y to 94Pu, the excitation sources, the target samples and the detectors. The references from which these data are obtained is also included.

|  |  |
| --- | --- |
| References | References from which the data were extracted. |
| Atomic parameters | The atomic parameters available in the references. |
| Target samples | The target sample utilized during the measurement of the to intensity ratios. |
| Excitation sources | The excitation sources used to bombard the samples. |
| Detectors | The detectors employed for the detection of the L-shell X-rays. |

**Table 2.** Summary of the experimental intensity ratios from 39Y to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 3.** Summary of the experimental intensity ratios from 39Y to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 4.** Summary of the experimental intensity ratios from 39Y to 94Pu is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 5.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 6.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 7.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 8.** Summary of the experimental intensity ratios from 56Ba to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 9.** Summary of the experimental intensity ratios from 50Sn to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 10.** Summary of the experimental intensity ratios from 50Sn to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

**Table 11.** Summary of the experimental intensity ratios from 66Dy to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |
| --- | --- |
| *Z* | Atomic number of the target element. |
| Symbol | Symbol of the target element. |
|  | The to experimental intensity ratio (*i* = β, γ, η, l, , , and ; *j*= α, β, and γ). |
|  | The uncertainty of the *n*th L*i* to L*j* experimental value (*i* = β, γ, η, l, , , and ; *j*= α, β, and γ). |
| References | References from which the database is obtained. |
|  | Weighted average to intensity ratio value (*i* = β, γ, η, l, , , and ; *j*= α, β, and γ). |
|  | Internal standard deviation associated with the calculated weighted average to value (*i* = β, γ, η, l, , , and ; *j*= α, β, and γ).  the combined standard deviation  The average *z*-score |

**Table 1.** Summary of the atomic parameters for elements ranging from 39Y to 94Pu, the excitation sources, the target samples and the detectors. The references from which these data are obtained is also included.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **References** | **Atomic parameters** | **Excitation sources** | **Target samples** | **Detectors** |
| (Rao *et al.,* 1971) | /L | Decays of 159Dy, 171Tm, 181W, 191Os, 186Re, 207Bi, 210Pb, 238Pu, 241Am and 244Cm (with the majority of them being free of carrier substances). | 65Tb, 70Yb, 73Ta, 77Ir, 78Pt, 81Tl, 82Pb, 83Bi, 92U, 93Np, and 94Pu. | Three distinct Si(Li) detectors with varying resolutions: one having a resolution of 260 eV FWHM at 6.4 keV, another with a resolution of 220 eV FWHM at 6.4 keV, and the third exhibiting a resolution of 155 eV FWHM at 6.4 keV. |
| (Salem and Winchell, 1974) | /,  /  /  /L | Commercial 24Cr X-ray tube with *Z*≤48 and commercial 74W X-ray tube for samples with *Z*⩾49. | 44Ru, 45Rh, 46Pd, 47Ag, 48Cd, 49In, 50Sn, 51Sb, 52Te, 53I, 55Cs, 56Ba, 57La, 58Ce, 59Pr, 60Nd, and 62Sm.  (with the exception of 56Ba, 59Pr, and 60Nd, which were utilized in their oxide forms, all the samples consisted of pure metals in an amorphous state. | Single-crystal spectrometer in conjunction with a flow proportional counter. |
| (Chang and Su, 1978) | /, /, / | From an 241Am annular source of 1000mCi and using an A NEN X-ray exciter, photons with energy levels of 17.8 keV, 25.8 keV, 46.9 keV, and 59.5 keV were emitted. | 79Au.  (Thin gold foil). | Si(Li) detector |
| (Shatendra *et al.,* 1982) | //, /  Lα+l/Lβ Lα+l/Lγ. | 59.57 KeV gamma rays from 241Am radioactive source with a strength of about 100 mCi. | 92U, 90Th, and 82Pb.  (The targets presented as discs with a circular shape). | ORTEC Si(Li) detector having 240 eV resolution at 5.9 keV. |
| (Shatendra *et al.,* 1983) | //, / | 59.57 keV gamma rays emitted from an 241Am radioactive source. | 39Y, 40Zr, 41Nb, 42Mo, 47Ag, 49In, 50Sn, 53I, 56Ba, 57La, 58Ce, 62Sm, and 64Gd. | EG Ortec Si(Li) detector having 240 eV resolution at 5.9 keV. |
| (Garg *et al.,* 1984) | /, /, / | NEN consisting of an annular source of 241Am ,tungsten spacer and shield and the secondary x-ray excitor have been used. | 73Ta, 79Au, 82Pb, and 83Bi.  (73Ta existed as a self-supporting thin foil, while 79Au, 82Pb, and 83Bi were also employed as thin foils). | Si(Li) detector with a resolution of 170 eV at 5.9 keV coupled to an ND-100 multi-channel analyser. |
| (Mehta *et al.,* 1985) | , L, L  L . | Decays of 141Ce and 170Tm sources. | 59Pr and 70Yb. | a vertical planar HPGe detector having 459 eV FWHM resolution at 122 keV and a vertical Si(Li) detector with 165 eV resolution at 5.9 keV |
| (Verma *et al.,* 1985) | /, /, /  / | 26 KeV gamma rays emitted from the 241Am source. | 74W and 80Hg .  (The targets consisted of a self-supporting tungsten foil and circular discs of mercuric chloride compressed into pellets). | EG Ortec Si(Li) detector having 162 eV resolution at 5.9 keV. |
| (Garg *et al.,* 1986) | / / | Photons of 22.6 KeV from 109Cd have been used for direct excitation of the target x-rays. | 67Ho, 68Er, and 70Yb.  (thin foils were evaporated on Mylar backing). | Si(Li) detector with 170 eV resolution at 5.9 keV. |
| (Mehta *et al.,* 1986) | , L , L L. | Decays of 192Ir, 160Tb, 169Yb and 152Eu. | 64Gd, 66Dy, 69Tm, 76Os, and 78Pt. | Coaxial HPGe detector having 1.7 K eV FWHM resolution at 1332 keV, vertical planar HPGe detector with 459 eV resolution at 122 keV and vertical Si(Li) detector with 165 eV resolution at 5.9 keV. |
| (Bhan *et al.,* 1987) | / | Decays of a 5 mCi 109Cd and a 10 mCi  125I sources. | 67Ho, 73Ta, 79Au, 82Pb, 83Bi, 90Th and, 92U.  (The samples were deposited in thick Mylar backing). | Kevex Si(Li) detector with a resolution better than 230eV at 6.4KeV. |
| (Mehta *et al.,* 1987a) | ,  . | Decays of 137Cs and 203Hg sources | 56Ba and 81Tl. | a vertical planar HPGe detector having 459 eV FWHM resolution at 122 keV and a vertical Si(Li) detector with 165 eV resolution at 5.9 keV. |
| (Mehta *et al.,* 1987b) | ,  , L , L ,L L . | Decays of 210Pb, 177Lu, 170Tm and 141Ce sources | 59Pr, 72Hf, and 83Bi. | a vertical planar HPGe detector having 459 eV FWHM resolution at 122 keV and a vertical Si(Li) detector with 165 eV resolution at 5.9 keV |
| (Raghavaiah *et al.,* 1987) | / | 14-17 keV x-rays emitted by a 30 mCi 238Pu source. | 55Cs, 56Ba, 58Ce, 59Pr, 60Nd, 61Pm, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 71Lu, 73Ta, 74W, 78Pt, 79Au, and 80Hg.  (Every element was utilized in its oxide state, and the powdered sample was uniformly compressed between two x-ray mylar films). | Si(Li) detector with 160 eV resolution at 5.9 keV. |
| (Singh *et al.,* 1987a) | / / | Photons in the  11-41KeV energy range, derived from 109Cd (25mCi), were utilized to directly induce excitation, while 241Am (300mCi) was employed as a secondary excitation source. | 57La, 59Pr, 62Sm, 63Eu, 64Gd, 65Tb, and 66Dy.  (spectroscopically pure thin foils were evaporated on mylar backing) | Si(Li) detector having 170 eV FWHM resolution at 5.9 keV |
| (Singh *et al.,* 1987b) | / / | Photons with an energy of 22.6KeV originating from 109Cd (50mCi) were employed to directly induce excitation, while photons with energies of 15.2, 17.8, and 25.8 from 241Am (300mCi) were utilized as secondary exciters. | 56Ba, 58Ce, and 60Nd.  (pure thin foils were evaporated on mylar backing) | Si(Li) detector having 170 eV FWHM resolution at 5.9 keV |
| (Singh *et al.,* 1987c) | // / | 22.6 and 59.54 keV photons emitted by a 241Am and 57Co annular source, respectively. | 69Tm, 71Lu, 90Th, and 92U.  (Spectroscopically pure samples were evaporated onto thick mylar backing using thin foils). | Si(Li) detector having 170 eV FWHM resolution at 5.9 keV |
| (Saleh *et al.,* 1988) | / / | Photons with energy values of 17.8 keV, 25.8 keV, and 46.9 keV were emitted from a 241Am annular source and with secondary excitation excitor. | 73Ta, 74W, 75Re, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, and 83Bi.  (The targets employed included self-supporting 73Ta foils, while thin foils were used for 74W, 78Pt, 79Au, 82Pb, 81Tl, and 83Bi targets, and 75Re pellets and mercuric chloride were shaped into disks). | Si(Li) detector having 170 eV FWHM resolution at 5.9 keV |
| (Chand *et al.,* 1989) | ,  . | Decays of 131I, 166Ho, 198Au and 199Au. | 54Xe, 68Er, and 80Hg. | Two coaxial HPGe detectors, a vertical planar HPGe detector  and two Si(Li) detectors |
| (Singh *et al.,* 1989) | / | Photons with energy values of 22.6 keV and 59.54 keV were discharged from an annular source containing 109Cd (25mCi) and 241Am (300mCi) respectively. | 72Hf, 75Re, 77Ir, 78Pt, and 82Pb.  (spectroscopically pure thin foils). | Si(Li) detector having 170 eV FWHM resolution at 5.9 keV |
| (Raghavaiah *et al.,* 1990) | / /. | 30mCi 238Pu source. | 55Cs, 56Ba, 57La, 58Ce, 59Pr, 60Nd, 61Pm, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 69Tm, 70Yb, 71Lu, 73Ta, 74W, 77Ir, 78Pt, 79Au, and 80Hg.  (each element was employed in the form of its oxide, and then compressed between two x-ray mylar films). | Si(Li) detector with high-resolution. |
| (Tan *et al.,* 1990) | / Lα/  Lα/ | Secondary excitation technique employed to generate gamma rays from a radioactive source of Am-241 with an activity of approximately 3.7 GBq. | 82Pb, 90Th, and 92U.  (pure samples with various thickness). | Ge(Li) detector |
| (Chand *et al.,* 1992a) | , | Decays of 182Ta. | 72Hf. | A horizontal planar Si(Li) detector (FWHM=165eV at 5.9 KeV), a vertical planar HPGE detector (FWHM=459eV at 122 KeV) and two coaxial HPGe detectors (FWHM=1.7KeV at 1332 KeV). |
| (Chand *et al.,* 1992b) | , | Decays of 153Sm and 153Gd . | 63Eu. | Two coaxial HPGe detectors (FWHM=1.7KeV at 1332 KeV), a vertical planar HPGE detector (FWHM=459eV at 122 KeV) and two Si(Li) detector (FWHM=165eV at 5.9 KeV) |
| (Darko and Tetteh*,* 1992) | /, /, / /. | Annular Cd-109 source which emits Ag x-rays energy 22.6KeV. | 62Sm, 74W, 77Ir, 79Au, 80Hg, 82Pb, and 92U.  (with intermediate thickness). | Si(Li) detector with 154 eV resolution at 5.9 keV. |
| (Rao and Gigante*,* 1993) | // / | X-ray tube with a secondary exciter. | 79Au and 82Pb. | The collimated HP Ge(Li) detector detector having a thickness of 5mm and 160eV resolution at 5.9KeV. |
| (Rao *et al.,* 1993) | // / | An X-ray tube containing a tungsten anode, with a maximum high voltage of 80kV and a maximum current of 5mA. | 59Pr, 67Ho, 70Yb, 79Au, and 82Pb. | Ge(Li) detector with a 5mm thickness and an energy resolution of 160eV at 5.9KeV |
| (Dhal and Padhi, 1994) | // / | γ-rays with an energy of 59.54 keV emitted from a point source of 241Am. | 78Pt, 82Pb, and 83Bi.  (High-purity samples in the form of foils were utilized) | Si(Li) detector. |
| (Rao *et al.,* 1995) | // / | X-ray tube with a secondary exciter. | 79Au and 82Pb. (Circular discs of approximately 0.01 mm thickness were used for both). | Si(Li) detector. |
| (Ertuğrul, 1996) | /, /, / /. | Gamma rays with an energy of 59.5 keV generated by a 241Am radioactive point-source with an activity of 100 mCi. | 57La, 58Ce, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 69Tm, 70Yb, 71Lu, 73Ta, 74W, 75Re, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U. | Si(Li) detector achieving a resolution of 160 eV at 5.9 keV. |
| (Ertuğrul, 1997) | / | γ- rays with an energy of 59.54 keV emitted by a 241Am point-source with an activity of 200 mCi. | 57La, 58Ce, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, and 69Tm.  (Targets of high purity and thinness.) | Si(Li) detector with 160 eV resolution at 5.9 keV. |
| (Ertuğrul *et al*, 1997) | /, /, / /. | Gamma rays of 59.54 keV energy generated by a 241Am radioactive source with an activity of 100 mCi. | Uranium (92U) and Thorium (90Th). | Si(Li) detector with 160 eV resolution at 5.9 keV. |
| (Sӧǧüt *et al.,* 1997) | / / | γ- rays with an energy of 59.54 keV originating from a radioactive 241Am source. | 80Hg, 83Bi, and 82Pb.(Powdered specimens of elemental metals and their corresponding compounds). | Si(Li) detector achieving a resolution of 160 eV when measuring 5.9 keV. |
| (Dogan *et al.,* 1998) | /, / / | Gamma-rays with energies of 59.5 and 122 keV emitted from a 241Am and 57Co annular source, each having an activity of 100 mCi, respectively. | 73Ta, 74W, 75Re, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (pure targets were evaporated on thick Maylar) | Si(Li) detector with a resolution of 160 eV FWHM at 5.96 keV. |
| (Al-Salah and Saleh, 1999) | / / | An X-ray tube featuring a Mo anode, having a maximum high voltage of 55 kV and a maximum current of 60 mA. | 65Tb, 66Dy, 67Ho, 69Tm, 70Yb, 71Lu, 74W, 78Pt, and 79Au.  (pure metals). | A Si(Li) detector with a 5mm thickness, exhibiting an energy resolution of 185eV at 5.9KeV. |
| (Ismail and Malhi, 2000) | /, / / | 20.48KeV Rh-ray tube. | 62Sm, 63Eu, 71Lu, 72Hf, 76Os, 78Pt, 81Tl, 82Pb, and 83Bi.  (Powdered specimens composed of elemental purity) | Si(Li) detector with 170 eV resolution at 5.9 keV. |
| (Simsek, 2000) | / / , Lα/  Lα/ | Gamma rays with an energy of 59.54 keV were generated using a 100-mCi annular radioactive source containing 241Am. | 80Hg, 83Bi, 90Th, and 92U.  (Circular disk-shaped targets made of pure material). | Si(Li) detector. |
| (Baydaş *et al.,* 2001) | / / | 59.5 keV gamma rays produced from a 241Am radioactive source. | 56Ba, 57La, 58Ce, 64Gd, 68Er, 70Yb, 73Ta, 79Au, 80Hg, 82Pb, and 83Bi.  (Samples of pure elements in powdered form were readied by being placed onto a mylar film support). | Si(Li) detector having 160 eV resolution at 5.9 keV |
| (Durak and Özdemir, 2001) | /, / / | Photons with an energy of 59.5 keV, emitted by a 100 mCi 241Am point source, were employed of excitation. | 57La, 58Ce, 59Pr, 60Nd, 62Sm, 65Tb, 66Dy, 67Ho, 68Er, 70Yb, 72Hf, 74W, 76Os, 80Hg, 81Tl, 82Pb, 90Th, and 92U. (Thin targets) | Detector Si(Li) capable of achieving a resolution of 188 eV at 5.9 keV. |
| (Küçükӧnder, 2002) | // / | Thoroughly filtered gamma rays with an energy of 59.6 keV, originating from a 75 mCi activity 241Am annular point source. | 90Th and 92U (Samples of powdered pure elements and their corresponding compounds: ThO2, Th(NO3)4.5H2 O, UCl3, U(NO3)3, U3O8, [(CH3COO)2 UO2].2 H2 O. | Si(Li) detector (FWHM=155eV at 5.9KeV). |
| (Saad, 2003) | / | X-ray tube with a (Mo) anode . | 57La, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 69Tm, 70Yb, and 71Lu.  (pure metals) | Si(Li) detector having a thickness of 5mm and 185eV resolution at 5.9KeV. |
| (Tiraşoǧlu *et al.,* 2003) | /, /, / /. | Gamma photons with an energy of 59.54 keV released from a 50 mCi annular source of radioactive 241Am. | 80Hg, 82Pb, and 83Bi. (powder samples of pure elements and its compounds). | A Si(Li) detector with a thickness of 3mm and a resolution of 147eV at 5.96KeV. |
| (Küçükӧnder *et al.,*  2004) | /, / /. | 59.5KeV gamma-photons emitted from a 75 mCi 241Am source. | 70Yb, 72Hf, 73Ta, 74W, 75Re, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (Powdered samples of pure targets with varying thicknesses, supported on a mylar film, for spectroscopic analysis). | Si(Li) detector (FWHM=155eV at 5.9KeV). |
| (Öz *et al.,* 2004) | /, /, /, /, / /. | Gamma rays with an energy of 59.5keV emitted from a 241Am point source with an activity of 3.7\*10 9 Bq. | 66Dy, 67Ho, 68Er, 72Hf, 74W, 81Tl, 83Bi, and 90Th.  (8 distinct elements with diverse excitation energies ranging from 8.265 to 21.705 keV). | Si(Li) detector with 160 eV resolution at 5.9 keV. |
| (Salah, 2004) | / / | Generating a photon energy of 17 keV by emitting the K X-ray of Mo using an annular source of 241Am. | 57La, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 69Tm, 70Yb, and 71Lu.  ( Self-supporting targets of high spectroscopic purity, having thicknesses ranging between 35.58 and 37.36µg cm-2. | Si(Li) detector having 185 eV resolution at 5.9 keV |
| (Turgut and Ertuğrul, 2004) | // / | Photon energy of 31.635 keV generated by a 3.7\*10 8 Bq activity annular source containing 133Ba. | 74W, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.( Thick Mylar substrates were used for evaporating spectroscopically pure targets) | Si(Li) detector having 160 eV resolution at 5.9 keV. |
| (Salah and Al-Jundi, 2005) | / / | 15.2 keV gamma rays produced from a 241Am annular radioactive source. | 57La, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 69Tm, 70Yb, and 71Lu.  (Self-supporting and pure samples) | Si(Li) detector achieving a resolution of 185 eV at 5.9 keV. |
| (Sӧǧüt *et al.,* 2005) | / | Thoroughly filtered gamma rays with an energy of 59.6 keV, produced from a 75 mCi activity 241Am annular source. | 62Sm, 63Eu, 67Ho, 68Er, 72Hf, 73Ta, 74W, 75Re, 78Pt, 79Au, 81Tl, 82Pb, 83Bi, and 92U.  (Powdered samples containing pure elements along with a selection of their compounds: La2O3, CeO2, YbO2, HgO, ThO2) | Si(Li) detector with 155 eV resolution at 5.96 keV. |
| (Karabulut and Gürol, 2006) | /, /, /, Lα/  Lα/  Lα/ . | 59.537KeV photons emitted from an 241Am radioisotope source with 100 mCi activity. | 72Hf, 73Ta, 74W, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (The samples are spectroscopically pure foils and powders). | A solid-state detector achieving a full-width at half-maximum (FWHM) resolution of 160 eV at 5.9 keV for  Mn line. |
| (Zou *et al.,* 2006) | / /, /, /  /. | Utilizing high-brilliance undulator radiation to generate synchrotron radiation spanning the range of 5.6 to 30 keV. | 56Ba.  (target was pressed powder in the form of a disc). | Double crystal monochromator cooled by liquid-nitrogen. |
| (Aylikci *et al.,* 2007) | // / | 123.6 keV gamma rays produced from a 57Co annular radioactive source. | 72Hf.  Both the pure element and its corresponding compounds, all in powdered form, placed on a mylar film | Ultra-LEGe detector with a resolution of 150eV at 5.9KeV. |
| (Demir and Sahin, 2007a) | / / /. | 59.5 keV gamma photon sourced from a filtered point source of 241Am with an intensity of 3.7\*10 8 Bq was employed for direct excitation. | Uranium (92U) and Thorium (90Th).  (spectroscopically pure powders with various magnetic field at 110° and 125°  (B=0, ±0.15T, ±0.30T, ±0.45T, ±0.60T, and ± 0.75T)). | Si(Li) detector with a resolution of 180 eV FWHM at 5.9 keV. |
| (Demir and Sahin, 2007b) | /, / /. | 59.54 keV gamma photon originating from a filtered point source of the radioisotope 241Am was employed to directly excite. | 73Ta, 74W, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (spectroscopically pure foil and powders with various magnetic field: 0T, ±0.15T, ±0.45T and ± 0.75T). | Si(Li) detector with a resolution of 180 eV FWHM at 5.9 keV. |
| (Demir and Sahin, 2008) | / | A gamma photon with an energy of 59.54 keV, emitted from a specifically filtered point source containing the radioisotope 241Am. | 73Ta, 74W, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (Foil and powders with spectroscopic purity, subjected to magnetic fields of ±0.75T and 0T). | A Si(Li) detector exhibiting a 180 eV FWHM resolution at 5.9 keV. |
| (Demir *et al.,* 2008) | , , , , , , , ,  , , , | Gamma rays with an energy of 59.54 keV generated by a radioactive point-source of 241Am. | 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (Samples of different thicknesses with high purity). | Collimated Si(Li) detector. |
| (Han *et al.,* 2008) | / | Gamma rays with an energy of 59.54 keV emitted from a 241Am point source at five angles ranging from 120° to 160° | 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, and 68Er.  (Targets characterized by their spectroscopic purity) | Si(Li) detector having 160 eV FWHM resolution at 5.9 keV |
| (Yalçin *et al.,* 2008) | / / / /, / | Photons resulting from 59.5KeV gamma rays were employed to excite the samples, utilizing an annular source of filtered radioisotope 241Am (100mCi), as well as the radioactive decay of 160Tb, 160Er, 173Lu, 182Re, 201Tl, 203Pb and 207Bi. | 66Dy, 67Ho, 70Yb, 74W, 80Hg, 81Tl, and 82Pb.  (Samples that are pure and in the form of powder). | Si(Li) detector having 160 eV resolution at 5.9 keV. |
| (Cengiz *et al.,* 2010a) | // /  / | Annular radioactive sources of 241Am and 57Co emitting gamma rays with energies of 59.5 keV and 123.6 keV, respectively. | 79Au.  (Both the elemental substance in its pure state and the associated compounds: AuCl, Au2O3 and AuBr3, all presented as powders and affixed to a mylar film). | Ultra-LEGe detector with a resolution of 0.150KeV at 5.9KeV. |
| (Cengiz *et al.,* 2010b) | //,/ / | Gamma rays with an energy of 59.5 keV emitted by an annular radioactive source containing 241Am. | 74W, 75Re, 76Os, and 78Pt.  (powder samples of pure elements and a variety of complexes). | Ultra-LEGe detector having 150 eV resolution at 5.9 keV |
| (Kaçal *et al.,* 2011) | /, /, /, /  / , /, / /  /, / /, | 22.6 keV photons produced from a 109Cd radioactive point source. | 66Dy, 68Er, 70Yb, 71Lu, 73Ta, 74W, 76Os, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (Targets with spectroscopic purity, having thicknesses that vary between 0.018 and 0.36 g/cm2). | Si(Li) detector having 160 eV FWHM resolution at 5.96 keV |
| (Kumar and Puri, 2011) | // //, /, /, /, /, / /. | 22.6 keV photons produced from a 109Cd radioactive source.  (Ag-kα). | Mercury (80Hg)  (target in its pure liquid state). | Peltier cooled Si-PIN x-ray detector arranged in the 90° reflection geometry. |
| (Porikli, 2011) | / /. | 59.54 keV gamma rays produced from a 241Am annular radioactive source of 100 mCi activity. | 57La, 58Ce, and 59Pr.  (The targets were readied as pellets, with the powdered materials compressed into circular disks for their ultimate utilization in the experiment) | Si(Li) detector |
| (Aksoy *et al.,* 2012) | /// / | 59.5 keV gamma rays produced from a 241Am annular radioactive source of 50 mCi activity. | 73Ta and 74W.  (powder samples of pure elements and their compounds: TaCl5, Tal5, TaF5, WS2, WSi2, W2B5, WC, WO3, Na2WO42(H2O) and WCl6). | Ultra-LEGe detector having 150 eV resolution at 5.9 keV. |
| (Durdu and Kucukonder, 2012) | //, /, / / | Highly filtered gamma rays at an energy level of 59.543 keV, generated by a 241Am radioisotope source with an activity of 75 mCi. | 62Sm and 63Eu.  (Pure elemental samples and its compounds in powder form were prepared by placing them onto a mylar film for support). | Si(Li) detector which has a 155 eV resolution at 5.9 keV. |
| (Kumar and Puri, 2012) | /, /, /, /, /, /, /, / / | The EDXRF spectrometer was employed to carry out measurements, utilizing disk-type radioactive sources of 109Cd and 241Am. Two incident photon energies, namely 22.6 KeV and 59.54 KeV, were involved in the process. | 66Dy.  (spectroscopically pure self-supporting pressed pellets of Dy2O3, Dy2(CO3)3, Dy2(SO4)3.8H2O, DyI2 and a pure Dy metallic foil ). | Peltier cooled Si-PIN detector having 152 eV resolution at 5.9 keV. |
| (Porikli, 2012) | /, / /. | 59.5 keV gamma rays produced from a 241Am annular radioactive source of 100 mCi activity. | 66Dy, 67Ho, and 68Er.  (The target samples were created by compacting finely powdered compounds, ensuring both the purity and consistent pressure of the target). | Si(Li) detector with a resolution of 155eV at 5.9KeV. |
| (Alqadi *et al.,* 2013) | // / | Rhodium X-ray tube at an excitation energie of 20.48KeV. | 56Ba, 59Pr, 78Pt, 80Hg, and 83Bi.  (pure elements in the form of powder). | Collimated Si(Li) detector having 167 eV resolution at 5.9 keV. |
| (Cesareo *et al.,* 2013) | / | X-ray tube by an  Ag-anode. | 79Au and 82Pb.  (thin and thick) | Si-drift detector a resolution of 125eV at 5.9KeV. |
| (Durdaǧi, 2013) | /, / / | Commercial 241Am radioactive source was used with an activity 100mCi. | 57La, 58Ce, 59Pr, 60Nd, 62Sm, 64Gd, 65Tb, 66Dy, 67Ho, and 68Er.  (Powder samples with magnetic field 0.6T and 1.2T). | Si(Li) detector having 155 eV resolution at 5.9 keV. |
| (Akman et al., 2015) | /, //, / / / | 59.54keV gamma rays produced from a 241Am annular radioactive source of 100 mCi activity | 70Yb, 73Ta, 74W, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U.  (pure targets with high spectroscopic quality, initially in powdered state, later compacted into pellets). | Si(Li) detector having 160 eV FWHM resolution at 5.96 keV |
| (Aylikci et al., 2015) | /  /  /,  /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, /, / / | 59.5 and 5.96 keV gamma-rays emitted by a 241Am and 57Fe annular source of 50 mCi activity, respectively.  (The 57Fe radioisotope for the elements in the range of 50≤Z≤53 and 241Am for 56≤Z≤92). | 50Sn, 51Sb, 52Te, 53I, 56Ba, 57La, 58Ce, 59Pr, 60Nd, 62Sm, 63Eu, 64Gd, 65Tb, 66Dy, 67Ho, 68Er, 69Tm, 71Lu, 72Hf, 73Ta, 74W, 75Re, 76Os, 77Ir, 78Pt, 79Au, 80Hg, 81Tl, 82Pb, 83Bi, 90Th, and 92U. | Collimated Ultra-LEGe detector having 150 eV resolution at 5.96 keV |
| (Doǧan et al., 2015) | /, /, / / | 59.5 keV gamma photons emitted by a 241Am annular radioactive source of 50 mCi activity. | 82Pb.  (Powdered samples containing a pure element and diverse complexes were readied by being placed onto a mylar film for support). | Ultra-LEGe detector having 150 eV resolution at 5.9 keV |
| (Wang et al., 2015) | /, / /. | 13.1 Kev bremsstrahlung radiation from X-ray tube. | 73Ta, 74W, 79Au, and 82Pb. | AMPTEX production silicon Drift detector(XR-100SDD) having 125 eV resolution at 5.9 keV. |
| (Kaur *et al*., 2016) | /, /, /  /. | Photoionization triggered by synchrotron radiation in the energy range of 10.2 KeV to 13.1 KeV. | 74W and 76Os.  (Spectroscopically ,pure self-supporting 74W (metallic foil) and thick pressed pellets of 76Os). | Silicon drift detector having an energy resolution~140eV at 5.89KeV. |
| (Krishnananda *et al.,* 2016) | /, /  /. | Synchroton radiation | 64Gd, 65Tb, and 67Ho.  (rare earth elements and their compounds). | Silicon drift detector having 130 eV resolution at 5.9 keV . |
| (Bansal *et al.,* 2017) | /, /  /. | Synchrotron radiation emitted at 17 distinct energy levels spanning from 8 KeV to 17 KeV, with intervals of 0.5 KeV between each. | 66Dy, 67Ho, 68Er, 71Lu, 73Ta, 74W, 78Pt, 79Au, 80Hg, 82Pb, and 83Bi.  (Spectroscopically pure elements, Tantalum (73Ta), tungsten (74W), platinum (78Pt), gold (79Au), and lead (82Pb) were in a metallic state, whereas holmium (67Ho) was in powder form. Self-supporting targets of dysprosium (66Dy), erbium (68Er), lutetium (71Lu), mercury (80Hg), and bismuth (83Bi) were prepared directly from powder). | Peltier cooled Vortex solid state Silicon drift detector having an energy resolution~138eV at 5.959KeV (Mn Kα) X-rays. |
| (Porikli Durdaǧi, 2017) | / /. | 59.54 keV gamma rays emitted by a 133Ba radioactive source of 100 mCi activity. | 60Nd, 62Sm, 64Gd, and 65Tb.  30 elements (60Nd, 62Sm, 64Gd,65Tb and their compounds) with high purity starting as powders, they were subsequently compressed into thin, solid pellets. | Si(Li) detector having 155 eV resolution for 5.9KeV X-ray peak. |
| (Kaur *et al.,* 2018) | /, /, /, / /. | Emission of ELETTRA synchrotron radiation within the energy range of 7.8-10KeV. | 66Dy.  (self-supporting pressed pellets of 66Dy compounds namely Dy2O3, Dy2(CO3)3, Dy2(SO4)3, .8H2O, DyI2 and a pure Dy metallic foil). | Silicon drift detector having FWHM ~131eV at 5.89 KeV. |
| (Hiremath *et al.,* 2019) | /, /  / | Synchrotron radiation at energies of 15, 16, and 17 keV. | 80Hg, 82Pb, and 83Bi.  (targets and their compounds which having different crystal structure with same chemical bonding and oxidation state) | Vortex-EX90 Silicon drift detector having 138 eV resolution at 5.9 keV. |
| (Ayri *et al.,* 2021) | /, /, /, / / | Emission of synchrotron radiation spanning energies within the range of 10.5 KeV to 14 KeV. | 75Re.  (A thin target with spectral purity deposited onto a thick mylar foil) | Silicon drift detector with FWHM ~131eV at 5.89KeV. |
| (Fernandez-Ruiz, 2021) | // /  / | 50W metal-ceramics Mo X-ray micro source working at 50KV and 600µA. | 79Au.  The assessed chemical conditions encompassed metallic Au(0) as well as chloride Au(3+) phases, each featuring distinct oxidation states and varying crystal field surroundings. | XFlash silicon drift detector(SDD) with a resolution of 150eV at 5.9KeV.  (Mn Kα). |
| (Duggal *et al.,* 2022) | //  /, /, /, /, /, /, /, / /. | X-rays generated using an X-ray tube equipped with a rhodium anode, operating at 60 kV and 50 mA. | 79Au.  spectroscopically pure thin targets of pure 79Au, AuCl, AuCl3, AuI, AuBr3 and Au(OH)3. | Scintillation counter for high energy X-ray and proportional counter for low energy X-rays. |
| (Alqadi *et al.,* 2023) | // / | 18 and 23 keV synchrotron radiation. | 62Sm, 64Gd, 65Tb, 68Er, 73Ta, 74W, 75Re, 80Hg, 82Pb, and 83Bi.  (pure metals). | KETEX silicon Drift detector(SDD) with an energy resolution of 138eV at 5.96 KeV  Fe Kα X-rays. |

**Table 2.** Summary of the experimental intensity ratios from 39Y to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation, and their means are also listed.

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| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =39, Y | 0.893±0.072 | (Shatendra et al., 1983) | 0.893±0.072 | 0 | 0 |
| *Z* =40, Zr | 0.909±0.074 | (Shatendra et al., 1983) | 0.909±0.074 | 0 | 0 |
| *Z* =41, Nb | 0.943±0.071  0.980±0.087 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.9578±0.055 | -0.16  0.22 | 0.03 |
| *Z* =42, Mo | 0.962±0.083  0.943±0.071 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.951±0.054 | 0.11  -0.09 | 0.01 |
| *Z* =47, Ag | 0.962±0.083  1.010±0.082  1.075±0.058  1.020±0.062 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 1.0276±0.0343 | -0.73  -0.2  0.70  -0.11 | -0.08 |
| *Z* =49, In | 0.990±0.078  1.010±0.092  1.099±0.060  0.813±0.046 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.9406±0.0311 | 0.59  0.71  2.34  -2.30 | 0.34 |
| *Z* =50, Sn | 0.962±0.083  1.042±0.076  1.053±0.066  1.020±0.062 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 1.0237±0.0352 | -0.68  0.22  0.39  -0.05 | -0.03 |
| *Z* =53, I | 1.010±0.082  1.042±0.087  1.111±0.062  1.053±0.066 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 1.0624±0.036 | -0.59  -0.22  0.68  -0.12 | -0.06 |
| *Z* =54, Xe | 0.793±0.069 | (Chand et al., 1989) | 0.793±0.069 | 0 | 0 |
| *Z* =55, Cs | 1.00±0.040 | (Raghavaiah et al., 1990) | 1.00±0.040 | 0 | 0 |
| *Z* =56, Ba | 0.980±0.087  0.990±0.078  1.111±0.062  1.053±0.066  0.805±0.045  0.760±0.042  0.951±0.052  1.020±0.056  1.088±0.060  0.969±0.053  0.927±0.046  1.022±0.051  1.088±0.054  0.951±0.048  1.053±0.042  0.620±0.031  0.8565±0.101 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Mehta et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Baydas et al., 2001)  (Alqadi et al., 2013) | 0.9093±0.0124 | 0.80  1.02  3.19  2.14  -2.23  -3.41  0.78  1.93  2.92  1.10  0.37  2.15  3.23  0.84  3.28  -8.66  -0.52 | 0.53 |
| *Z* =57, La | 0.971±0.085  1.064±0.091  1.111±0.074  1.031±0.064  0.861±0.047  1.034±0.057  1.010±0.056  1.133±0.062  1.133±0.062  0.909±0.036  0.800±0.071  0.682±0.034  0.775±0.060  0.7005±0.056  0.96±0.12  1.32±0.15  0.742±0.044  0.779±0.049(B=0.6T)  0.789±0.056(B=1.2T) | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.8730±0.0128 | 1.14  2.08  3.17  2.42  -0.25  2.76  2.39  4.11  4.11  0.94  -1.01  -5.26  -1.60  -3.00  0.72  2.97  -2.86  -1.86  -1.46 | 0.50 |
| *Z* =58, Ce | 1.010±0.082  1.053±0.089  1.099±0.072  1.042±0.065  0.883±0.049  0.978±0.054  1.060±0.058  1.186±0.065  1.102±0.061  0.952±0.048  1.033±0.052  1.186±0.059  1.075±0.054  0.926±0.037  0.755±0.066  0.629±0.030  0.781±0.061  0.724±0.063  0.733±0.059(B=0.6T)  0.773±0.066(B=1.2T) | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.9062±0.0121 | 1.25  1.63  2.64  2.05  -0.46  1.30  2.60  4.23  3.15  0.93  2.38  4.65  3.05  0.51  -2.25  -8.57  -2.01  -2.84  -2.87  -1.98 | 0.47 |
| *Z* =59, Pr | 0.936±0.051  0.966±0.053  0.991±0.055  1.131±0.062  1.031±0.057  0.943±0.038  1.055±0.042  1.076±0.050  0.802±0.071  0.794±0.069  0.6832±0.055  0.98±0.12  1.15±0.14  1.0556±0.1238  0.744±0.033  0.777±0.048(B=0.6T)  0.797±0.057(B=1.2T) | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Alqadi et al., 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.9072±0.013 | 0.55  1.08  1.48  3.53  2.12  0.89  3.36  3.27  -1.46  -1.61  -3.96  0.60  1.73  1.19  -4.60  -2.62  -1.89 | 0.21 |
| *Z* =60, Nd | 0.835±0.046  0.920±0.051  0.913±0.050  1.115±0.061  1.013±0.056  0.901±0.045  0.952±0.048  1.115±0.056  0.995±0.050  0.935±0.037  0.797±0.072  0.781±0.061  0.7570±0.061  1.03±0.12  1.20±0.14  0.801±0.064  0.810±0.072(B=0.6T)  0.814±0.066(B=1.2T) | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.9181±0.0132 | -1.74  0.04  -0.1  3.15  1.65  -0.36  0.68  3.42  1.49  0.43  -1.65  -2.2  -2.58  0.93  2.00  -1.79  -1.48  -1.55 | 0.02 |
| *Z* =61, Pm | 1.031±0.041 | (Raghavaiah et al., 1990) | 1.031±0.041 | 0 | 0 |
| *Z* =62, Sm | 1.010±0.092  1.064±0.091  1.190±0.085  1.075±0.069  0.997±0.055  1.090±0.060  1.139±0.063  1.145±0.063  1.219±0.067  1.020±0.041  1.053±0.100  0.789±0.072  0.980±0.077  0.781±0.067  0.83328±0.067  1.15±0.11  1.12±0.13  0.822±0.049  0.810±0.049  0.815±0.049  0.826±0.050  0.826±0.050  0.836±0.050  0.862±0.040  0.861±0.040  0.751±0.040  0.883±0.086(B=0.6T)  0.912±0.075(B=1.2T)  1.119±0.09  1.114±0.09 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Ertugrul, 1996)  (Ismail and Malhi., 2000)  (Durak and Özdemir., 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Durdu and Kucukonder, 2012)  (Durdu and Kucukonder, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.9214±0.0181 | 0.95  1.54  3.09  2.15  1.31  2.69  3.32  3.41  4.29  2.2  1.3  -1.78  0.74  -2.02  -1.27  2.05  1.51  -1.9  -2.13  -2.04  -1.79  -1.79  -1.61  -1.35  -1.37  -3.88  -0.44  -0.12  2.15  2.1 | 0.38 |
| Z=63, Eu | 0.822±0.045  0.934±0.051  0.992±0.055  1.038±0.057  1.079±0.059  1.065±0.059  0.971±0.039  0.857±0.036  0.891±0.038  0.763±0.067  0.952±0.091  0.8988±0.072  1.16±0.13  1.13±0.13  0.825±0.050  0.813±0.049  0.816±0.049  0.826±0.050  0.837±0.050  0.833±0.050  0.758±0.050  0.753±0.050 | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Chand et al., 1992b)  (Chand et al., 1992b)  (Ertugrul, 1996)  (Ismail and Malhi, 2000)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Durdu and kucukonder, 2012)  (Durdu and kucukonder, 2012) | 0.8827±0.0111 | -1.31  0.98  1.95  2.67  3.27  3.04  2.18  -0.68  0.21  -1.76  0.76  0.22  2.13  1.9  -1.13  -1.39  -1.33  -1.11  -0.89  -0.97  -2.43  -2.53 | 0.17 |
| *Z* =64, Gd | 1.00±0.090  1.099±0.085  1.163±0.081  1.099±0.060  1.053±0.1  1.220±0.119  1.190±0.113  1.163±0.112  0.886±0.049  0.932±0.051  0.982±0.054  1.050±0.058  1.079±0.059  1.140±0.063  0.990±0.040  0.781±0.070  0.629±0.031  0.7610±0.061  1.12±0.13  1.13±0.13  0.834±0.050  0.821±0.049  0.830±0.050  0.835±0.050  0.839±0.050  0.847±0.050  0.682±0.056  0.712±0.056(B=0.6T)  0.734±0.054(B=1.2T)  0.962±0.009  1.277±0.09  1.248±0.09 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.9309±0.0069 | 0.77  1.97  2.86  2.78  1.22  2.43  2.29  2.07  -0.91  0.02  0.94  2.04  2.49  3.3  1.46  -2.13  -9.51  -2.77  1.45  1.53  -1.92  -2.22  -2  -1.9  -1.82  -1.66  -4.41  -3.88  -3.62  2.75  3.83  3.51 | 0.03 |
| *Z* =65, Tb | 0.856±0.047  0.934±0.051  0.992±0.055  1.074±0.059  1.148±0.063  1.158±0.064  0.917±0.037  0.791±0.070  1.0058±0.080  1.0528±0.084  1.0578±0.085  0.826±0.061  0.9801±0.078  1.06±0.13  1.17±0.09  0.815±0.049  0.804±0.048  0.808±0.048  0.819±0.049  0.820±0.049  0.824±0.049  0.765±0.053  0.769±0.053(B=0.6T)  0.770±0.065(B=1.2T)  0.943±0.009  1.301±0.10  1.254±0.10 | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.9276±0.0071 | -1.51  0.12  1.16  2.46  3.48  3.58  -0.28  -1.94  0.97  1.49  1.53  -1.65  0.67  1.02  2.69  -2.27  -2.55  -2.46  -2.19  -2.17  -2.09  -3.04  -2.97  -2.41  1.35  3.72  3.26 | -0.002 |
| *Z* =66, Dy | 0.961±0.057  0.918±0.050  0.964±0.053  1.014±0.056  1.074±0.059  1.143±0.063  1.218±0.067  0.926±0.037  0.789±0.070  1.0443±0.084  1.0439±0.084  1.0610±0.085  0.826±0.068  0.8077±0.065  0.885±0.141  1.07±0.13  1.09±0.12  0.843±0.051  0.832±0.050  0.835±0.050  0.844±0.051  0.852±0.051  0.853±0.051  0.841±0.062  0.786±0.003  1.161±0.077  1.159±0.078  1.17±0.07  0.903±0.054  0.808±0.072  0.808±0.072  0.810±0.066(B=0.6T)  0.824±0.068(B=1.2T)  0.186±0.006  0.193±0.006  0.808±0.024  0.778±0.023  0.781±0.023  0.938±0.028  0.941±0.028  0.942±0.028  0.946±0.028  0.943±0.028 | (Mehta et al., 1986)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Öz et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Kumar and Puri, 2012)  (Kumar and Puri, 2012)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018) | 0.6206±0.0807 | 3.45  3.13  3.56  4  4.53  5.1  5.69  3.44  1.58  3.64  3.63  3.76  1.95  1.81  1.63  2.94  3.25  2.33  2.23  2.26  2.34  2.42  2.43  2.17  2.05  4.84  4.8  5.14  2.91  1.73  1.73  1.82  1.93  -5.37  -5.28  2.23  1.88  1.91  3.72  3.75  3.76  3.81  3.77 | 2.66 |
| Z=67, Ho | 0.961±0.048  0.963±0.048  1.048±0.052  1.058±0.053  1.199±0.060  1.220±0.061  0.990±0.040  1.082±0.039  1.072±0.034  0.830±0.075  1.1093±0.089  1.0669±0.085  1.1005±0.088  0.862±0.067  0.8170±0.065  0.952±0.118  1.11±0.13  1.10±0.13  0.848±0.051  0.840±0.050  0.843±0.050  0.846±0.050  0.852±0.051  0.859±0.051  0.905±0.057  0.813±0.011  0.833±0.062  0.833±0.062  0.826±0.075(B=0.6T)  0.836±0.077(B=1.2T)  0.971±0.009 | (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Öz et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016) | 0.9236±0.0058 | 0.77  0.82  2.38  2.52  4.57  4.84  1.64  4.02  4.3  -1.24  2.08  1.68  2.01  -0.92  -1.63  0.24  1.43  1.36  -1.47  -1.66  -1.6  -1.54  -1.39  -1.26  -0.32  -8.89  -1.45  -1.45  -1.3  -1.13  4.43 | 0.38 |
| *Z* =68, Er | 0.939±0.047  1.020±0.051  1.104±0.055  1.095±0.055  1.137±0.057  1.263±0.063  1.061±0.053  0.990±0.040  0.815±0.073  0.629±0.006  0.840±0.056  0.926±0.129  0.852±0.051  0.846±0.051  0.852±0.051  0.852±0.051  0.853±0.051  0.858±0.051  1.167±0.076  1.159±0.075  0.835±0.063  0.835±0.063  0.834±0.049(B=0.6T)  0.829±0.055(B=1.2T)  1.240±0.08 | (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Chand et al., 1989)  (Raghavaiah et al., 1990)  (Ertugrul., 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Han et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Alqadi et al., 2023) | 0.6987±0.0053 | 5.08  6.27  7.34  7.17  7.66  8.93  6.8  7.22  1.59  -8.7  2.51  1.76  2.99  2.87  2.99  2.99  3.01  3.11  6.15  6.12  2.16  2.16  2.75  2.36  6.75 | 4 |
| *Z* =69, Tm | 0.956±0.039  1.035±0.052  1.094±0.055  1.156±0.058  1.175±0.059  1.280±0.064  1.203±0.060  0.962±0.038  0.812±0.073  1.0919±0.087  1.0079±0.081  1.0716±0.086  0.77745±0.062  1.08±0.13  1.12±0.13 | (Mehta et al., 1986)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005) | 1.0367±0.0155 | -1.92  -0.03  1  1.99  2.27  3.69  2.68  -1.82  -3.01  0.63  -0.35  0.4  -4.06  0.33  0.64 | 0.16 |
| *Z* =70, Yb | 1.052±0.015  1.003±0.050  1.043±0.052  1.125±0.056  1.138±0.057  1.212±0.061  1.356±0.068  0.980±0.039  1.137±0.040  1.060±0.038  1.449±0.174  1.1314±0.091  1.0852±0.087  1.1212±0.090  1.015±0.051  1.515±0.184  0.8221±0.066  1.553±0.077  1.12±0.13  1.14±0.14  1.458±0.036  1.420±0.016  1.147±0.074  1.166±0.075  1.299±0.067 | (Mehta et al., 1985)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Saad, 2003)  (Küçükönder et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 1.1907±0.0082 | -8.11  -3.7  -2.81  -1.16  -0.91  0.35  2.41  -5.29  -1.31  -3.36  1.48  -0.65  -1.21  -0.77  -3.4  1.76  -5.54  4.68  -0.54  -0.36  7.24  12.76  -0.59  -0.33  1.6 | -0.31 |
| *Z* =71, Lu | 1.024±0.051  1.089±0.054  1.141±0.057  1.220±0.061  1.363±0.068  1.485±0.074  0.901±0.036  1.342±0.083  1.0891±0.087  1.0702±0.086  1.0954±0.088  1.020±0.083  0.8112±0.065  1.11±0.13  1.09±0.12  1.133±0.072  1.125±0.072 | (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Ismail and Malhi, 2000)  (Saad, 2003)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Kaçal et al., 2011)  (Kaçal et al., 2011) | 1.0861±0.0160 | -1.16  0.05  0.93  2.12  3.96  5.27  -4.7  3.03  0.03  -0.18  0.1  -0.78  -4.11  0.18  0.03  0.64  0.53 | 0.35 |
| *Z* =72, Hf | 1.105±0.025  0.980±0.106  1.429±0.163  1.404±0.063  1.031±0.128  1.538±0.189  1.0826±0.0487 | (Mehta et al., 1987b)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Karabulut and Gurol, 2006)  (Aylikci et al., 2007) | 1.1350±0.0200 | -0.93  -1.44  1.79  4.07  -0.80  2.12  -0.99 | 0.54 |
| *Z* =73, Ta | 1.087±0.025  1.184±0.027  1.333±0.038  1.380±0.039  1.073±0.025  1.230±0.027  1.475±0.041  0.926±0.037  1.582±0.198  1.460±0.149  0.968±0.052  1.116±0.055  1.410±0.064  1.370±0.169  1.155±0.072  1.153±0.072  1.525±0.078  1.429±0.061  1.187±0.07  1.163±0.09 | (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012)  (Akman et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.1874±0.0096 | -3.75  -0.12  3.71  4.79  -4.27  1.48  6.83  -6.84  1.99  1.83  -4.15  3.44  1.08  -1.28  -0.45  -0.47  4.3  3.91  -0.006  -0.27 | 0.59 |
| *Z* =74, W | 1.043±0.031  1.132±0.034  1.288±0.038  1.050±0.031  1.178±0.034  1.382±0.038  0.885±0.035  1.233±0.053  1.592±0.200  1.464±0.129  1.019±0.050  1.0121±0.081  1.0378±0.083  1.0328±0.083  1.250±0.109  1.477±0.065  0.962±0.092  1.198±0.041  1.370±0.188  1.600±0.036  1.531±0.167  1.461±0.075  1.152±0.065  1.174±0.066  1.583±0.080  1.429±0.061  1.136±0.08  1.092±0.086 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Chand et al., 1992a)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012)  (Akman et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.1917±0.0097 | -4.58  -1.69  2.45  -4.36  -0.39  4.85  -8.44  0.77  2  2.1  -3.39  -2.2  -1.84  -1.9  0.53  4.34  -2.48  0.15  0.95  10.95  2.03  3.56  -0.6  -0.27  4.86  3.84  -0.69  -1.15 | 0.34 |
| *Z* =75, Re | 1.029±0.027  1.132±0.025  1.299±0.045  1.486±0.181  1.344±0.090  1.058±0.060  1.274±0.067  1.390±0.071  1.086±0.12  1.031±0.08 | (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Küçükönder et al., 2004)  (Cengiz et al., 2010b)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.1367±0.0148 | -3.50  -0.16  3.42  1.92  2.27  -1.27  2.00  3.49  -0.42  -1.30 | 0.65 |
| *Z* =76, Os | 1.040±0.062  0.870±0.060  1.064±0.113  1.288±0.066  1.019±0.058  1.026±0.058 | (Mehta et al., 1986)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011) | 1.0408±0.0263 | -0.01  -2.61  0.20  3.48  -0.34  -0.23 | 0.08 |
| *Z* =77, Ir | 0.935±0.037  1.064±0.091 | (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992) | 0.9533±0.0343 | -0.36  1.14 | 0.39 |
| *Z* =78, Pt | 1.114±0.039  0.981±0.021  1.031±0.022  0.826±0.034  1.121±0.038  0.9739±0.078  0.9623±0.077  0.9868±0.079  0.826±0.068  1.144±0.056  1±0.099  1.274±0.064  1.005±0.057  1.010±0.057  1.0713±0.129 | (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Dhal and Padhi, 1994)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Ismail and Malhi, 2000)  (Küçükönder et al., 2004)  (Demir et al., 2008)  (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Alqadi et al., 2013) | 1.0117±0.0108 | 2.53  -1.3  0.79  -5.21  2.77  -0.48  -0.64  -0.31  -2.7  2.32  -0.12  4.04  -0.12  -0.03  0.46 | 0.13 |
| *Z* =79, Au | 0.841±0.011  0.848±0.012  0.824±0.013  0.834±0.034  0.974±0.017  1.008±0.022  1.106±0.080  1.097±0.041  0.969±0.019  1.009±0.024  1.073±0.056  0.926±0.037  1.010±0.092  1.1189±0.048  1.1149±0.046  1.1458±0.044  1.1660±0.044  1.1911±0.042  1.045±0.044  1.059±0.046  1.1144±0.038  1.1327±0.034  1.1583±0.030  1.078±0.111  0.979±0.058  1.037±0.045  0.9432±0.075  0.9521±0.076  0.9831±0.079  1.003±0.050  1.110±0.059  0.918±0.042  0.990±0.127  1.010±0.100  1.204±0.084  0.954±0.054  0.956±0.054  1.020±0.042  1.370±0.056  1.2±0.1  1.095±0.055 | (Chang and Su, 1978)  (Chang and Su, 1978)  (Chang and Su, 1978)  (Chang and Su, 1978)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao et al., 1993)  (Rao et al., 1993)  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol., 2006)  (Demir et al., 2008)  (Cengiz et al., 2010a)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Cesareo et al., 2013)  (Cesareo et al., 2013)  (Fernandez-Ruiz, 2021)  (Duggal et al., 2022) | 0.9402±0.0136 | -5.66  -5.07  -6.17  -2.9  1.55  2.62  2.04  3.63  1.23  2.49  2.3  -0.36  0.75  3.58  3.64  4.46  4.9  5.68  2.28  2.48  4.31  5.25  6.62  1.23  0.65  2.06  0.04  0.15  0.54  1.21  2.8  -0.5  0.39  0.69  3.1  0.25  0.28  1.81  7.46  2.57  2.73 | 1.64 |
| *Z* =80, Hg | 0.980±0.035  1.012±0.037  1.086±0.055  0.960±0.032  0.995±0.035  1.042±0.055  1.086±0.045  1.184±0.040  0.952±0.038  0.990±0.078  0.989±0.098  1.055±0.067  1.025±0.034  1.099±0.109  1.174±0.058  1.062±0.070  0.911±0.040  0.990±0.127  1.050±0.104  1.193±0.151  1.082±0.015  0.951±0.054  0.955±0.054  1.06±0.06  1.0328±0.125  0.962±0.037  0.932±0.08  0.862±0.08 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Chand et al., 1989)  (Chand et al., 1989)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Kumar and Puri, 2011)  (Alqadi et al., 2013)  (Akman et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.0310±0.0048 | -1.44  -0.51  1  -2.19  -1.02  0.2  1.22  3.8  -2.06  -0.52  -0.43  0.36  -0.17  0.62  2.46  0.44  -2.98  -0.32  0.18  1.07  3.24  -1.48  -1.4  0.48  0.01  -1.85  -1.23  -2.11 | -0.17 |
| *Z* =81, Tl | 1.042±0.057  0.953±0.029  0.986±0.032  1.022±0.037  1.034±0.105  1.056±0.022  1.036±0.025  0.870±0.068  1.042±0.119  0.978±0.059  0.840±0.092  0.951±0.045  0.962±0.120  1.050±0.104  1.066±0.022  1.028±0.007  0.953±0.053  0.956±0.053  1.075±0.046 | (Mehta et al., 1987a)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 1.0242±0.0056 | 0.31  -2.41  -1.18  -0.06  0.09  1.4  0.46  -2.26  0.15  -0.78  -2  -1.61  -0.52  0.25  1.84  0.42  -1.34  -1.28  1.1 | -0.39 |
| *Z* =82, Pb | 1.220±0.059  1.043±0.099  1.004±0.018  1.040±0.037  0.978±0.036  1.203±0.104  0.949±0.043  0.984±0.021  1.012±0.033  1.020±0.083  1.0190±0.036  1.0382±0.034  1.0462±0.032  1.0531±0.030  1.1465±0.028  1.028±0.048  1.023±0.046  1.073±0.025  0.9021±0.046  0.9132±0.044  1.0346±0.040  1.065±0.111  1.2464±0.0311  1.059±0.067  1.037±0.020  1.053±0.089  1.241±0.062  1.031±0.096  1.149±0.119  1.078±0.052  0.972±0.044  0.980±0.125  1.010±0.100  1.093±0.027  1.063±0.017  0.941±0.052  0.943±0.053  0.962±0.046  1.333±0.053  0.952±0.036  0.9087±0.0509  0.917±0.025  0.918±0.08  0.845±0.079 | (Kumar et al., 1982)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Darko and Tetteh, 1992)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao et al., 1993)  (Rao et al., 1993)  (Dhal and Padhi, 1994)  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1996)  (Sögüt et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Tirasoglu et al., 2003)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Cesareo et al., 2013)  (Cesareo et al., 2013)  (Akman et al., 2015)  (Dogan et al., 2015)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.0332±0.0055 | 3.15  0.1  -1.55  0.18  -1.52  1.63  -1.94  -2.27  -0.63  -0.16  -0.39  0.15  0.4  0.65  3.97  -0.11  -0.22  1.56  -2.83  -2.71  0.03  0.29  6.75  0.38  0.18  0.22  3.34  -0.02  0.97  0.86  -1.38  -0.43  -0.23  2.17  1.67  -1.76  -1.69  -1.54  5.63  -2.23  -2.43  -4.54  -1.44  -2.38 | -0.002 |
| *Z* =83, Bi | 1.005±0.030  1.039±0.021  1.091±0.048  1.140±0.047  1.074±0.098  0.947±0.030  0.988±0.018  1.012±0.048  1.099±0.038  1.055±0.108  1.057±0.056  1.057±0.031  0.901±0.065  1.314±0.066  1.070±0.058  0.855±0.080  0.943±0.042  1.020±0.135  1.050±0.104  0.918±0.050  0.919±0.050  1.0505±0.0926  0.990±0.039  0.935±0.026  0.808±0.075  0.844±0.077 | (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Dhal and Padhi, 1994)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Alqadi et al., 2013)  (Akman et al., 2015)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 1.0039±0.0079 | 0.04  1.57  1.79  2.86  0.71  -1.83  -0.81  0.17  2.45  0.47  0.94  1.66  -1.57  4.67  1.13  -1.85  -1.42  0.12  0.44  -1.7  -1.68  0.5  -0.35  -2.53  -2.6  -2.07 | 0.04 |
| *Z* =90, Th | 1.190±0.071  1.027±0.051  1.058±0.053  1.091±0.055  1.114±0.056  1.115±0.056  1.116±0.103  1.205±0.030  1.319±0.033  1.361±0.033  1.462±0.036  1.597±0.041  1.669±0.042  1.706±0.044  1.129±0.102  1.056±0.027  1.111±0.111  1.081±0.051  0.909±0.091  1.038±0.045  1.010±0.133  1.200±0.119  1.011±0.053  1.008±0.053  1.163±0.041 | (Kumar et al., 1982)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 1.2413±0.0094 | -0.72  -4.13  -3.41  -2.69  -2.24  -2.22  -1.21  -1.15  2.27  3.49  5.93  8.46  9.94  10.33  -1.1  -6.48  -1.17  -3.09  -3.63  -4.42  -1.73  -0.35  -4.28  -4.33  -1.86 | -0.39 |
| *Z* =92, U | 1.163±0.068  1.003±0.050  1.008±0.050  1.082±0.054  1.083±0.054  1.108±0.055  0.847±0.065  1.183±0.127  1.015±0.026  1.096±0.028  1.198±0.030  1.232±0.030  1.222±0.030  1.282±0.033  1.362±0.033  1.085±0.082  0.970±0.020  1.042±0.098  0.915±0.026  0.884±0.047  0.927±0.047  0.980±0.125  1.150±0.114  0.892±0.048  0.932±0.050  1.075±0.035 | (Kumar et al., 1982)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Darko and Tetteh, 1992)  (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Küçükönder, 2002)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 1.0754±0.0076 | 1.28  -1.43  -1.33  0.12  0.14  0.59  -3.49  0.85  -2.23  0.71  3.96  5.06  4.74  6.1  8.46  0.12  -4.92  -0.34  -5.92  -4.02  -3.12  -0.76  0.65  -3.77  -2.84  -0.01 | -0.05 |

**Table 3.** Summary of the experimental intensity ratios from 39Y to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =39, Y | 0.176±0.015 | (Shatendra et al., 1983) | 0.176±0.015 | 0 | 0 |
| *Z* =40, Zr | 0.181±0.016 | (Shatendra et al., 1983) | 0.181±0.016 | 0 | 0 |
| *Z* =41, Nb | 0.184±0.017  0.188±0.016 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.1861±0.017 | -0.10  0.09 | -0.004 |
| *Z* =42, Mo | 0.192±0.015  0.200±0.017 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.1955±0.0112 | -0.19  0.22 | 0.02 |
| *Z* =47, Ag | 0.205±0.017  0.213±0.016  0.234±0.014  0.168±0.010 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.1965±0.0067 | 0.46  0.95  2.42  -2.37 | 0.37 |
| *Z* =49, In | 0.206±0.018  0.227±0.021  0.316±0.029  0.230±0.013 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.2317±0.0090 | -1.28  -0.21  2.78  -0.11 | 0.30 |
| *Z* =50, Sn | 0.209±0.017  0.231±0.019  0.257±0.020  0.239±0.014 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.2331±0.0085 | -1.27  -0.10  1.1  0.36 | 0.02 |
| *Z* =53, I | 0.222±0.019  0.228±0.020  0.261±0.017  0.236±0.014 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.2380±0.0085 | -0.77  -0.46  1.21  -0.12 | -0.04 |
| *Z* =54, Xe | 0.099±0.010 | (Chand et al., 1989) | 0.099±0.010 | 0 | 0 |
| *Z* =55, Cs | 0.144±0.007 | (Raghavaiah et al., 1990) | 0.144±0.007 | 0 | 0 |
| *Z* =56, Ba | 0.212±0.018  0.233±0.019  0.258±0.015  0.226±0.013  0.099±0.007  0.144±0.008  0.143±0.008  0.194±0.011  0.194±0.010  0.145±0.007  0.114±0.006 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Mehta et al., 1987)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Baydas et al., 2001) | 0.1486±0.0027 | 3.48  4.40  7.18  5.83  -6.60  -0.54  -0.66  4.01  4.38  -0.48  -5.25 | 1.43 |
| *Z* =57, La | 0.213±0.017  0.236±0.019  0.267±0.019  0.258±0.015  0.136±0.007  0.159±0.009  0.181±0.010  0.234±0.013  0.153±0.008  0.103±0.001  0.148±0.007  0.113±0.012  0.20±0.03  0.17±0.02  0.123±0.006  0.123±0.006  0.127±0.005(B=0.6T)  0.152±0.018(B=1.2T) | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Porikli, 2011)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.1105±0.0009 | 6.02  6.6  8.23  9.81  3.61  5.36  7.02  9.48  5.28  -5.56  5.31  0.21  2.98  2.97  2.06  2.06  3.24  2.3 | 4.28 |
| *Z* =58, Ce | 0.192±0.017  0.249±0.022  0.266±0.021  0.216±0.013  0.173±0.010  0.197±0.011  0.249±0.014  0.191±0.011  0.249±0.012  0.185±0.009  0.145±0.007  0.107±0.008  0.134±0.007  0.114±0.009  0.117±0.007  0.117±0.007  0.124±0.007(B=0.6T)  0.131±0.014(B=1.2T) | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Porikli, 2011)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.1503±0.0022 | 2.43  4.46  5.48  4.98  2.21  4.16  6.96  3.62  8.08  3.74  -0.73  -5.22  -2.22  -3.92  -4.54  -4.54  -3.58  -1.36 | 1.11 |
| *Z* =59, Pr | 0.156±0.001  0.164±0.009  0.166±0.009  0.188±0.010  0.224±0.012  0.155±0.008  0.1743±0.009  0.1753±0.010  0.109±0.009  0.122±0.010  0.17±0.02  0.16±0.02  0.107±0.008  0.1428±0.0167  0.107±0.008  0.109±0.009(B=0.6T)  0.110±0.010(B=1.2T) | (Mehta et al., 1987)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Durak and Özdemir, 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Porikli, 2011)  (Alqadi et al., 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.1542±0.0009 | 1.31  1.08  1.3  3.36  5.8  0.1  2.22  2.1  -5  -3.21  0.79  0.29  -5.86  -0.68  -5.86  -5  -4.4 | -0.69 |
| *Z* =60, Nd | 0.130±0.007  0.141±0.008  0.233±0.013  0.148±0.008  0.233±0.012  0.145±0.007  0.172±0.009  0.107±0.010  0.118±0.010  0.16±0.02  0.18±0.02  0.110±0.006  0.111±0.008(B=0.6T)  0.117±0.011(B=1.2T)  0.110±0.006 | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987b)  (Singh et al., 1987b)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Durak and Özdemir, 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2017) | 0.1346±0.0022 | -0.63  0.77  7.46  1.61  8.06  1.41  4.03  -2.7  -1.62  1.26  2.25  -3.85  -2.85  -1.57  -3.85 | 0.65 |
| *Z* =61, Pm | 0.160±0.008 | (Raghavaiah et al., 1990) | 0.160±0.008 | 0 | 0 |
| *Z* =62, Sm | 0.196±0.017  0.250±0.021  0.279±0.020  0.222±0.013  0.121±0.007  0.136±0.007  0.170±0.009  0.215±0.012  0.165±0.008  0.231±0.020  0.114±0.009  0.141±0.019  0.131±0.008  0.17±0.02  0.18±0.03  0.126±0.006  0.124±0.006  0.119±0.013  0.121±0.011(B=0.6T)  0.127±0.009(B=1.2T)  0.119±0.013  0.202±0.027  0.188±0.02 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Ertugrul, 1996)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdu and Kucukonder, 2012)  (Durdu and Kucukonder, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2017)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.1436±0.0021 | 3.06  5.04  6.73  5.95  -3.08  -1.04  2.86  5.86  2.59  4.35  -3.2  -0.13  -1.52  1.31  1.21  -2.76  -3.07  -1.87  -2.01  -1.79  -1.87  2.16  2.21 | 0.91 |
| *Z* =63, Eu | 0.147±0.008  0.122±0.007  0.161±0.009  0.162±0.009  0.220±0.012  0.146±0.007  0.111±0.007  0.147±0.018  0.19±0.03  0.19±0.03  0.133±0.007  0.132±0.007 | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Ismail and Malhi, 2000)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdu and kucukonder, 2012)  (Durdu and kucukonder, 2012) | 0.1412±0.0025 | 0.69  -2.58  2.12  2.22  6.42  0.64  -4.06  0.32  1.62  1.62  -1.10  -1.24 | 0.56 |
| *Z* =64, Gd | 0.200±0.017  0.251±0.021  0.263±0.021  0.238±0.014  0.189±0.015  0.254±0.023  0.261±0.023  0.271±0.060  0.107±0.006  0.136±0.007  0.142±0.008  0.183±0.010  0.171±0.009  0.207±0.011  0.146±0.007  0.113±0.013  0.166±0.008  0.20±0.03  0.17±0.02  0.113±0.005  0.117±0.007(B=0.6T)  0.133±0.013(B=1.2T)  0.149±0.002  0.113±0.005  0.238±0.028  0.209±0.02 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016)  (Durdagi, 2017)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.1452±0.0014 | 3.21  5.03  5.6  6.59  2.91  4.72  5.02  2.1  -6.21  -1.29  -0.4  3.74  2.83  5.57  0.11  -2.46  2.56  1.82  1.24  -6.21  -3.95  -0.93  1.55  -6.21  3.31  3.18 | 1.29 |
| *Z* =65, Tb | 0.145±0.006  0.134±0.007  0.171±0.008  0.168±0.010  0.183±0.009  0.248±0.011  0.156±0.008  0.116±0.008  0.1571±0.013  0.1875±0.015  0.1899±0.015  0.126±0.008  0.19±0.03  0.17±0.02  0.116±0.006  0.120±0.006  0.132±0.010  0.150±0.003  0.116±0.006  0.237±0.03  0.198±0.028 | (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016)  (Durdagi, 2017)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.1450±0.0017 | -0.007  -1.54  3.18  2.26  4.15  9.26  1.34  -3.56  0.92  2.81  2.97  -2.33  1.5  1.24  -4.67  -4.02  -1.29  1.45  -4.67  3.06  1.89 | 0.66 |
| *Z* =66, Dy | 0.169±0.010  0.125±0.007  0.150±0.008  0.133±0.007  0.155±0.009  0.187±0.010  0.189±0.010  0.158±0.008  0.118±0.007  0.1700±0.014  0.1869±0.015  0.1966±0.016  0.127±0.007  0.156±0.024  0.20±0.03  0.17±0.02  0.122±0.001  0.119±0.0002  0.198±0.014  0.190±0.014  0.125±0.008  0.248±0.017  0.125±0.008  0.130±0.010(B=0.6T)  0.137±0.012(B=1.2T) | (Mehta et al., 1986)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Singh et al., 1987a)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Porikli, 2012)  (Kumar and Puri, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013) | 0.1194±0.0002 | 4.96  0.8  3.83  1.95  3.96  6.76  6.96  4.83  -0.2  3.62  4.5  4.83  1.09  1.53  2.69  2.53  2.58  -1.33  5.62  5.04  0.7  7.57  0.7  1.06  1.47 | 3.12 |
| *Z* =67, Ho | 0.127±0.006  0.205±0.010  0.176±0.009  0.202±0.010  0.199±0.010  0.242±0.012  0.149±0.007  0.1854±0.007  0.1852±0.008  0.120±0.007  0.1937±0.015  0.1927±0.015  0.1909±0.015  0.136±0.008  0.159±0.020  0.19±0.03  0.18±0.03  0.123±0.0004  0.121±0.0001  0.128±0.012  0.128±0.012  0.139±0.015(B=0.6T)  0.151±0.017(B=1.2T)  0.152±0.003 | (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Krishnananda et al., 2016) | 0.1212±0.0001 | 0.96  8.38  6.09  8.08  7.78  10.06  3.97  9.17  8  -0.18  4.83  4.76  4.64  1.85  1.89  2.29  1.96  4.3  -1.66  0.56  0.56  1.18  1.75  10.25 | 4.23 |
| *Z* =68, Er | 0.167±0.008  0.189±0.009  0.175±0.009  0.211±0.011  0.221±0.011  0.271±0.014  0.164±0.010  0.162±0.008  0.128±0.007  0.167±0.008  0.131±0.008  0.161±0.023  0.214±0.015  0.204±0.014  0.132±0.007  0.132±0.007  0.136±0.011(B=0.6T)  0.144±0.015(B=1.2T)  0.227±0.023 | (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Chand et al., 1989)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Alqadi et al., 2023) | 0.1619±0.0022 | 0.61  2.92  1.41  4.37  5.26  7.7  0.2  0.007  -4.62  0.61  -3.73  -0.04  3.43  2.97  -4.08  -4.08  -2.31  -1.18  2.82 | 0.65 |
| *Z* =69, Tm | 0.159±0.006  0.146±0.007  0.191±0.010  0.231±0.012  0.179±0.009  0.257±0.013  0.195±0.010  0.158±0.008  0.126±0.005  0.1777±0.014  0.1807±0.014  0.1977±0.016  0.20±0.03  0.18±0.02 | (Mehta et al., 1986)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Salah, 2004)  (Salah and Al-Jundi, 2005) | 0.1642±0.0024 | -0.8  -2.45  2.61  5.46  1.59  7.02  2.99  -0.74  -6.85  0.95  1.16  2.07  1.19  0.79 | 1.07 |
| *Z* =70, Yb | 0.170±0.002  0.121±0.006  0.203±0.010  0.160±0.008  0.233±0.012  0.159±0.008  0.227±0.011  0.171±0.009  0.2139±0.012  0.2112±0.007  0.339±0.015  0.1924±0.015  0.2106±0.017  0.2124±0.017  0.167±0.008  0.300±0.023  0.288±0.014  0.21±0.03  0.19±0.03  0.356±0.003  0.337±0.002  0.205±0.014  0.204±0.014  0.254±0.027 | (Mehta et al., 1985)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Garg et al., 1986)  (Raghavaiah et al., 1990)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 0.2533±0.0011 | -36.29  -21.67  -5  -11.55  -1.69  -11.67  -2.38  -9.08  -3.27  -5.94  5.7  -4.05  -2.51  -2.4  -10.68  2.03  2.47  -1.44  -2.11  32.04  36.45  -3.44  -3.51  0.03 | -2.50 |
| *Z* =71, Lu | 0.142±0.007  0.185±0.009  0.209±0.010  0.217±0.011  0.257±0.013  0.367±0.018  0.168±0.008  0.322±0.022  0.1866±0.015  0.1764±0.014  0.2119±0.017  0.180±0.012  0.21±0.03  0.17±0.02  0.207±0.014  0.204±0.014 | (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Ismail and Malhi, 2000)  (Salah, 2004)  (Salah and Al-Jundi, 2005)  (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.1927±0.0030 | -6.65  -0.81  1.57  2.14  4.82  9.55  -2.89  5.83  -0.4  -1.14  1.11  -1.02  0.58  -1.12  1  0.79 | 0.84 |
| *Z* =72, Hf | 0.184±0.006  0.154±0.017  0.274±0.017  0.265±0.013  0.204±0.026  0.325±0.042  0.1825±0.0082 | (Mehta et al., 1987)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Karabulut and Gurol, 2006)  (Aylikci et al., 2007) | 0.1975±0.0042 | -1.84  -2.48  4.37  4.95  0.25  3.02  -1.63 | 0.95 |
| *Z* =73, Ta | 0.201±0.010  0.230±0.014  0.276±0.022  0.265±0.021  0.185±0.010  0.225±0.006  0.289±0.008  0.164±0.008  0.316±0.020  0.297±0.097  0.138±0.018  0.170±0.008  0.240±0.011  0.315±0.041  0.311±0.012  0.399±0.024(B=+0.15T)  0.399±0.024(B=-0.15T)  0.403±0.023(B=+0.45T)  0.402±0.023(B=-0.45T)  0.406±0.018(B=+0.75T)  0.407±0.021(B=-0.75T)  0.207±0.014  0.206±0.014  0.329±0.024  0.282±0.028  0.198±0.02  0.183±0.018 | (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin., 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Wang et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.2353±0.0046 | -3.33  -0.38  1.84  1.4  -4.88  -1.59  6.4  -8.51  4  0.64  -5.36  -7.79  0.41  1.94  6.17  6.78  6.78  7.25  7.2  9.39  8.12  -1.99  -2.06  3.88  1.66  -1.85  -2.88 | 1.23 |
| *Z* =74, W | 0.206±0.010  0.233±0.011  0.348±0.017  0.178±0.010  0.212±0.011  0.266±0.017  0.153±0.008  0.182±0.009  0.360±0.027  0.305±0.112  0.133±0.017  0.1787±0.014  0.1826±0.015  0.1961±0.016  0.331±0.027  0.242±0.010  0.169±0.017  0.277±0.020  0.324±0.006  0.311±0.007  0.326±0.042  0.313±0.014  0.334±0.017(B=+0.15T)  0.334±0.018(B=-0.15T)  0.337±0.016(B=+0.45T)  0.337±0.016(B=-0.45T)  0.340±0.014(B=+0.75T)  0.340±0.014(B=-0.75T)  0.199±0.013  0.205±0.014  0.272±0.022  0.296±0.030  0.190±0.018  0.173±0.017 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Chand et al., 1992)  (Ertugrul., 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Wang et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.2502±0.0022 | -4.32  -1.54  5.7  -7.05  -3.41  0.92  -11.72  -7.36  4.05  0.49  -6.84  -5.05  -4.46  -3.35  2.98  -0.8  -4.74  1.33  11.54  8.28  1.8  4.43  4.89  4.62  5.37  5.37  6.33  6.33  -3.88  -3.19  0.98  1.52  -3.32  -4.5 | 0.04 |
| *Z* =75, Re | 0.173±0.009  0.201±0.009  0.246±0.018  0.304±0.022  0.247±0.062  0.135±0.018  0.183±0.008  0.182±0.023  0.161±0.017 | (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Küçükönder et al., 2004)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.1892±0.0043 | -1.62  1.19  3.07  5.12  0.93  -2.93  -0.68  -0.31  -1.61 | 0.35 |
| *Z* =76, Os | 0.145±0.007  0.260±0.014  0.193±0.013  0.191±0.013 | (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.1756±0.0052 | -3.52  5.65  1.24  1.10 | 1.12 |
| *Z* =77, Ir | 0.153±0.008  0.182±0.014 | (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992) | 0.1601±0.0069 | -0.67  1.40 | 0.36 |
| *Z* =78, Pt | 0.165±0.008  0.181±0.005  0.205±0.015  0.170±0.009  0.217±0.007  0.1623±0.013  0.1673±0.013  0.1906±0.015  0.157±0.007  0.193±0.009  0.204±0.020  0.181±0.012  0.180±0.012  0.1290±0.0154 | (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Dhal and Padhi, 1994)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Ismail and Malhi, 2000)  (Küçükönder et al., 2004)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Alqadi et al., 2013) | 0.1797±0.0025 | -1.76  0.22  1.66  -1.04  5.02  -1.32  -0.94  0.71  -3.06  1.42  1.20  0.10  0.02  -3.25 | -0.07 |
| *Z* =79, Au | 0.194±0.005  0.194±0.006  0.207±0.007  0.184±0.021  0.174±0.016  0.181±0.009  0.193±0.023  0.227±0.066  0.165±0.009  0.178±0.010  0.199±0.012  0.159±0.008  0.183±0.014  0.1776±0.012  0.1768±0.010  0.1951±0.018  0.2155±0.016  0.2150±0.016  0.2145±0.014  0.2133±0.012  0.1803±0.018  0.2108±0.016  0.2053±0.014  0.195±0.016  0.187±0.044  0.138±0.018  0.1587±0.013  0.1717±0.014  0.1989±0.016  0.224±0.011  0.172±0.009  0.175±0.015  0.201±0.026  0.205±0.011  0.203±0.010(B=+0.15T)  0.203±0.011(B=-0.15T)  0.182±0.008(B=+0.45T)  0.182±0.008(B=-0.45T)  0.167±0.006(B=+0.75T)  0.167±0.006(B=-0.75T)  0.173±0.017  0.219±0.015  0.175±0.011  0.173±0.011  0.218±0.022  0.15±0.03  0.210±0.011 | (Chang and Su, 1978)  (Chang and Su, 1978)  (Chang and Su, 1978)  (Chang and Su, 1978)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Rao et al., 1993)  (Rao et al., 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Al-Saleh and Saleh, 1999)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Cengiz et al., 2010a)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Wang et al., 2015)  (Fernandez-Ruiz, 2021)  (Duggal et al., 2022) | 0.1861±0.0016 | 1.51  1.27  2.91  -0.1  -0.75  -0.56  0.3  0.62  -2.31  -0.8  1.06  -3.33  -0.22  -0.7  -0.92  0.5  1.83  1.8  2.02  2.25  -0.32  1.54  1.36  0.55  0.02  -2.66  -2.09  -1.02  0.8  3.41  -1.54  -0.74  0.57  1.7  1.67  1.52  -0.5  -0.5  -3.08  -3.08  -0.77  2.18  -1  -1.18  1.45  -1.2  2.15 | 0.11845 |
| *Z* =80, Hg | 0.180±0.010  0.169±0.009  0.182±0.010  0.166±0.011  0.177±0.009  0.195±0.010  0.209±0.010  0.236±0.009  0.161±0.008  0.192±0.014  0.179±0.010  0.212±0.047  0.164±0.025  0.279±0.092  0.203±0.013  0.189±0.013  0.174±0.015  0.204±0.027  0.212±0.011  0.210±0.011(B=+0.15T)  0.210±0.011(B=-0.15T)  0.206±0.010(B=+0.45T)  0.206±0.010(B=-0.45T)  0.166±0.006(B=+0.75T)  0.167±0.006(B=-0.75T)  0.192±0.019  0.216±0.014  0.207±0.001  0.185±0.012  0.180±0.012  0.193±0.012  0.1312±0.0155  0.185±0.010  0.174±0.018  0.159±0.017 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Chand et al., 1989)  (Chand et al., 1989)  (Raghavaiah et al., 1990)  (Darko and Tetteh, 1992)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Kumar and Puri, 2011)  (Alqadi et al., 2013)  (Akman et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.2021±0.0009 | -2.2  -3.66  -2  -3.27  -2.78  -0.71  0.69  3.75  -5.11  -0.72  -2.3  0.21  -1.52  0.84  0.07  -1.01  -1.87  0.07  0.9  0.71  0.71  0.39  0.39  -5.96  -5.79  -0.53  0.99  3.66  -1.42  -1.84  -0.76  -4.57  -1.71  -1.56  -2.53 | -1.16 |
| *Z* =81, Tl | 0.207±0.012  0.173±0.007  0.180±0.012  0.195±0.008  0.181±0.011  0.213±0.046  0.172±0.025  0.163±0.013  0.214±0.015  0.199±0.011  0.151±0.017  0.178±0.017  0.188±0.024  0.217±0.007  0.228±0.008(B=+0.15T)  0.228±0.008(B=-0.15T)  0.230±0.007(B=+0.45T)  0.230±0.007(B=-0.45T)  0.231±0.006(B=+0.75T)  0.231±0.006(B=-0.75T)  0.183±0.018  0.232±0.016  0.209±0.002  0.184±0.012  0.184±0.012  0.204±0.008 | (Mehta et al., 1987)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 0.2095±0.0014 | -0.21  -5.12  -2.45  -1.79  -2.57  0.08  -1.5  -3.56  0.3  -0.95  -3.43  -1.85  -0.9  1.04  2.27  2.27  2.87  2.87  3.48  3.48  -1.47  1.4  -0.23  -2.11  -2.11  -0.68 | -0.42 |
| *Z* =82, Pb | 0.254±0.014  0.213±0.011  0.180±0.020  0.211±0.017  0.197±0.030  0.235±0.022  0.173±0.007  0.184±0.010  0.198±0.009  0.183±0.013  0.1697±0.008  0.1898±0.010  0.1996±0.009  0.2133±0.010  0.2188±0.010  0.2230±0.012  0.2130±0.014  0.217±0.006  0.1804±0.008  0.1833±0.010  0.2094±0.012  0.198±0.016  0.2970±0.0074  0.209±0.044  0.184±0.029  0.166±0.008  0.299±0.015  0.236±0.017  0.192±0.019  0.177±0.009  0.184±0.017  0.236±0.031  0.208±0.005  0.206±0.006(B=+0.15T)  0.206±0.006(B=-0.15T)  0.204±0.006(B=+0.45T)  0.204±0.006(B=-0.45T)  0.199±0.005(B=+0.75T)  0.199±0.005(B=-0.75T)  0.170±0.017  0.240±0.018  0.219±0.006  0.184±0.012  0.182±0.012  0.207±0.010  0.151±0.006  0.151±0.016  0.143±0.015 | (Kumar et al., 1982)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Darko and Tetteh, 1992)  (Rao et al., 1993)  (Rao et al., 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Dhal and Padhi, 1994)  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1996)  (Sögüt et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Baydas et al., 2001)  (Durak and Özdemir, 2001)  (Tirasoglu et al., 2003)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.2008±0.0013 | 3.79  1.1  -1.04  0.6  -0.13  1.55  -3.9  -1.66  -0.31  -1.36  -3.84  -1.09  -0.13  1.24  1.79  1.84  0.87  2.64  -2.51  -1.73  0.71  -0.17  12.81  0.19  -0.58  -4.29  6.52  2.07  -0.46  -2.62  -0.98  1.14  1.4  0.85  0.85  0.52  0.52  -0.34  -0.34  -1.81  2.17  2.97  -1.39  -1.56  0.62  -8.11  -3.1  -3.84 | 0.03 |
| *Z* =83, Bi | 0.206±0.010  0.207±0.017  0.218±0.028  0.230±0.024  0.177±0.005  0.190±0.008  0.205±0.008  0.234±0.007  0.209±0.014  0.225±0.052  0.194±0.031  0.174±0.009  0.263±0.013  0.219±0.011  0.160±0.016  0.185±0.016  0.229±0.030  0.207±0.006  0.205±0.008(B=+0.15T)  0.205±0.008(B=-0.15T)  0.200±0.007(B=+0.45T)  0.200±0.007(B=-0.45T)  0.199±0.007(B=+0.75T)  0.199±0.007(B=-0.75T)  0.186±0.018  0.174±0.011  0.173±0.011  0.210±0.009  0.153±0.007  0.160±0.016  0.153±0.015 | (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Saleh et al., 1988)  (Dhal and Padhi, 1994)  (Ertugrul, 1996)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Baydas et al., 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.1959±0.0017 | 1  0.65  0.79  1.42  -3.58  -0.72  1.11  5.29  0.93  0.56  -0.06  -2.39  5.12  2.08  -2.23  -0.68  1.1  1.78  1.11  1.11  0.57  0.57  0.43  0.43  -0.55  -1.97  -2.06  1.54  -5.96  -2.23  -2.84 | 0.08 |
| *Z* =90, Th | 0.261±0.016  0.220±0.011  0.243±0.012  0.236±0.012  0.252±0.013  0.247±0.021  0.217±0.005  0.215±0.005  0.231±0.006  0.252±0.006  0.286±0.007  0.282±0.007  0.292±0.007  0.258±0.070  0.192±0.030  0.246±0.018  0.269±0.013  0.188±0.019  0.216±0.015  0.198±0.026  0.249±0.001  0.257±0.001  0.258±0.002(B=+0.75T)  0.265±0.001(B=+0.75T)  0.248±0.002(B=+0.60T)  0.254±0.002(B=+0.60T)  0.241±0.002(B=+0.45T)  0.247±0.001(B=+0.45T)  0.238±0.001(B=+0.30T)  0.243±0.002(B=+0.30T)  0.241±0.002(B=+0.15T)  0.247±0.001(B=+0.15T)  0.257±0.002(B=-0.75T)  0.266±0.001(B=-0.75T)  0.247±0.002(B=-0.60T)  0.255±0.002(B=-0.60T)  0.241±0.001(B=-0.45T)  0.247±0.002(B=-0.45T)  0.238±0.002(B=-0.30T)  0.243±0.002(B=-0.30T)  0.242±0.002(B=-0.15T)  0.247±0.002(B=-0.15T)  0.249±0.001  0.270±0.009(B=+0.15T)  0.270±0.009(B=-0.15T)  0.273±0.008(B=+0.45T)  0.273±0.008(B=-0.45T)  0.276±0.007(B=+0.75T)  0.276±0.006(B=-0.75T)  0.232±0.023  0.221±0.014  0.218±0.014  0.262±0.012 | (Kumar et al., 1982)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 0.2500±0.0003 | 0.69  -2.72  -0.58  -1.17  0.16  -0.14  -6.59  -6.99  -3.16  0.34  5.14  4.57  6  0.11  -1.93  -0.22  1.46  -3.26  -2.27  -2  -0.95  6.76  3.97  14.46  -0.98  1.99  -4.45  -2.87  -11.54  -3.46  -4.45  -2.87  3.47  15.43  -1.48  2.48  -8.65  -1.48  -5.93  -3.46  -3.95  -1.48  -0.95  2.22  2.22  2.88  2.88  3.71  4.33  -0.78  -2.07  -2.28  1 | -0.17 |
| *Z* =92, U | 0.271±0.017  0.207±0.010  0.234±0.012  0.235±0.012  0.229±0.011  0.274±0.022  0.237±0.006  0.246±0.006  0.275±0.001  0.282±0.007  0.280±0.007  0.311±0.008  0.315±0.008  0.246±0.063  0.213±0.039  0.233±0.016  0.241±0.006  0.241±0.013  0.202±0.017  0.228±0.030  0.236±0.001  0.240±0.001  0.239±0.001(B=+0.75T)  0.241±0.001(B=+0.75T)  0.235±0.001(B=+0.60T)  0.237±0.001(B=+0.60T)  0.233±0.001(B=+0.45T)  0.235±0.001(B=+0.45T)  0.231±0.001(B=+0.30T)  0.234±0.001(B=+0.30T)  0.233±0.001(B=+0.15T)  0.236±0.001(B=+0.15T)  0.239±0.001(B=-0.75T)  0.241±0.001(B=-0.75T)  0.236±0.001(B=-0.60T)  0.238±0.001(B=-0.60T)  0.233±0.001(B=-0.45T)  0.235±0.001(B=-0.45T)  0.232±0.001(B=-0.30T)  0.234±0.001(B=-0.30T)  0.233±0.001(B=-0.15T)  0.236±0.001(B=-0.15T)  0.236±0.001  0.239±0.007(B=+0.15T)  0.239±0.007(B=-0.15T)  0.241±0.006(B=+0.45T)  0.241±0.006(B=-0.45T)  0.244±0.005(B=+0.75T)  0.244±0.005(B=-0.75T)  0.230±0.023  0.242±0.009 | (Kumar et al., 1982)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Küçükönder, 2002)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir et al., 2008)  (Akman et al., 2015) | 0.2376±0.0002 | 1.96  -3.06  -0.3  -0.22  -0.78  1.65  -0.1  1.4  36.64  6.34  6.05  9.17  9.67  0.13  -0.63  -0.29  0.56  0.26  -2.1  -0.32  -1.59  2.33  1.35  3.31  -2.57  -0.61  -4.53  -2.57  -6.49  -3.55  -4.53  -1.59  1.35  3.31  -1.59  0.37  -4.53  -2.57  -5.51  -3.55  -4.53  -1.59  -1.59  0.2  0.2  0.56  0.56  1.28  1.28  -0.33  0.49 | 0.57 |

**Table 4.** Summary of the experimental intensity ratios from 39Y to 94Pu is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =39, Y | 0.041±0.004 | (Shatendra et al., 1983) | 0.041±0.004 | 0 | 0 |
| *Z* =40, Zr | 0.051±0.005 | (Shatendra et al., 1983) | 0.051±0.005 | 0 | 0 |
| *Z* =41, Nb | 0.049±0.005  0.054±0.005 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.0515± 0.0035 | -0.41  0.41 | 0 |
| *Z* =42, Mo | 0.058±0.005  0.047±0.004 | (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.0513±0.0031 | 1.14  -0.85 | 0.15 |
| *Z* =44, Ru | 0.021±0.004 | (Salem and Winchell, 1974) | 0.021±0.004 | 0 | 0 |
| *Z* =45, Rh | 0.023±0.0045 | (Salem and Winchell, 1974) | 0.023±0.0045 | 0 | 0 |
| *Z* =46, Pd | 0.020±0.0044 | (Salem and Winchell, 1974) | 0.020±0.0044 | 0 | 0 |
| *Z* =47, Ag | 0.041±0.0057  0.052±0.005  0.043±0.004  0.060±0.004  0.057±0.004 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.0517±0.0020 | -1.77  0.06  -1.94  1.87  1.20 | 0.002 |
| *Z* =48, Cd | 0.031±0.0047 | (Salem and Winchell, 1974) | 0.031±0.0047 | 0 | 0 |
| *Z* =49, In | 0.039±0.006  0.050±0.004  0.059±0.005  0.068±0.004  0.058±0.003 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983) | 0.0568±0.0018 | -2.84  -1.55  0.41  2.55  0.34 | -0.22 |
| *Z* =50, Sn | 0.0305±0.005  0.051±0.004  0.051±0.004  0.068±0.005  0.063±0.004  0.1834±0.0093 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Aylikci et al., 2015) | 0.0587±0.0019 | -5.27  -1.73  -1.73  1.74  0.98  13.14 | 1.19 |
| *Z* =51, Sb | 0.039±0.006  0.1858±0.0095 | (Salem and Winchell, 1974)  (Aylikci et al., 2015) | 0.0809±0.0051 | -5.33  9.74 | 2.21 |
| *Z* =52, Te | 0.043±0.0065  0.2010±0.0103 | (Salem and Winchell, 1974)  (Aylikci et al., 2015) | 0.0880±0.0055 | -5.29  9.68 | 2.20 |
| *Z* =53, I | 0.039±0.006  0.056±0.005  0.050±0.004  0.054±0.003  0.057±0.004  0.2172±0.0111 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Aylikci et al., 2015) | 0.0570±0.0018 | -2.87  -0.18  -1.59  -0.85  0.008  14.25 | 1.46 |
| *Z* =54, Xe | 0.039±0.006 | (Chand et al., 1989) | 0.039±0.006 | 0 | 0 |
| *Z* =55, Cs | 0.038±0.006  0.037±0.002 | (Salem and Winchell, 1974)  (Raghavaiah et al., 1987) | 0.0371±0.0019 | 0.14  -0.04 | 0.05 |
| *Z* =56, Ba | 0.040±0.0055  0.053±0.005  0.071±0.006  0.058±0.003  0.065±0.004  0.029±0.003  0.037±0.002  0.0364±0.0022  0.0396±0.0020 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Mehta et al., 1987)  (Raghavaiah et al., 1987)  (Zou et al., 2006)  (Aylikci et al., 2015) | 0.0419±0.0010 | -0.35  2.17  4.78  5.10  5.60  -4.11  -2.23  -2.31  -1.06 | 0.84 |
| *Z* =57, La | 0.0365±0.0052  0.056±0.005  0.044±0.004  0.062±0.003  0.059±0.004  0.0359±0.002  0.0389±0.0020 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Ertugrul, 1997)  (Aylikci et al., 2015) | 0.0438±0.0011 | -1,37  2,38  0,05  5,69  3,66  -3,46  -2,14 | 0,69 |
| *Z* =58, Ce | 0.039±0.0055  0.043±0.004  0.062±0.005  0.067±0.004  0.065±0.004  0.039±0.002  0.0378±0.002  0.0387±0.0019 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Aylikci et al., 2015) | 0.0430±0.0010 | -0.72  -0.003  3.73  5.82  5.34  -1.80  -2.34  -2.02 | 1 |
| *Z* =59, Pr | 0.039±0.0055  0.039±0.002  0.0392±0.002  0.0512±0.006  0.0408±0.0021 | (Salem and Winchell, 1974)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Alqadi et al., 2013)  (Aylikci et al., 2015) | 0.0400±0.0011 | -0.18  -0.44  -0.35  1.83  0.33 | 0.24 |
| *Z* =60, Nd | 0.035±0.005  0.039±0.002  0.0401±0.002  0.0400±0.020 | (Salem and Winchell, 1974)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Aylikci et al., 2015) | 0.0392±0.0014 | -0.81  -0.09  0.37  0.04 | -0.12 |
| *Z* =61, Pm | 0.040±0.002 | (Raghavaiah et al., 1987) | 0.040±0.002 | 0 | 0 |
| *Z* =62, Sm | 0.035±0.005  0.055±0.005  0.057±0.005  0.064±0.004  0.067±0.005  0.040±0.002  0.029±0.003  0.0388±0.001  0.046±0.005  0.040±0.003  0.042±0.002  0.042±0.002  0.0418±0.0021  0.031±0.008  0.032±0.008 | (Salem and Winchell, 1974)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Raghavaiah et al., 1987)  (Darko and Tetteh, 1992)  (Ertugrul, 1997)  (Ismail and Malhi, 2000)  (Sögüt and Küçükönder, 2005)  (Durdu and Kucukonder, 2012)  (Durdu and Kucukonder, 2012)  (Aylikci et al., 2015)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0411±0.0006 | -1.2  2.77  3.16  5.67  5.15  -0.5  -3.93  -1.9  0.98  -0.34  0.45  0.45  0.34  -1.25  -1.13 | 0.58 |
| *Z* =63, Eu | 0.040±0.003  0.039±0.002  0.045±0.002  0.0392±0.002  0.042±0.003  0.040±0.003  0.039±0.002  0.040±0.002  0.0419±0.0021 | (Raghavaiah et al., 1987)  (Chand et al., 1992)  (Chand et al., 1992)  (Ertugrul, 1997)  (Ismail and Malhi, 2000)  (Sögüt and Küçükönder, 2005)  (Durdu and Kucukonder, 2012)  (Durdu and Kucukonde., 2012)  (Aylikci et al., 2015) | 0.0407±0.0007 | -0.22  -0.78  2.03  -0.69  0.43  -0.22  -0.78  -0.31  0.55 | 0.003 |
| *Z* =64, Gd | 0.042±0.004  0.049±0.004  0.058±0.003  0.065±0.004  0.053±0.006  0.055±0.005  0.069±0.007  0.067±0.008  0.041±0.003  0.0400±0.002  0.0429±0.0022  0.041±0.001  0.038±0.009  0.039±0.009 | (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Shatendra et al., 1983)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Aylikci et al., 2015)  (Krishnananda et al., 2016)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0440±0.0007 | -0.48  1.24  4.56  5.18  1.5  2.19  3.56  2.87  -0.96  -1.87  -0.46  -2.42  -0.66  -0.55 | 0.98 |
| *Z* =65, Tb | 0.038±0.003  0.041±0.003  0.0420±0.002  0.041±0.003  0.0445±0.0023  0.039±0.001  0.036±0.01  0.039±0.012 | (Rao et al., 1971)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Durak and Özdemir, 2001)  (Aylikci et al., 2015)  (Krishnananda et al., 2016)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0402±0.0007 | -0.70  0.27  0.86  0.27  1.79  -0.94  -0.42  -0.1 | 0.13 |
| *Z* =66, Dy | 0.058±0.005  0.042±0.003  0.0422±0.002  0.043±0.003  0.044±0.007  0.043±0.0002  0.043±0.0001  0.040±0.003  0.040±0.003  0.042±0.003  0.0416±0.0037  0.0453±0.0045  0.042±0.003  0.043±0.003(B=0.6T)  0.044±0.003(B=1.2T)  0.0468±0.0024  0.050±0.004  0.050±0.003  0.047±0.003  0.0416±0.002  0.0409±0.002  0.0413±0.002 | (Mehta et al., 1986)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Porikli, 2012)  (Kumar and Puri, 2012)  (Kumar and Puri, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Kaur et al., 2018)  (Kaur et al., 2018)  (Kaur et al., 2018) | 0.0430±0.0001 | 3  -0.33  -0.40  -0.001  0.14  -0.02  -0.03  -1  -1  -0.33  -0.38  0.51  -0.33  -0.001  0.33  1.58  1.75  2.33  1.33  -0.70  -1.05  -0.85 | 0.21 |
| *Z* =67, Ho | 0.040±0.002  0.042±0.003  0.045±0.004  0.045±0.004  0.0439±0.003  0.043±0.003  0.045±0.006  0.042±0.004  0.043±0.0003  0.042±0.0001  0.043±0.002  0.043±0.002  0.044±0.002  0.045±0.003  0.0469±0.0024  0.041±0.001  0.038±0.003  0.038±0.003(B=0.6T)  0.035±0.002(B=1.2T) | (Chander et al., 1987)  (Raghavaiah et al., 1987)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul., 1997)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Sögüt and Küçükönder, 2005)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Aylikci et al., 2015)  (Krishnananda et al., 2016)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0421±0.0001 | -1.04  -0.03  0.73  0.73  0.60  0.30  0.49  -0.02  2.91  -0.63  0.46  0.46  0.96  0.97  2  -1.08  -1.36  -1.36  -3.54 | 0.08 |
| *Z* =68, Er | 0.041±0.003  0.037±0.002  0.0440±0.003  0.045±0.003  0.047±0.007  0.043±0.003  0.041±0.003  0.041±0.003  0.043±0.002  0.043±0.002  0.046±0.003(B=0.6T)  0.046±0.003(B=1.2T)  0.0479±0.0024  0.050±0.003  0.041±0.003  0.036±0.003  0.041±0.008 | (Raghavaiah et al., 1987)  (Chand et al., 1989)  (Ertugrul, 1997)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Sögüt and Küçükönder, 2005)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Porikli, 2012)  (Durdagi, 2013)  (Durdagi, 2013)  (Durdagi, 2013)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Alqadi et al., 2023) | 0.0428±0.0007 | -0.58  -2.74  0.4  0.72  0.6  0.07  -0.58  -0.58  0.11  0.11  1.05  1.05  2.05  2.35  -0.58  -2.20  -0.22 | 0.06 |
| *Z* =69, Tm | 0.055±0.002  0.045±0.002  0.061±0.003  0.057±0.003  0.046±0.002  0.046±0.002  0.0441±0.003  0.0722±0.0037 | (Mehta et al., 1986)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Ertugrul, 1997)  (Aylikci et al., 2015) | 0.0506±0.0181 | 0.08  -0.11  0.16  0.11  -0.09  -0.09  -0.14  0.29 | 0.03 |
| *Z* =70, Yb | 0.043±0.003  0.042±0.001  0.045±0.004  0.045±0.004  0.0446±0.003  0.045±0.003  0.045±0.0005  0.045±0.0002  0.044±0.003  0.045±0.003  0.042±0.009 | (Rao et al., 1971)  (Mehta et al., 1985)  (Rao et al., 1993)  (Rao et al., 1993)  (Ertugrul, 1997)  (Durak and Özdemir, 2001)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015) | 0.0449±0.0002 | -0.63  -2.84  0.03  0.03  -0.1  0.04  0.21  0.41  -0.3  0.04  -0.32 | -0.31 |
| *Z* =71, Lu | 0.042±0.003  0.035±0.002  0.034±0.002  0.064±0.003  0.048±0.002  0.054±0.003  0.0451±0.003  0.047±0.005  0.043±0.003  0.044±0.003  0.0766±0.0039  0.040±0.003  0.044±0.003  0.042±0.003 | (Raghavaiah et al., 1987)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Ertugrul, 1997)  (Ismail and Malhi, 2000)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0445±0.0007 | -0.82  -4.47  -4.94  6.31  1.63  3.07  0.19  0.49  -0.49  -0.17  8.08  -1.46  -0.17  -0.82 | 0.46 |
| *Z* =72, Hf | 0.055±0.002  0.041±0.002  0.051±0.005  0.045±0.003  0.045±0.002  0.047±0.006  0.045±0.004  0.046±0.006  0.0571±0.0025  0.0781±0.0040 | (Mehta et al., 1987)  (Singh et al., 1989)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Aylikci et al., 2007)  (Aylikci et al., 2015) | 0.0497±0.0009 | 2.42  -3.97  0.26  -1.5  -2.14  -0.44  -1.14  -0.61  2.79  6.93 | 0.26 |
| *Z* =73, Ta | 0.044±0.002  0.0475±0.009  0.0464±0.018  0.0524±0.009  0.0438±0.012  0.042±0.003  0.045±0.003  0.0465±0.004  0.045±0.005  0.044±0.002  0.046±0.004  0.045±0.006  0.046±0.003  0.051±0.003(B=+0.15T)  0.051±0.003(B=-0.15T)  0.051±0.003(B=+0.45T)  0.051±0.003(B=-0.45T)  0.051±0.003(B=+0.75T)  0.051±0.003(B=-0.75T)  0.0462±0.002  0.0513±0.003(B=+0.75T)  0.0513±0.003(B=-0.75T)  0.046±0.003  0.047±0.003  0.0500±0.0028  0.047±0.008  0.0800±0.0041  0.038±0.003  0.047±0.003  0.043±0.003  0.039±0.006  0.041±0.006 | (Rao et al., 1971)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Chander et al., 1987)  (Raghavaiah et al., 1987)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Küçükönder et al., 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012)  (Akman et al., 2015)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0474±0.0006 | -1.64  0.009  -0.06  0.55  -0.3  -1.77  -0.79  -0.23  -0.48  -1.64  -0.35  -0.4  -0.46  1.17  1.17  1.17  1.17  1.17  1.17  -0.58  1.27  1.27  -0.46  -0.14  0.9  -0.05  7.87  -3.08  -0.14  -1.45  -1.4  -1.06 | 0.08 |
| *Z* =74, W | 0.047±0.004  0.050±0.004  0.054±0.004  0.047±0.003  0.040±0.003  0.0471±0.004  0.050±0.004  0.047±0.003  0.047±0.005  0.038±0.001  0.053±0.005  0.046±0.004  0.054±0.007  0.048±0.003  0.052±0.004  0.052±0.004  0.052±0.004  0.052±0.004  0.053±0.004  0.053±0.004  0.0478±0.003  0.0526±0.005(B=+0.75T)  0.0527±0.005(B=-0.75T)  0.047±0.00001  0.047±0.00004  0.0524±0.0027  0.047±0.003  0.048±0.003  0.0486±0.0027  0.049±0.007  0.0831±0.0042  0.043±0.003  0.052±0.004  0.048±0.003  0.051±0.004  0.043±0.006  0.047±0.007 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Raghavaiah et al., 1987)  (Chand et al., 1992)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Durak and Özdemir, 2001)  (Öz et al., 2004)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012)  (Akman et al., 2015)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Kaur et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0470±0.00001 | 6.37×10-5  0.75  1.75  8.5×10-5  -2.33  0.03  0.75  8.5×10-5  5.1×10-5  -9  1.2  -0.25  1  0.33  1.25  1.25  1.25  1.25  1.5  1.5  0.27  1.12  1.14  0.02  6.19×10-3  2  8.5×10-5  0.33  0.59  0.29  8.6  -1.33  1.25  0.33  1  -0.67  3.64×10-5 | 0.46403 |
| *Z* =75, Re | 0.043±0.002  0.0469±0.004  0.059±0.004  0.043±0.002  0.047±0.004  0.0482±0.0025  0.0885±0.0045  0.046±0.002  0.045±0.007  0.050±0.008 | (Singh et al., 1989)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Küçükönder et al., 2004)  (Sögüt and Küçükönder, 2005)  (Cengiz et al., 2010b)  (Aylikci et al., 2015)  (Ayri et al., 2021)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0476±0.0009 | -2.1  -0.18  2.77  -2.1  -0.15  0.22  8.9  -0.74  -0.37  0.29 | 0.65 |
| *Z* =76, Os | 0.012±0.001  0.050±0.004  0.049±0.003  0.0491±0.0025  0.049±0.003  0.049±0.003  0.0881±0.0045  0.051±0.004 | (Mehta et al., 1986)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Cengiz et al., 2010)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015)  (Kaur et al., 2019) | 0.0281±0.0008 | -12.72  5.38  6.75  8.03  6.75  6.75  13.14  5.62 | 4.96 |
| *Z* =77, Ir | 0.042±0.004  0.048±0.003  0.046±0.004  0.0856±0.0044 | (Rao et al., 1971)  (Singh et al., 1989)  (Darko and Tetteh, 1992)  (Aylikci et al., 2015) | 0.0530±0.0019 | -2.5  -1.42  -1.59  6.82 | 0.33 |
| *Z* =78, Pt | 0.048±0.002  0.050±0.003  0.049±0.003  0.0491±0.0015  0.052±0.004  0.042±0.002  0.048±0.003  0.060±0.006  0.0514±0.0026  0.049±0.003  0.049±0.003  0.0435±0.0052  0.0867±0.0044  0.056±0.004  0.046±0.003  0.049±0.003 | (Rao et al., 1971)  (Raghavaiah et al., 1987)  (Singh et al., 1989)  (Dhal and Padhi, 1994)  (Ismail and Malhi, 2000)  (Küçükönder et al., 2004)  (Sögüt and Küçükönder, 2005)  (Demir et al., 2008)  (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Alqadi et al., 2013)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0494±0.0007 | -0.64  0.21  -0.11  -0.15  0.65  -3.48  -0.44  1.76  0.76  -0.11  -0.11  -1.12  8.39  1.64  -1.09  -0.11 | 0.38 |
| *Z* =79, Au | 0.0672±0.0042  0.0638±0.005  0.0757±0.009  0.0465±0.009  0.0462±0.012  0.069±0.035  0.0668±0.122  0.048±0.004  0.050±0.003  0.053±0.004  0.052±0.005  0.052±0.005  0.052±0.005  0.052±0.005  0.053±0.005  0.048±0.004  0.049±0.004  0.052±0.005  0.052±0.005  0.053±0.005  0.0514±0.005  0.054±0.004  0.045±0.002  0.046±0.004  0.051±0.004  0.048±0.006  0.051±0.007  0.038±0.004  0.038±0.004  0.038±0.004  0.038±0.004  0.038±0.003  0.038±0.003  0.0511±0.005  0.0379±0.004  0.0379±0.004  0.052±0.005  0.0532±0.004  0.051±0.003  0.051±0.003  0.0905±0.0046  0.045±0.003  0.048±0.003  0.047±0.003  0.040±0.001  0.049±0.002  0.0507±0.003 | (Chang and Su, 1978)  (Chang and Su, 1978)  (Chang and Su, 1978)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Chander et al., 1987)  (Raghavaiah et al., 1987)  (Darko and Tetteh, 1992)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao et al., 1993)  (Rao et al., 1993  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Cengiz et al., 2010a)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Fernandez-Ruiz, 2021)  (Duggal et al., 2022)  (Duggal et al., 2022) | 0.0463±0.0005 | 4.93  3.47  3.26  0.02  -0.01  0.65  0.17  0.41  1.2  1.65  1.13  1.13  1.13  1.13  1.33  0.41  0.66  1.13  1.13  1.33  1.01  1.9  -0.65  -0.08  1.16  0.28  0.66  -2.07  -2.07  -2.07  -2.07  -2.74  -2.74  0.95  -2.09  -2.09  1.13  1.7  1.53  1.53  9.54  -0.44  0.55  0.22  -5.68  1.29  1.43 | 0.56 |
| *Z* =80, Hg | 0.052±0.004  0.054±0.004  0.052±0.004  0.052±0.003  0.046±0.005  0.045±0.003  0.058±0.005  0.0502±0.005  0.056±0.003  0.055±0.005  0.052±0.004  0.055±0.003  0.049±0.005  0.052±0.007  0.052±0.005  0.043±0.003(B=+0.15T)  0.043±0.003(B=-0.15T)  0.043±0.003(B=+0.45T)  0.043±0.003(B=-0.45T)  0.043±0.003(B=+0.75T)  0.043±0.003(B=-0.75T)  0.0523±0.004  0.0428±0.002(B=+0.75T)  0.0429±0.002(B=-0.75T)  0.055±0.005  0.053±0.0003  0.052±0.0001  0.050±0.003  0.050±0.003  0.0480±0.0034  0.0485±0.0057  0.049±0.005  0.0880±0.0045  0.043±0.003  0.045±0.003  0.049±0.003  0.044±0.005  0.050±0.006 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Raghavaiah et al., 1987)  (Chand et al., 1989)  (Chand et al., 1989)  (Darko and Tetteh, 1992)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Simsek, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Turgut and Ertugru, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Kumar and Puri, 2011)  (Alqadi et al., 2013)  (Akman et al., 2015)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0520±0.0001 | 2.19×10-3  0.5  2.19×10-3  2.92×10-3  -1.2  -2.33  1.2  -0.36  1.34  0.6  2.19×10-3  1  -0.6  1.25×10-3  1.75×10-3  -3  -3  -3  -3  -3  -3  0.08  -4.59  -4.54  0.6  3.21  0.06  -0.66  -0.66  -1.17  -0.61  -0.6  8  -3  -2.33  -1  -1.6  -0.33 | -0.71 |
| *Z* =81, Tl | 0.046±0.002  0.049±0.003  0.0515±0.005  0.055±0.004  0.058±0.003  0.055±0.004  0.049±0.002  0.052±0.006  0.048±0.005  0.053±0.005  0.051±0.007  0.051±0.004  0.060±0.004(B=+0.15T)  0.060±0.004(B=-0.15T)  0.060±0.004(B=+0.45T)  0.060±0.004(B=-0.45T)  0.060±0.004(B=+0.75T)  0.060±0.004(B=-0.75T)  0.0514±0.004  0.0599±0.003(B=+0.75T)  0.0599±0.003(B=-0.75T)  0.054±0.005  0.057±0.001  0.054±0.0001  0.052±0.003  0.052±0.003  0.054±0.004  0.0942±0.0048 | (Rao et al., 1971)  (Mehta et al., 1987)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Aylikci et al., 2015) | 0.0540±0.0001 | -4.01  -1.68  -0.51  0.24  1.32  0.24  -2.52  -0.34  -1.21  -0.21  -0.43  -0.76  1.49  1.49  1.49  1.49  1.49  1.49  -0.66  1.95  1.95  -7.33×10-3  2.95  -0.26  -0.68  -0.68  -9.16×10-3  8.37 | 0.43 |
| *Z* =82, Pb | 0.049±0.001  0.055±0.003  0.0560±0.019  0.0482±0.013  0.0599±0.013  0.0470±0.010  0.051±0.004  0.051±0.003  0.049±0.003  0.055±0.005  0.053±0.005  0.052±0.005  0.053±0.005  0.055±0.005  0.054±0.005  0.047±0.004  0.047±0.004  0.0517±0.0015  0.053±0.005  0.053±0.005  0.053±0.005  0.0549±0.005  0.056±0.005  0.056±0.004  0.053±0.003  0.050±0.005  0.045±0.003  0.049±0.004  0.055±0.005  0.053±0.007  0.053±0.007  0.047±0.005(B=+0.15T)  0.047±0.005(B=-0.15T)  0.047±0.005(B=+0.45T)  0.047±0.005(B=-0.45T)  0.047±0.005(B=+0.75T)  0.047±0.005(B=-0.75T)  0.0531±0.003  0.0465±0.003(B=+0.75T)  0.0466±0.003(B=-0.75T)  0.057±0.006  0.054±0.0004  0.053±0.0003  0.054±0.004  0.054±0.004  0.050±0.004  0.0936±0.0048  0.0509±0.0029  0.060±0.004  0.054±0.004  0.047±0.003  0.051±0.003  0.049±0.006  0.065±0.008 | (Rao et al., 1971)  (Kumar et al., 1982)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Chander et al., 1987)  (Singh et al., 1989)  (Darko and Tetteh, 1992)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao and Gigante, 1993)  (Rao et al., 1993)  (Rao et al., 1993)  (Dhal and Padhi, 1994)  (Rao et al., 1995)  (Rao et al., 1995)  (Rao et al., 1995)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Durak and Özdemir, 2001)  (Tirasoglu et al., 2003)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Aylikci et al., 2015)  (Dogan et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0529±0.0002 | -3.82  0.69  0.16  -0.36  0.54  -0.59  -0.48  -0.64  -1.3  0.42  0.02  -0.18  0.02  0.42  0.22  -1.48  -1.48  -0.8  0.02  0.02  0.02  0.4  0.62  0.77  0.03  -0.58  -2.63  -0.98  0.42  0.01  0.01  -1.18  -1.18  -1.18  -1.18  -1.18  -1.18  0.06  -2.13  -2.1  0.68  2.4  0.24  0.27  0.27  -0.73  8.47  -0.69  1.77  0.27  -1.97  -0.64  -0.65  1.51 | -0.20 |
| *Z* =83, Bi | 0.050±0.001  0.0504±0.018  0.0588±0.010  0.0591±0.014  0.0653±0.050  0.062±0.005  0.054±0.003  0.057±0.016  0.0557±0.0015  0.0562±0.005  0.055±0.005  0.058±0.003  0.058±0.005  0.047±0.004  0.054±0.005  0.053±0.005  0.056±0.005  0.056±0.007  0.054±0.006  0.048±0.005(B=+0.15T)  0.048±0.005(B=-0.15T)  0.047±0.005(B=+0.45T)  0.047±0.005(B=-0.45T)  0.047±0.005(B=+0.75T)  0.047±0.005(B=-0.75T)  0.0544±0.004  0.0473±0.004(B=+0.75T)  0.0473±0.004(B=-0.75T)  0.054±0.005  0.055±0.004  0.055±0.004  0.0423±0.005  0.057±0.004  0.1005±0.0051  0.056±0.004  0.048±0.003  0.048±0.003  0.052±0.003  0.049±0.005  0.051±0.006 | (Rao et al., 1971)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Garg et al., 1984)  (Shatendra et al., 1985)  (Chander et al., 1987)  (Mehta et al., 1987)  (Dhal and Padhi, 1994)  (Ertugrul, 1997)  (Dogan et al., 1998)  (Ismail and Malhi, 2000)  (Simsek, 2000)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul., 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Alqadi et al., 2013)  (Akman et al., 2015)  (Aylikci et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Hiremath et al., 2019)  (Alqadi et al., 2023)  (Alqadi et al., 2023) | 0.0525±0.0006 | -2.18  -0.12  0.63  0.47  0.26  1.89  0.5  0.28  2.01  0.74  0.5  1.81  1.1  -1.36  0.3  0.1  0.7  0.5  0.25  -0.89  -0.89  -1.09  -1.09  -1.09  -1.09  0.47  -1.28  -1.28  0.3  0.62  0.62  -2.02  1.12  9.36  0.87  -1.47  -1.47  -0.16  -0.69  -0.25 | 0.17 |
| *Z* =90, Th | 0.069±0.004  0.060±0.004  0.062±0.003  0.053±0.003  0.056±0.003  0.054±0.003  0.057±0.003  0.054±0.005  0.0712±0.006  0.079±0.002  0.076±0.002  0.074±0.002  0.070±0.002  0.069±0.002  0.062±0.002  0.063±0.002  0.060±0.006  0.060±0.007  0.065±0.004  0.059±0.005  0.058±0.002  0.062±0.006  0.052±0.005  0.061±0.008  0.061±0.003  0.064±0.004(B=+0.15T)  0.064±0.004(B=-0.15T)  0.064±0.004(B=+0.45T)  0.064±0.004(B=-0.45T)  0.065±0.004(B=+0.75T)  0.064±0.004(B=-0.75T)  0.0607±0.002  0.0645±0.002(B=+0.75T)  0.0643±0.002(B=-0.75T)  0.067±0.007  0.062±0.004  0.062±0.004  0.063±0.003  0.1248±0.0064 | (Kumar et al., 1982)  (Chander et al., 1987)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Tan et al., 1990)  (Ertugrul, 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Simsek, 2000)  (Durak and Özdemir, 2001)  (Küçükönder et al., 2004)  (Öz et al., 2004)  (Turgut and Ertugrul, 2004)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Aylikci et al., 2015) | 0.0651±0.0005 | 0.98  -1.26  -1.01  -3.97  -2.98  -3.64  -2.65  -2.2  1.02  6.78  5.32  4.35  2.4  1.92  -1.49  -1  -0.84  -0.72  -0.01  -1.21  -3.44  -0.51  -2.6  -0.51  -1.34  -0.26  -0.26  -0.26  -0.26  -0.01  -0.26  -2.12  -0.27  -0.37  0.28  -0.76  -0.76  -0.68  9.31 | -0.14 |
| *Z* =92, U | 0.061±0.003  0.067±0.004  0.061±0.003  0.063±0.003  0.060±0.003  0.061±0.003  0.055±0.003  0.052±0.003  0.053±0.005  0.058±0.005  0.0712±0.006  0.101±0.003  0.085±0.002  0.067±0.002  0.065±0.002  0.061±0.002  0.046±0.001  0.043±0.001  0.062±0.007  0.062±0.007  0.067±0.004  0.060±0.004  0.062±0.003  0.062±0.003  0.060±0.005  0.062±0.006  0.065±0.008  0.065±0.006  0.074±0.007(B=+0.15T)  0.074±0.008(B=-0.15T)  0.075±0.008(B=+0.45T)  0.075±0.008(B=-0.45T)  0.075±0.007(B=+0.75T)  0.075±0.007(B=-0.75T)  0.0651±0.004  0.0749±0.004(B=+0.75T)  0.0747±0.004(B=-0.75T)  0.066±0.007  0.063±0.004  0.063±0.004  0.059±0.002  0.1329±0.0068 | (Rao et al., 1971)  (Kumar et al., 1982)  (Chander et al., 1987)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Singh et al., 1987c)  (Tan et al., 1990)  (Darko and Tetteh, 1992)  (Ertugrul, 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Dogan et al., 1998)  (Dogan et al., 1998)  (Simsek, 2000)  (Durak and Özdemir, 2001)  (Küçükönder, 2002)  (Küçükönder et al., 2004)  (Turgut and Ertugrul, 2004)  (Sögüt and Küçükönder, 2005)  (Karabulut and Gurol, 2006)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2007b)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir and Sahin, 2008)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Akman et al., 2015)  (Aylikci et al., 2015) | 0.0580±0.0004 | 0.99  2.24  0.99  1.65  0.66  0.99  -0.99  -1.98  -1  -8.61×10-4  2.19  14.18  13.19  4.39  3.42  1.46  -11.01  -13.76  0.57  0.57  2.24  0.5  1.32  1.32  0.4  0.66  0.87  1.16  2.28  2  2.12  2.12  2.42  2.42  1.76  4.2  4.15  1.14  1.24  1.24  0.49  10.99 | 1.57 |
| *Z* =93, Np | 0.061±0.002 | (Rao et al., 1971) | 0.061±0.002 | 0 | 0 |
| *Z* =94, Pu | 0.061±0.002 | (Rao et al., 1971) | 0.061±0.002 | 0 | 0 |

**Table4.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =54, Xe | 0.125±0.013 | (Chand et al., 1989) | 0.125±0.013 | 0 | 0 |
| *Z* =56, Ba | 0.122±0.008 | (Mehta et al., 1987a) | 0.122±0.008 | 0 | 0 |
| *Z* =57, La | 0.129±0.009 | (Ertugrul, 1996) | 0.129±0.009 | 0 | 0 |
| *Z* =58, Ce | 0.145±0.012 | (Ertugrul, 1996) | 0.145±0.012 | 0 | 0 |
| *Z* =59, Pr | 0.135±0.008 | (Ertugrul, 1996) | 0.135±0.008 | 0 | 0 |
| *Z* =60, Nd | 0.139±0.006 | (Ertugrul, 1996) | 0.139±0.006 | 0 | 0 |
| *Z* =62, Sm | 0.140±0.005 | (Ertugrul, 1996) | 0.140±0.005 | 0 | 0 |
| *Z* =63, Eu | 0.135±0.010 | (Ertugrul, 1996) | 0.135±0.010 | 0 | 0 |
| *Z* =64, Gd | 0.134±0.010 | (Ertugrul, 1996) | 0.134±0.010 | 0 | 0 |
| *Z* =65, Tb | 0.147±0.012 | (Ertugrul, 1996) | 0.147±0.012 | 0 | 0 |
| *Z* =66, Dy | 0.176±0.010  0.150±0.015  0.176±0.027  0.152±0.001  0.150±0.001 | (Mehta et al., 1986)  (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008) | 0.1511±0.0007 | 2.48  -0.08  0.92  0.70  -0.93 | 0.62 |
| *Z* =67, Ho | 0.143±0.011  0.167±0.021  0.155±0.002  0.150±0.0001 | (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008) | 0.1500±0.0001 | -0.64  0.81  2.49  -0.09 | 0.64 |
| *Z* =68, Er | 0.155±0.009  0.157±0.014  0.174±0.025 | (Chand et al., 1989)  (Ertugrul, 1996)  (Öz et al., 2004) | 0.1571±0.0072 | -0.18  -0.008  0.65 | 0.15 |
| *Z* =69, Tm | 0.166±0.007  0.155±0.008 | (Mehta et al., 1986)  (Ertugrul, 1996) | 0.1612±0.0053 | 0.54  -0.65 | -0.05 |
| *Z* =70, Yb | 0.162±0.002  0.234±0.015  0.249±0.003  0.242±0.001  0.196±0.019 | (Mehta et al., 1985)  (Ertugrul, 1996)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.2278±0.0009 | -30.27  0.41  6.79  10.77  -1.67 | -2.80 |
| *Z* =71, Lu | 0.240±0.018 | (Ertugrul, 1996) | 0.240±0.018 | 0 | 0 |
| *Z* =72, Hf | 0.167±0.005  0.188±0.023 | (Mehta et al., 1987b)  (Öz et al., 2004) | 0.1679±0.0049 | -0.14  0.85 | 0.36 |
| *Z* =73, Ta | 0.214±0.014  0.231±0.018 | (Ertugrul, 1996)  (Akman et al., 2015) | 0.2204±0.0111 | -0.36  0.50 | 0.07 |
| *Z* =74, W | 0.147±0.007  0.248±0.020  0.176±0.018  0.214±0.005  0.206±0.001  0.191±0.015 | (Chand et al., 1992)  (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.2051±0.0010 | -8.23  2.14  -1.62  1.74  0.63  -0.94 | -1.04 |
| *Z* =75, Re | 0.205±0.013 | (Ertugrul, 1996) | 0.205±0.013 | 0 | 0 |
| *Z* =78, Pt | 0.204±0.020 | (Demir et al., 2008) | 0.204±0.020 | 0 | 0 |
| *Z* =79, Au | 0.181±0.014  0.171±0.017 | (Ertugrul, 1996)  (Demir et al., 2008) | 0.1770±0.0108 | 0.23  -0.30 | -0.03 |
| *Z* =80, Hg | 0.193±0.010  0.199±0.007  0.182±0.017  0.183±0.018  0.203±0.010  0.191±0.002  0.192±0.010 | (Chand et al., 1989)  (Chand et al., 1989)  (Ertugrul, 1996)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.1918±0.0108 | 0.11  0.99  -0.58  -0.49  1.10  -0.31  0.02 | 0.12 |
| *Z* =81, Tl | 0.199±0.011  0.175±0.019  0.180±0.020  0.174±0.017  0.200±0.002  0.184±0.006  0.191±0.010 | (Mehta et al., 1987a)  (Ertugrul, 1996)  (Öz et al., 2004)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.1975±0.0018 | 0.13  -1.18  -0.87  -1.38  0.91  -2.16  -0.64 | -0.74 |
| *Z* =82, Pb | 0.186±0.015  0.168±0.017  0.223±0.013  0.215±0.008  0.218±0.013 | (Ertugrul, 1996)  (Demir et al., 2008)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.2086±0.0053 | -1.42  -2.28  1.03  0.67  0.67 | -0.27 |
| *Z* =83, Bi | 0.198±0.010  0.187±0.019  0.177±0.018  0.211±0.010 | (Ertugrul, 1996)  (Öz et al., 2004)  (Demir et al., 2008)  (Akman et al., 2015) | 0.1993±0.0062 | -0.11  -0.62  -1.17  0.99 | -0.23 |
| *Z* =90, Th | 0.172±0.020  0.180±0.004  0.163±0.004  0.171±0.004  0.172±0.004  0.179±0.004  0.169±0.004  0.171±0.004  0.207±0.021  0.222±0.001  0.224±0.001  0.227±0.001(B=+0.75T)  0.229±0.001(B=+0.75T)  0.223±0.001(B=+0.60T)  0.225±0.001(B=+0.60T)  0.221±0.001(B=+0.45T)  0.222±0.001(B=+0.45T)  0.218±0.001(B=+0.30T)  0.220±0.001(B=+0.30T)  0.220±0.001(B=+0.15T)  0.221±0.001(B=+0.15T)  0.227±0.001(B=-0.75T)  0.229±0.001(B=-0.75T)  0.223±0.001(B=-0.60T)  0.224±0.001(B=-0.60T)  0.220±0.001(B=-0.45T)  0.222±0.001(B=-0.45T)  0.218±0.001(B=-0.30T)  0.220±0.001(B=-0.30T)  0.220±0.001(B=-0.15T)  0.221±0.001(B=-0.15T)  0.193±0.019  0.226±0.011 | (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Öz et al., 2004)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir et al., 2008)  (Akman et al., 2015) | 0.2216±0.0002 | -2.48  -10.37  -14.62  -12.62  -12.37  -10.62  -13.12  -12.62  -0.69  0.44  2.39  5.33  7.29  1.42  3.37  -0.54  0.44  -3.48  -1.52  -1.52  -0.54  5.33  7.29  1.42  2.39  -1.52  0.44  -3.48  -1.52  -1.52  -0.54  -1.5  0.4 | -2.10 |
| *Z* =92, U | 0.232±0.017  0.233±0.006  0.224±0.006  0.230±0.006  0.229±0.006  0.229±0.006  0.242±0.006  0.232±0.006  0.218±0.001  0.221±0.001  0.221±0.001(B=+0.75T)  0.224±0.001(B=+0.75T)  0.218±0.001(B=+0.60T)  0.221±0.001(B=+0.60T)  0.216±0.001(B=+0.45T)  0.218±0.001(B=+0.45T)  0.215±0.001(B=+0.30T)  0.216±0.001(B=+0.30T)  0.216±0.001(B=+0.15T)  0.217±0.001(B=+0.15T)  0.221±0.001(B=-0.75T)  0.224±0.001(B=-0.75T)  0.218±0.0003(B=-0.60T)  0.221±0.001(B=-0.60T)  0.216±0.001(B=-0.45T)  0.218±0.001(B=-0.45T)  0.215±0.001(B=-0.30T)  0.216±0.001(B=-0.30T)  0.216±0.0005(B=-0.15T)  0.217±0.001(B=-0.15T)  0.200±0.020  0.226±0.009 | (Ertugrul, 1996)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Ertugrul et al., 1997)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir et al., 2008)  (Akman et al., 2015) | 0.2181±0.0002 | 0.82  2.48  0.98  1.98  1.82  1.82  3.98  2.32  -0.10  2.86  2.86  5.81  -0.10  2.86  -2.08  -0.10  -3.06  -2.08  -2.08  -1.09  2.86  5.81  -0.30  2.86  -2.08  -0.10  -3.06  -2.08  -3.99  -1.09  -0.91  0.88 | 0.58 |

**Table 6.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =54, Xe | 0.389±0.064 | (Chand et al., 1989) | 0.389±0.064 | 0 | 0 |
| *Z* =56, Ba | 0.291±0.030 | (Mehta et al., 1987a) | 0.291±0.030 | 0 | 0 |
| *Z* =57, La | 0.3480±0.019 | (Ertugrul, 1996) | 0.3480±0.019 | 0 | 0 |
| *Z* =58, Ce | 0.3450±0.021 | (Ertugrul, 1996) | 0.3450±0.021 | 0 | 0 |
| *Z* =59, Pr | 0.3610±0.022 | (Ertugrul, 1996) | 0.3610±0.022 | 0 | 0 |
| *Z* =60, Nd | 0.3610±0.022 | (Ertugrul, 1996) | 0.3610±0.022 | 0 | 0 |
| *Z* =62, Sm | 0.3690±0.031 | (Ertugrul, 1996) | 0.3690±0.031 | 0 | 0 |
| *Z* =63, Eu | 0.3510±0.026 | (Ertugrul, 1996) | 0.3510±0.026 | 0 | 0 |
| *Z* =64, Gd | 0.3550±0.019 | (Ertugrul, 1996) | 0.3550±0.019 | 0 | 0 |
| *Z* =65, Tb | 0.3620±0.017 | (Ertugrul, 1996) | 0.3620±0.017 | 0 | 0 |
| *Z* =66, Dy | 0.344±0.027  0.3570±0.023  0.29±0.05  0.313±0.019  0.348±0.014  0.326±0.021  0.230±0.016 | (Mehta et al., 1986)  (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.3130±0.0075 | 1.11  1.82  -0.46  -9.15 x 10-4  2.20  0.58  -4.70 | 0.08 |
| *Z* =67, Ho | 0.3660±0.023  0.29±0.04  0.293±0.029  0.362±0.006  0.302±0.018  0.224±0.015 | (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.3385±0.0051 | 1.17  -1.20  -1.54  3  -1.95  -7.23 | -1.29 |
| *Z* =68, Er | 0.225±0.013  0.3450±0.025  0.29±0.04  0.305±0.019  0.238±0.017 | (Chand et al., 1989)  (Ertugrul, 1996)  (Öz et al., 2004)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2597±0.0083 | -2.25  3.24  0.74  2.18  -1.15 | 0.55 |
| *Z* =69, Tm | 0.344±0.006  0.0351±0.026 | (Mehta et al., 1986)  (Ertugrul, 1996) | 0.3284±0.0058 | 1.86  -11 | -4.57 |
| *Z* =70, Yb | 0.244±0.003  0.1316±0.011  0.119±0.006  0.132±0.011  0.17±0.05 | (Mehta et al., 1985)  (Ertugrul, 1996)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.2096±0.0025 | 8.75  -6.91  -13.91  -6.88  -0.79 | -3.95 |
| *Z* =71, Lu | 0.1400±0.090  0.307±0.019  0.289±0.017 | (Ertugrul, 1996)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2940±0.0125 | -1.69  0.57  -0.23 | -0.45 |
| *Z* =72, Hf | 0.298±0.010  0.23±0.03 | (Mehta et al., 1987b)  (Öz et al., 2004) | 0.2912±0.0095 | 0.49  -1.95 | -0.73 |
| *Z* =73, Ta | 0.1470±0.099  0.14±0.04  0.356±0.025  0.185±0.014 | (Ertugrul, 1996)  Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2175±0.0116 | -0.71  -1.86  5.02  -1.79 | 0.17 |
| *Z* =74, W | 0.220±0.015  0.1310±0.010  0.28±0.03  0.127±0.011  0.156±0.004  0.18±0.04  0.322±0.021  0.225±0.015 | (Chand et al., 1992)  (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.1627±0.0033 | 3.73  -3.02  3.89  -3.11  -1.30  0.43  7.49  4.06 | 1.52 |
| *Z* =75, Re | 0.1544±0.010 | (Ertugrul, 1996) | 0.1544±0.010 | 0 | 0 |
| *Z* =78, Pt | 0.2630±0.015  0.286±0.016  0.267±0.021 | (Ertugrul, 1996)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2723±0.0097 | -0.52  0.73  -0.23 | -0.007 |
| *Z* =79, Au | 0.280±0.016  0.319±0.020 | (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2952±0.0125 | -0.75  1 | 0.13 |
| *Z* =80, Hg | 0.218±0.026  0.189±0.011  0.2801±0.016  0.218±0.015  0.261±0.006  0.26±0.03  0.282±0.016  0.277±0.023 | (Chand et al., 1989)  (Chand et al., 1989)  (Ertugrul, 1996)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2484±0.0044 | -1.15  -5.02  1.91  -1.95  1.70  0.38  2.03  1.22 | -0.11 |
| *Z* =81, Tl | 0.236±0.015  0.2840±0.016  0.35±0.04  0.230±0.011  0.266±0.007  0.26±0.02 | (Mehta et al., 1987a)  (Ertugrul, 1996)  (Öz et al., 2004)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015) | 0.2580±0.005 | -1.39  1.55  2.28  -2.31  0.94  0.1 | 0.19 |
| *Z* =82, Pb | 0.2780±0.017  0.218±0.017  0.243±0.018  0.24±0.03  0.304±0.019  0.302±0.018 | (Ertugrul, 1996)  (Yalçin et al., 2008)  (Yalçin et al., 2008)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2655±0.0077 | 0.67  -2.55  -1.15  -0.82  1.88  1.86 | -0.02 |
| *Z* =83, Bi | 0.2690±0.017  0.34±0.03  0.27±0.02  0.329±0.022  0.302±0.018 | (Ertugrul, 1996)  (Öz et al., 2004)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.2941±0.009 | -1.31  1.46  -1.1  1.47  0.39 | 0.18 |
| *Z* =90, Th | 0.2880±0.018  0.32±0.03  0.178±0.021  0.245±0.017  0.099±0.022(B=+0.75T)  0.137±0.021(B=+0.75T)  0.129±0.012(B=+0.60T)  0.159±0.018(B=+0.60T)  0.151±0.014(B=+0.45T)  0.176±0.011(B=+0.45T)  0.170±0.015(B=+0.30T)  0.192±0.014(B=+0.30T)  0.186±0.027(B=+0.15T)  0.214±0.019(B=+0.15T)  0.099±0.012(B=-0.75T)  0.138±0.020(B=-0.75T)  0.131±0.015(B=-0.60T)  0.159±0.011(B=-0.60T)  0.152±0.018(B=-0.45T)  0.178±0.015(B=-0.45T)  0.171±0.012(B=-0.30T)  0.192±0.016(B=-0.30T)  0.185±0.015(B=-0.15T)  0.215±0.017(B=-0.15T)  0.24±0.01 | (Ertugrul, 1996)  (Öz et al., 2004)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Akman et al., 2015) | 0.1758±0.003 | 6.15  4.78  0.10  4  -3.46  -1.83  -3.78  -0.92  -1.73  0.02  -0.38  1.13  0.38  1.99  -6.21  -1.87  -2.93  -1.47  -1.30  0.14  -0.39  1  0.60  2.27  6.15 | 0.1 |
| *Z* =92, U | 0.2600±0.017  0.176±0.024  0.265±0.021  0.116±0.010(B=+0.75T)  0.128±0.009(B=+0.75T)  0.153±0.011(B=+0.60T)  0.135±0.011(B=+0.60T)  0.183±0.014(B=+0.45T)  0.157±0.012(B=+0.45T)  0.203±0.015(B=+0.30T)  0.180±0.015(B=+0.30T)  0.194±0.002(B=+0.15T)  0.206±0.010(B=+0.15T)  0.114±0.010(B=-0.75T)  0.124±0.011(B=-0.75T)  0.157±0.011(B=-0.60T)  0.134±0.010(B=-0.60T)  0.185±0.016(B=-0.45T)  0.153±0.011(B=-0.45T)  0.203±0.015(B=-0.30T)  0.179±0.014(B=-0.30T)  0.194±0.009(B=-0.15T)  0.207±0.009(B=-0.15T)  0.24±0.01 | (Ertugrul, 1996)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Demir and Sahin, 2007a)  (Akman et al., 2015) | 0.1836±0.0015 | 4.47  -0.32  3.86  -6.69  -6.09  -2.76  -4.38  -0.05  -2.20  1.28  -0.24  4.10  2.21  -6.88  -5.37  -2.40  -4.91  0.08  -2.76  1.28  -0.33  1.13  2.56  5.57 | -0.78 |

**Table 7.** Summary of the experimental intensity ratios from 54Xe to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =54, Xe | 0.049±0.008 | (Chand et al., 1989) | 0.049±0.008 | 0 | 0 |
| *Z* =56, Ba | 0.036±0.003 | (Mehta et al., 1987a) | 0.036±0.003 | 0 | 0 |
| *Z* =57, La | 0.0449±0.003 | (Ertugrul, 1996) | 0.0449±0.003 | 0 | 0 |
| *Z* =58, Ce | 0.0501±0.003 | (Ertugrul, 1996) | 0.0501±0.003 | 0 | 0 |
| *Z* =59, Pr | 0.0489±0.002 | (Ertugrul, 1996) | 0.0489±0.002 | 0 | 0 |
| *Z* =60, Nd | 0.0515±0.004 | (Ertugrul, 1996) | 0.0515±0.004 | 0 | 0 |
| *Z* =62, Sm | 0.0531±0.005 | (Ertugrul, 1996) | 0.0531±0.005 | 0 | 0 |
| *Z* =63, Eu | 0.045±0.002  0.051±0.002  0.0526±0.004 | (Chand et al., 1992b)  (Chand et al., 1992b)  (Ertugrul, 1996) | 0.0485±0.0013 | -1.46  1.04  0.97 | 0.18 |
| *Z* =64, Gd | 0.0528±0.004 | (Ertugrul, 1996) | 0.0528±0.004 | 0 | 0 |
| *Z* =65, Tb | 0.0531±0.004 | (Ertugrul, 1996) | 0.0531±0.004 | 0 | 0 |
| *Z* =66, Dy | 0.060±0.005  0.0535±0.004  0.05±0.01  0.067±0.001  0.051±0.004  0.044±0.003 | (Mehta et al., 1986)  (Ertugrul, 1996)  (Öz et al., 2004)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0632±0.0009 | -0.64  -2.38  -1.32  2.83  -2.99  -6.15 | -1.77 |
| *Z* =67, Ho | 0.0529±0.005  0.05±0.01  0.067±0.001  0.051±0.004  0.042±0.003 | (Ertugrul, 1996)  (Öz et al., 2004)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0633±0.0009 | -2.05  -1.33  2.74  -3  -6.80 | -2.09 |
| *Z* =68, Er | 0.035±0.001  0.0540±0.005  0.05±0.01  0.069±0.001  0.049±0.003  0.043±0.003 | (Chand et al., 1989)  (Ertugrul, 1996)  (Öz et al., 2004)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0514±0.0007 | -13.70  0.51  -0.14  14.63  -0.79  -2.75 | -0.37 |
| *Z* =69, Tm | 0.057±0.002  0.0543±0.002 | (Mehta et al., 1986)  (Ertugrul, 1996) | 0.0557±0.0014 | 0.55  -0.55 | 0 |
| *Z* =70, Yb | 0.039±0.001  0.0308±0.002  0.033±0.007 | (Mehta et al., 1985)  (Ertugrul, 1996)  (Akman et al., 2015) | 0.0373±0.0009 | 1.28  -2.97  -0.61 | -0.77 |
| *Z* =71, Lu | 0.0336±0.002  0.069±0.001  0.053±0.004  0.053±0.004 | (Ertugrul, 1996)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0611±0.0009 | -12.65  6  -1.98  -1.98 | -2.65 |
| *Z* =72, Hf | 0.050±0.002  0.05±0.01 | (Mehta et al., 1987b)  (Öz et al., 2004) | 0.05±0.002 | 0  0 | 0 |
| *Z* =73, Ta | 0.0315±0.003  0.033±0.006  0.070±0.001  0.057±0.004  0.044±0.003 | (Ertugrul, 1996)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0631±0.0009 | -10.13  -4.97  5.17  -1.50  -6.13 | -3.51 |
| *Z* =74, W | 0.032±0.002  0.0326±0.002  0.05±0.01  0.034±0.005  0.070±0.001  0.058±0.004  0.055±0.004 | (Chand et al., 1992a)  (Ertugrul, 1996)  (Öz et al., 2004)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0568±0.0008 | -11.55  -11.27  -0.67  -4.50  10.48  0.30  -0.43 | -2.51986 |
| *Z* =75, Re | 0.0316±0.002 | (Ertugrul, 1996) | 0.0316±0.002 | 0 | 0 |
| *Z* =76, Os | 0.012±0.001 | (Mehta et al., 1986) | 0.012±0.001 | 0 | 0 |
| *Z* =78, Pt | 0.072±0.002  0.070±0.005  0.054±0.004 | (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0686±0.0017 | 1.31  0.27  -3.356 | -0.59 |
| *Z* =79, Au | 0.0477±0.002  0.070±0.001  0.060±0.004  0.076±0.005 | (Ertugrul, 1996)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0656±0.0009 | -8.22  3.34  -1.37  2.05 | -1.05 |
| *Z* =80, Hg | 0.038±0.002  0.042±0.005  0.0508±0.003  0.051±0.006  0.071±0.002  0.072±0.005  0.066±0.005 | (Chand et al., 1989)  (Chand et al., 1989)  (Ertugrul, 1996)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0547±0.0011 | -7.24  -2.48  -1.21  -0.61  7.07  3.37  2.20 | 0.16 |
| *Z* =81, Tl | 0.047±0.003  0.0498±0.003  0.06±0.01  0.050±0.004 | (Mehta et al., 1987a)  (Ertugrul, 1996)  (Öz et al., 2004)  (Akman et al., 2015) | 0.0491±0.0018 | -0.61  0.19  1.07  0.20 | 0.21 |
| *Z* =82, Pb | 0.0516±0.003  0.053±0.005  0.073±0.002  0.069±0.005  0.080±0.006 | (Ertugrul, 1996)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0663±0.0015 | -4.40  -2.55  2.71  0.52  2.22 | -0.30 |
| *Z* =83, Bi | 0.050±0.014  0.0533±0.004  0.06±0.01  0.058±0.004  0.073±0.002  0.067±0.005  0.056±0.004 | (Mehta et al., 1987)  (Ertugrul, 1996)  (Öz et al., 2004)  (Akman et al., 2015)  (Bansal et al., 2017)  (Bansal et al., 2017)  (Bansal et al., 2017) | 0.0655±0.0014 | -1.1  -2.86  -0.54  -1.75  3.07  0.30  -2.23 | -0,73 |
| *Z* =90, Th | 0.0496±0.004  0.07±0.01  0.054±0.003 | (Ertugrul, 1996)  (Öz et al., 2004)  (Akman et al., 2015) | 0.0534±0.0023 | -0.81  1.62  0.16 | 0.23 |
| *Z* =92, U | 0.0602±0.004  0.055±0.002 | (Ertugrul, 1996)  (Akman et al., 2015) | 0.0560±0.0018 | 0.95  -0.39 | 0.28 |

**Table 8.** Summary of the experimental intensity ratios from 56Ba to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =56, Ba | 0.0033±0.0002 | (Aylikci et al., 2015) | 0.0033±0.0002 | 0 | 0 |
| *Z* =57, La | 0.0035±0.0002 | (Aylikci et al., 2015) | 0.0035±0.0002 | 0 | 0 |
| *Z* =58, Ce | 0.0034±0.0002 | (Aylikci et al., 2015) | 0.0034±0.0002 | 0 | 0 |
| *Z* =59, Pr | 0.0035±0.0002 | (Aylikci et al., 2015) | 0.0035±0.0002 | 0 | 0 |
| *Z* =60, Nd | 0.0035±0.0002 | (Aylikci et al., 2015) | 0.0035±0.0002 | 0 | 0 |
| *Z* =62, Sm | 0.0036±0.0002 | (Aylikci et al., 2015) | 0.0036±0.0002 | 0 | 0 |
| *Z* =63, Eu | 0.0036±0.0002 | (Aylikci et al., 2015) | 0.0036±0.0002 | 0 | 0 |
| *Z* =64, Gd | 0.0037±0.0002 | (Aylikci et al., 2015) | 0.0037±0.0002 | 0 | 0 |
| *Z* =65, Tb | 0.0040±0.0002 | (Aylikci et al., 2015) | 0.0040±0.0002 | 0 | 0 |
| *Z* =66, Dy | 0.0040±0.0002 | (Aylikci et al., 2015) | 0.0040±0.0002 | 0 | 0 |
| *Z* =67, Ho | 0.0042±0.0002 | (Aylikci et al., 2015) | 0.0042±0.0002 | 0 | 0 |
| *Z* =68, Er | 0.0043±0.0002 | (Aylikci et al., 2015) | 0.0043±0.0002 | 0 | 0 |
| *Z* =69, Tm | 0.0077±0.0004 | (Aylikci et al., 2015) | 0.0077±0.0004 | 0 | 0 |
| *Z* =71, Lu | 0.0087±0.0004 | (Aylikci et al., 2015) | 0.0087±0.0004 | 0 | 0 |
| *Z* =72, Hf | 0.007±0.001  0.0089±0.0005 | (Karabulut and Gurol, 2006)  (Aylikci et al., 2015) | 0.0085±0.0004 | -1.39  0.57 | -0.41 |
| *Z* =73, Ta | 0.005±0.001  0.005±0.0004  0.005±0.0004  0.0093±0.0005 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0060±0.0002 | -0.96  -2.10  -2.11  5.99 | 0.20 |
| *Z* =74, W | 0.004±0.001  0.005±0.0004  0.005±0.0004  0.0094±0.0005 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0059±0.0002 | -1.90  -2.04  -2.04  6.23 | 0.07 |
| *Z* =75, Re | 0.0089±0.0005 | (Aylikci et al., 2015) | 0.0089±0.0005 | 0 | 0 |
| *Z* =76, Os | 0.005±0.0004  0.005±0.0004  0.0081±0.0004 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0060±0.0002 | -2.4  -2.24  4.47 | 0 |
| *Z* =77, Ir | 0.0083±0.0004 | (Aylikci et al., 2015) | 0.0083±0.0004 | 0 | 0 |
| *Z* =78, Pt | 0.005±0.0004  0.004±0.0004  0.0077±0.0004 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0056±0.0002 | -1.23  -3.39  4.62 | 0 |
| *Z* =79, Au | 0.004±0.001  0.004±0.0003  0.004±0.0003  0.0078±0.0004 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0048±0.0002 | -0.79  -2.29  -2.29  6.80 | 0.36 |
| *Z* =80, Hg | 0.003±0.0004  0.004±0.0004  0.004±0.0004  0.0078±0.0004 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0047±0.0002 | -3,80  -1,57  -1,57  6.93 | 0 |
| *Z* =81, Tl | 0.005±0.001  0.004±0.0003  0.004±0.0003  0.0078±0.0004 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0048±0.0002 | 0.16  -2.39  -2.39  6.72 | 0.53 |
| *Z* =82, Pb | 0.005±0.001  0.005±0.0004  0.004±0.0004  0.0081±0.0004 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0057±0.0002 | -0.65  -1.45  -3.63  5.31 | -0.10 |
| *Z* =83, Bi | 0.005±0.001  0.004±0.0003  0.004±0.0003  0.0082±0.0004 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0049±0.0002 | 0.07  -2.63  -2.63  7.44 | 0.56 |
| *Z* =90, Th | 0.004±0.001  0.005±0.0004  0.005±0.0004  0.0106±0.0005 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0062±0.0002 | -2.16  -2.62  -2.62  7.90 | 0.12 |
| *Z* =92, U | 0.005±0.001  0.004±0.0003  0.004±0.0003  0.01101±0.0006 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0048±0.0002 | 0.21  -2.20  -2.20  9.86 | 1.42 |

**Table 9.** Summary of the experimental intensity ratios from 50Sn to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =50, Sn | 0.0037±0.0002 | (Aylikci et al., 2015) | 0.0037±0.0002 | 0 | 0 |
| *Z* =51, Sb | 0.0086±0.0004 | (Aylikci et al., 2015) | 0.0086±0.0004 | 0 | 0 |
| *Z* =52, Te | 0.0139±0.0007 | (Aylikci et al., 2015) | 0.0139±0.0007 | 0 | 0 |
| *Z* =53, I | 0.0202±0.0010 | (Aylikci et al., 2015) | 0.0202±0.0010 | 0 | 0 |
| *Z* =56, Ba | 0.0041±0.0002 | (Aylikci et al., 2015) | 0.0041±0.0002 | 0 | 0 |
| *Z* =57, La | 0.0043±0.0002 | (Aylikci et al., 2015) | 0.0043±0.0002 | 0 | 0 |
| *Z* =58, Ce | 0.0038±0.0002 | (Aylikci et al., 2015) | 0.0038±0.0002 | 0 | 0 |
| *Z* =59, Pr | 0.0037±0.0002 | (Aylikci et al., 2015) | 0.0037±0.0002 | 0 | 0 |
| *Z* =60, Nd | 0.0034±0.0002 | (Aylikci et al., 2015) | 0.0034±0.0002 | 0 | 0 |
| *Z* =62, Sm | 0.0031±0.0002 | (Aylikci et al., 2015) | 0.0031±0.0002 | 0 | 0 |
| *Z* =63, Eu | 0.0032±0.0002 | (Aylikci et al., 2015) | 0.0032±0.0002 | 0 | 0 |
| *Z* =64, Gd | 0.0033±0.0002 | (Aylikci et al., 2015) | 0.0033±0.0002 | 0 | 0 |
| *Z* =65, Tb | 0.0032±0.0002 | (Aylikci et al., 2015) | 0.0032±0.0002 | 0 | 0 |
| *Z* =66, Dy | 0.009±0.001  0.009±0.001  0.0033±0.0002 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0037±0.0002 | 5.18  5.18  -1.52 | 2.95 |
| *Z* =67, Ho | 0.0033±0.0002 | (Aylikci et al., 2015) | 0.0033±0.0002 | 0 | 0 |
| *Z* =68, Er | 0.010±0.001  0.010±0.001  0.0033±0.0002 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0038±0.0002 | 6.09  6.09  -1.79 | 3.47 |
| *Z* =69, Tm | 0.0284±0.0014 | (Aylikci et al., 2015) | 0.0284±0.0014 | 0 | 0 |
| *Z* =70, Yb | 0.009±0.001  0.009±0.001 | (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.0090±0.0007 | 0  0 | 0 |
| *Z* =71, Lu | 0.009±0.001  0.009±0.001  0.0299±0.0015 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0128±0.0006 | -3.20  -3.20  10.49 | 1.36 |
| *Z* =72, Hf | 0.019±0.002  0.0311±0.0016 | (Karabulut and Gurol, 2006)  (Aylikci et al., 2015) | 0.0264±0.0012 | -3.13  2.33 | -0.40 |
| *Z* =73, Ta | 0.019±0.002  0.010±0.001  0.010±0.001  0.0338±0.0017 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0140±0.0006 | 2.37  -3.43  -3.43  10.92 | 1.61 |
| *Z* =74, W | 0.023±0.003  0.009±0.001  0.010±0.001  0.0391±0.0020 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0133±0.0007 | 3.17  -3.58  -2.74  12.28 | 2.28 |
| *Z* =75, Re | 0.0346±0.0018 | (Aylikci et al., 2015) | 0.0346±0.0018 | 0 | 0 |
| *Z* =76, Os | 0.008±0.001  0.008±0.001  0.0275±0.0014 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0120±0.0006 | -3.35  -3.35  10.12 | 1.14 |
| *Z* =77, Ir | 0.0232±0.0012 | (Aylikci et al., 2015) | 0.0232±0.0012 | 0 | 0 |
| *Z* =78, Pt | 0.006±0.001  0.006±0.001  0.0209±0.0011 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0104±0.0006 | -3.74  -3.74  8.43 | 0.31 |
| *Z* =79, Au | 0.011±0.001  0.006±0.0005  0.006±0.0005  0.0191±0.0010 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0078±0.0003 | 3.04  -3.06  -3.06  10.76 | 1.92 |
| *Z* =80, Hg | 0.010±0.001  0.006±0.0005  0.006±0.0005  0.0201±0.0010 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0078±0.0003 | 2.09  -3.06  -3.06  11.72 | 1.92 |
| *Z* =81, Tl | 0.010±0.001  0.006±0.0005  0.006±0.0005  0.0201±0.0010 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0078±0.0003 | 2.09  -3.06  -3.06  11.72 | 1.92 |
| *Z* =82, Pb | 0.013±0.002  0.006±0.0004  0.005±0.0004  0.0200±0.0010 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0067±0.0003 | 3.13  -1.43  -3.51  12.85 | 2.76 |
| *Z* =83, Bi | 0.012±0.002  0.005±0.0004  0.005±0.0004  0.0216±0.0011 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0061±0.0003 | 2.90  -2.36  -2.36  13.65 | 2.96 |
| *Z* =90, Th | 0.012±0.002  0.006±0.001  0.006±0.001  0.0293±0.0015 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0104±0.0006 | 0.77  -3.76  -3.76  11.67 | 1.23 |
| *Z* =92, U | 0.013±0.002  0.0301±0.0015 | (Karabulut and Gurol, 2006)  (Aylikci et al., 2015) | 0.0239±0.0012 | -4.69  3.20 | -0.74 |

**Table 10.** Summary of the experimental intensity ratios from 50Sn to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbol |  | References |  |  |  |
| *Z* =50, Sn | 0.0729±0.0037 | (Aylikci et al., 2015) | 0.0729±0.0037 | 0 | 0 |
| *Z* =51, Sb | 0.0723±0.0037 | (Aylikci et al., 2015) | 0.0723±0.0037 | 0 | 0 |
| *Z* =52, Te | 0.0810±0.0041 | (Aylikci et al., 2015) | 0.0810±0.0041 | 0 | 0 |
| *Z* =53, I | 0.0847±0.0043 | (Aylikci et al., 2015) | 0.0847±0.0043 | 0 | 0 |
| *Z* =56, Ba | 0.0145±0.0007 | (Aylikci et al., 2015) | 0.0145±0.0007 | 0 | 0 |
| *Z* =57, La | 0.0146±0.0007 | (Aylikci et al., 2015) | 0.0146±0.0007 | 0 | 0 |
| *Z* =58, Ce | 0.0142±0.0007 | (Aylikci et al., 2015) | 0.0142±0.0007 | 0 | 0 |
| *Z* =59, Pr | 0.0150±0.0008 | (Aylikci et al., 2015) | 0.0150±0.0008 | 0 | 0 |
| *Z* =60, Nd | 0.0144±0.0007 | (Aylikci et al., 2015) | 0.0144±0.0007 | 0 | 0 |
| *Z* =62, Sm | 0.0148±0.0008 | (Aylikci et al., 2015) | 0.0148±0.0008 | 0 | 0 |
| *Z* =63, Eu | 0.0154±0.0008 | (Aylikci et al., 2015) | 0.0154±0.0008 | 0 | 0 |
| *Z* =64, Gd | 0.0152±0.0008 | (Aylikci et al., 2015) | 0.0152±0.0008 | 0 | 0 |
| *Z* =65, Tb | 0.0170±0.0009 | (Aylikci et al., 2015) | 0.0170±0.0009 | 0 | 0 |
| *Z* =66, Dy | 0.0163±0.0008 | (Aylikci et al., 2015) | 0.0163±0.0008 | 0 | 0 |
| *Z* =67, Ho | 0.0175±0.0009 | (Aylikci et al., 2015) | 0.0175±0.0009 | 0 | 0 |
| *Z* =68, Er | 0.0173±0.0009 | (Aylikci et al., 2015) | 0.0173±0.0009 | 0 | 0 |
| *Z* =69, Tm | 0.0332±0.0017 | (Aylikci et al., 2015) | 0.0332±0.0017 | 0 | 0 |
| *Z* =71, Lu | 0.0370±0.0019 | (Aylikci et al., 2015) | 0.0370±0.0019 | 0 | 0 |
| *Z* =72, Hf | 0.0374±0.0019 | (Aylikci et al., 2015) | 0.0374±0.0019 | 0 | 0 |
| *Z* =73, Ta | 0.0373±0.0019 | (Aylikci et al., 2015) | 0.0373±0.0019 | 0 | 0 |
| *Z* =74, W | 0.0377±0.0019 | (Aylikci et al., 2015) | 0.0377±0.0019 | 0 | 0 |
| *Z* =75, Re | 0.0365±0.0019 | (Aylikci et al., 2015) | 0.0365±0.0019 | 0 | 0 |
| *Z* =76, Os | 0.019±0.002  0.019±0.002  0.0341±0.0017 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.02518±0.0010 | -2.71  -2.71  4.42 | -0.33 |
| *Z* =77, Ir | 0.019±0.002  0.0309±0.0016 | (Darko and Tetteh, 1992)  (Aylikci et al., 2015) | 0.02626±0.0013 | -3.08  2.29 | -0.39 |
| *Z* =78, Pt | 0.018±0.001  0.018±0.001  0.0299±0.0015 | (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.02016±0.0006 | -1.82  -1.82  5.97 | 0.78 |
| *Z* =79, Au | 0.018±0.001  0.0179±0.001  0.018±0.001  0.017±0.001  0.0302±0.0015  0.019±0.002  0.0165±0.001 | (Darko and Tetteh, 1992)  (Cengiz et al., 2010a)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015)  (Fernandez-Ruiz, 2021)  (Duggal et al., 2022) | 0.01854±0.0004 | -0.50  -0.59  -0.50  -1.42  7.49  0.23  -1.88 | 0.40 |
| *Z* =80, Hg | 0.015±0.002  0.022±0.003  0.012±0.002  0.018±0.020  0.018±0.003  0.019±0.001  0.016±0.001  0.016±0.001  0.0166±0.0012  0.0303±0.0015 | (Verma et al., 1985)  (Verma et al., 1985)  (Verma et al., 1985)  (Chand et al., 1989)  (Chand et al., 1989)  (Darko and Tetteh, 1992)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Kumar and Puri, 2011)  (Aylikci et al., 2015) | 0.01794±0.0005 | -1.43  1.34  -2.90  0.003  0.02  0.97  -1.76  -1.76  -1.04  7.89 | 0.13 |
| *Z* =81, Tl | 0.016±0.001  0.016±0.001  0.016±0.001  0.0309±0.0016 | (Mehta et al., 1987)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.01772±0.0005 | -1.51  -1.51  -1.51  7.80 | 0.82 |
| *Z* =82, Pb | 0.020±0.002  0.015±0.001  0.017±0.001  0.017±0.001  0.0319±0.0016 | (Darko and Tetteh, 1992)  (Tirasoglu et al., 2003)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.01826±0.0005 | 0.84  -2.88  -1.11  -1.11  8.10 | 0.77 |
| *Z* =83, Bi | 0.007±0.002  0.016±0.001  0.016±0.001  0.0319±0.0016 | (Mehta et al., 1987)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.0175±0.0006 | -5.02  -1.28  -1.28  8.40 | 0.21 |
| *Z* =90, Th | 0.017±0.002  0.019±0.002  0.017±0.001  0.017±0.001  0.0395±0.0020 | (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.01923±0.0006 | -1.07  -0.11  -1.91  -1.91  9.70 | 0.94 |
| *Z* =92, U | 0.016±0.001  0.017±0.002  0.017±0.002  0.016±0.001  0.016±0.001  0.0391±0.0020 | (Darko and Tetteh, 1992)  (Karabulut and Gurol, 2006)  (Demir et al., 2008)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.01767±0.0005 | -1.49  -0.33  -0.33  -1.49  -1.49  10.37 | 0.88 |

**Table 11.** Summary of the experimental intensity ratios from 66Dy to 92U is presented according to their target atomic numbers. The weighted average values , the references from which the databases are extracted, the standard deviation , and their means are also listed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Z*, Symbbol |  | References |  |  |  |
| *Z* =66, Dy | 0.119±0.009  0.112±0.008 | (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.1151±0.060 | 0.36  -0.31 | 0.03 |
| *Z* =68, Er | 0.127±0.009  0.120±0.009 | (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.1235±0.0064 | 0.32  -0.32 | 0 |
| *Z* =70, Yb | 0.122±0.009  0.120±0.009 | (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.121±0.0064 | 0.09  -0.09 | 0 |
| *Z* =71, Lu | 0.124±0.009  0.126±0.009 | (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.125±0.0064 | -0.09  0.09 | 0 |
| *Z* =72, Hf | 0.148±0.019 | (Karabulut and Gurol, 2006) | 0.148±0.019 | 0 | 0 |
| *Z* =73, Ta | 0.147±0.019  0.137±0.010  0.134±0.009  0.165±0.008 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012) | 0.1475±0.005 | -0.03  -0.94  -1.31  1.86 | -0.11 |
| *Z* =74, W | 0.156±0.020  0.129±0.009  0.136±0.009  0.149±0.007  0.167±0.009 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aksoy et al., 2012)  (Cengiz et al., 2010) | 0.1462±0.0041 | 0.48  -1.74  -1.03  0.35  2.10 | 0.03 |
| *Z* =75, Re | 0.154±0.008 | (Cengiz et al., 2010b) | 0.154±0.008 | 0 | 0 |
| *Z* =76, Os | 0.154±0.008  0.130±0.009  0.128±0.009 | (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011) | 0.1387±0.005 | 1.62  -0.84  -1.04 | -0.09 |
| *Z* =78, Pt | 0.124±0.006  0.127±0.009  0.126±0.009  0.2147±0.0109 | (Cengiz et al., 2010b)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1376±0.0041 | -1.87  -1.07  -1.17  6.63 | 0.63 |
| *Z* =79, Au | 0.117±0.015  0.115±0.008  0.116±0.008  0.2234±0.0114 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1348±0.0048 | -1.13  -2.12  -2.01  7.16 | 0.47 |
| *Z* =80, Hg | 0.120±0.016  0.123±0.008  0.120±0.008  0.2300±0.0117 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1400±0.0049 | -1.20  -1.82  -2.14  7.10 | 0.49 |
| *Z* =81, Tl | 0.109±0.014  0.123±0.008  0.122±0.008  0.2300±0.0117 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1389±0.0048 | -2.02  -1.71  -1.81  7.21 | 0.42 |
| *Z* =82, Pb | 0.140±0.018  0.123±0.008  0.119±0.008  0.2350±0.0120  0.1214±0.0679 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015)  (Dogan et al., 2015) | 0.1415±0.0049 | -0.08  -1.97  -2.40  7.21  -0.30 | 0.49 |
| *Z* =83, Bi | 0.130±0.017  0.116±0.007  0.115±0.007  0.2389±0.0122 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1327±0.0044 | -0.16  -2.02  -2.14  8.18 | 0.97 |
| *Z* =90, Th | 0.130±0.017  0.148±0.009  0.146±0.009  0.3157±0.0161 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1655±0.0056 | -1.98  -1.65  -1.84  8.81 | 0.83 |
| *Z* =92, U | 0.132±0.017  0.123±0.008  0.122±0.008  0.3283±0.0167 | (Karabulut and Gurol, 2006)  (Kaçal et al., 2011)  (Kaçal et al., 2011)  (Aylikci et al., 2015) | 0.1426±0.0051 | -0.60  -2.07  -2.17  10.63 | 1.45 |