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# Lattice wave interference in atomic-scale metamirrors, phonon nanocapacitors and in heat transfer through crystal interfaces

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**Date: Tuesday, 11 December. 2018, 15:00-16:00**

**Venue: Room 232, 3F Faculty of Engineering Bldg. 2**

## Abstract:

In this Seminar, we will discuss the three-dimensional atomic-scale models of metamaterials, in which destructive interference of lattice waves (phonons) allows one to control the thermal conductance of the nanosystem. We will discuss the possibility of total resonant reflection or total absorption of a phonon by the two-dimensional lattice defect, phononic metamirror, the effective thickness of which is much smaller than the phonon wavelength. The unusual effect of the reduction of thermal conductance of the nanosystem by increasing the number of conducting channels for heat waves will be described. Two types of atomic metamaterials were studied using realistic interatomic potentials: a FCC lattice of Argon (Ar) where the defects are heavy isotopes and a diamond lattice of silicon (Si) with Germanium (Ge) atoms as the defects. On the basis of such metamaterials, highly sensitive atomic-scale metamirrors for heat waves can be created. Hypersonic metamirrors can be used to build ultracompact phonon nanocapacitors for the storage and emission (lasing) of coherent Terahertz lattice waves. Destructive interference of lattice waves in the arrays of Ge nanoparticles in Si lattice will be discussed in connection with the possibility of reduction of thermal conductance in the lower-end frequency range.



Biography: Dr. Sci. Yuriy A. Kosevich is a Principal Scientific Researcher at the Department of Polymers and Composite Materials of the Semenov Institute of Chemical Physics of the Russian Academy of Sciences in Moscow. Prior to joining Semenov Institute of Chemical Physics in 2005, Dr. Sci. Kosevich worked in Theoretical Department of the National Surface and Vacuum Research Center where he was involved in the studies of nonlinear magnetotransport in semiconductor superlattices in strong fields and of nonlinear surface elastic waves in crystals. Yuriy Kosevich has defended his Dr. Sci. Thesis in the Kapitza Institute for Physical Problems in 1991. His current research interests are in the theory of phonon interference control of atomic-scale metamirrors and interface thermal conductance, and of solitons, supersonic kinks and nonlinear excitations in anharmonic lattices. He is author or co-author of over 100 journal and conference publications. Dr. Sci. Kosevich is a Member of the American Physical Society since 2014, Member of National System of Investigators of Mexico since 2003, and was an Associate Member in 1996 – 2001 of the International Centre for Theoretical Physics, Trieste, Italy.

主催： 東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション (GMSI)  
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