

Colloquium Notice

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Ferroelectricity in Nanowires: Finite-Size Scaling and Screening

First order phase transitions such as the ferroelectric phase transition play a central role in the functional properties of materials; detailed microscopic characterization of the first-order solid-solid transformation has been difficult, however, because bulk measurements often obscure the crucial importance of the surface and defects. We characterize the size-dependent evolution of ferroelectricity in individual, single-crystalline perovskite nanowires using variable-temperature scanning probe microscopy in ultrahigh vacuum, and without the difficulties of ensemble averaging. The measurements show that the ferroelectric phase transition temperature is depressed as the nanowire diameter decreases, reaching room temperature for 3 nm diameter nanowires. Using a combination of density functional theory calculations, phenomenological Landau theory, and thermodynamic analysis, we propose and discuss a new mechanism for surface charge screening in which ferroelectricity is stabilized and even enhanced in smaller domains.

Monday
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Starts at 12:15 PM
Physics Conference Room, SB B326