

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

IS PROUD TO HOST A SEMINAR BY

***“QUASI-1D/2D CHARGE-DENSITY-WAVE
MATERIALS: FROM EXOTIC PHYSICS TO
APPLICATION PROSPECTS”***



ALEXANDER A. BALANDIN

**DISTINGUISHED PROFESSOR
DEPARTMENT OF MATERIALS SCIENCE AND
ENGINEERING
UNIVERSITY OF CALIFORNIA, LOS ANGELES**

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2:00 PM - 3:20 PM

McDonnell Douglas Engineering Auditorium

Abstract: The field of charge density wave (CDW) materials has undergone a resurgence and is experiencing rapid growth. The interest is driven by the exotic physics of a strongly correlated electron-lattice condensate, the synthesis of new materials with the transition to CDW phases near room temperature or above, and prospects of applications of such materials in quantum technologies and harsh environments. The early work on CDW materials was conducted using bulk crystals with a one-dimensional (1D) motif in their crystal structure, which revealed Peierls instabilities and CDW sliding at low temperatures. Recent developments include nanowires and thin films of quasi-1D and quasi-2D van der Waals materials with multiple CDW phases spanning a wide temperature range. In this talk, I will describe our recent results for nanowires of quasi-1D $(\text{TaSe}_4)_2\text{I}$ and NbS_3 materials, where we achieved “quiet” electrical conduction of the sliding CDW condensate with electronic noise suppressed below the normal electron limit, creating a prospect for ultra-low noise interconnects. I will also discuss quasi-2D 1T-TaS₂ thin films, which reveal CDW phase transition above room temperature. We utilized this unique material to nanofabricate radiation-hard voltage-controlled oscillators and switches, and used such CDW condensate devices for information processing at room temperature.

Bio: Alexander A. Balandin is a distinguished professor and vice chair for graduate education at the Department of Materials Science and Engineering (MSE) at UCLA. He holds the appointment of the Fang Lu Endowed Chair in Engineering, directs the Phonon Optimized Engineered Materials (UCLA POEM) Laboratory at the MSE department, and the Brillouin – Mandelstam Spectroscopy (BMS) Laboratory at The California NanoSystems Institute (CNSI). Before rejoining UCLA, he served as a founding chair of the MSE program and director of the Nano-Fab at a sister UC campus in Riverside. Professor Balandin is a recipient of the MRS Medal from the Materials Research Society for the discovery of unique thermal properties of graphene. He received the Pioneer of Nanotechnology Award from the IEEE Society for his research on phonon-engineered materials. He is an elected Fellow of MRS, APS, IEEE, OSA, SPIE, AAAS, and a current Vannevar Bush Faculty Fellow. He serves as a Deputy Editor-in-Chief of the Applied Physics Letters. More information is on his group website: <https://balandin-group.ucla.edu/>

