University at Buffalo
Institute of Electrical and Electronics Engineers

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Invited Talk:

Room-Temperature Switchable Rashba/Dresselhaus Effect in a Ferroelectric Quantum Well

Abstract: Quantum well structures lacking inversion symmetry host a plethora of exciting physical phenomena. In this talk, we show the design, creation, and electron-spin-lattice interactions of quantum well polar materials for spintronics and energy transduction. Frist, we show the role of dimensionality on the phonon and polarization dynamics of free-standing inorganic two-dimensional membranes [1]. Then, we show the discovery of the persistent spin helix in a hybrid ferroelectric perovskite hosting a natural quantum well structure [2]. We demonstrate that the spin-polarized band structure is switchable at room temperature via an intrinsic ferroelectric field. The favored short spin helix wavelength (three orders of magnitude shorter than in III–V materials), room-temperature operation and non-volatility make the hybrid perovskite an ideal platform for understanding symmetry-tuned spin dynamics, towards designing practical spintronic materials and devices that can resolve the control-relaxation dilemma.
References: [1] Nature, 607, 480, 2022. [2] Nature Photonics 16, 529, 2022.

Biography: Dr. Jian Shi is currently an Associate Professor in the Department of Materials Science and Engineering, and Department of Physics at Rensselaer Polytechnic Institute. Dr. Shi was a postdoctoral research fellow at Harvard University from 2013 to 2014. Dr. Shi received his Ph.D. degree in Materials Science at the University of Wisconsin at Madison in 2012. He is a recipient of AFSOR Young Investigator program award in 2018 and a recipient of IEEE Ferroelectrics Young Investigator Award in 2023. He is also an associate editor of Journal of Applied Physics. His current research foci are: polar, spintronic, chiral and Berry parameters-tunable materials for computing and energy.