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Subject: [External] [TOMORROW, Thur 2-3 pm] Nanoscale thermophysical properties of 2D/3D nanostructures | Prof. Oleg Kolosov
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Probing nanoscale thermophysical and nanomechanical properties of 2D and 2D/3D nanostructures via scanning probe microscopy

Prof. Oleg Kolosov

Department of Physics

Lancaster University, UK

Hosted by **Prof. Eric Pop**

Thursday, April 18th, 2-3 pm ([calendar invite attached](#))

Hybrid: **Allen 101 (Linvill)** and **Zoom** ([link](#)), Meeting ID: 915

2933 1365, Password: 447085

About the talk:

Out of three key physical properties of nanoscale materials – electrical, thermal and mechanical, the latter two are the most challenging for the nanoscale explorations. The talk will present scanning probe microscopy (SPM) approaches including Ultrasonic and Heterodyne Force Microscopy (UFM/HFM) allowing to map and quantify nanomechanical properties of 2D materials nanostructures with nanoscale spatial and nanosecond time scale resolutions. By combining these as well as scanning thermal microscopy (SThM) with Beam Exit Ar-ion nano-Polishing (BEXP), one can obtain three-dimensional maps and quantitative measurements of anisotropic thermal conductivity, nanomechanical and nanoelectrical properties in 2D, 2D/3D and 3D materials, with applications ranging from phase change memories and thermoelectrics to solar cells and photodetectors. By introducing novel scanning thermal gate microscopy (STGM) to map local thermoelectrical properties, we were able to discover what we called Geometric Thermoelectricity (GTE), the phenomenon where thermoelectric properties of a uniform nano-material can be modified by its geometrical patterning alone, not requiring “junctions” of “thermo couples” of dissimilar materials and allowing to create a single material “thermocouples” and thermoelectric elements.

About the speaker:

Oleg Kolosov is currently a Professor of Nanoscience in Physics Department of Lancaster University, UK. He explores nanometre length and nanosecond time scale physical phenomena in materials and devices using scanning probe microscopies and related techniques. He published >160 refereed papers, was awarded 28 patents, co-written three book chapters and a monograph, and served as a principal investigator on UK, EU and UK/NSF grants. His inventions include Ultrasonic and Heterodyne Force Microscopies, Immersion Scanning Thermal Microscopy, Scanning Thermal Gate Microscopy and array of approaches for the high throughput screening of materials properties. He pioneered the nano-manipulation of ferroelectric domains via scanning probe microscopy while being a Fellow of Science and Technology Agency of Japan, and was later selected as Advanced EPSRC Fellow at Oxford University, UK and a Senior JSPS Fellow, Japan. In 2000-2006 he was a Director of Innovation at Symyx Technologies, USA, the company that pioneered the combinatorial discovery of inorganic and polymeric materials, establishing in 2016 Lancaster Materials Analysis of which he is a Director and serving as a founding Director establishing Lancaster Materials Science Institute. He is a recipient of Metrology for World Class Manufacturing, two Paul Instrument Fund Awards, his UG students were selected for UK Physics students Awards and his PG student theses published as books in Springer Thesis series selecting “...very best Ph.D. theses from around the world and across the physical sciences”. Prof. Kolosov is currently serving as a Chair of an Atomic Force and other Scanning Probe Microscopies science section of the Royal Microscopical Society, UK.