

Toward Topological Spintronics: Local Conductance on Terraced Bi₂Te₃ Surfaces and Proximity Induced Ferromagnetism from Nanoparticle Arrays

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ABSTRACT: Scanning probe mapping of the local conductance on Bi₂Te₃ surfaces reveals a 10-100X enhancement in currents at step-edges compared with that on terraces. Analysis of these results and those for control samples indicate that the enhancement is not an artifact but rather the result of local differences in electronic properties, and support the intriguing possibility that spin-orbit coupling and topological effects play significant roles in the observations. We have also observed anomalous Hall effect in graphene integrated with an array of Fe₃O₄ nanoparticles, thereby demonstrating proximity induced ferromagnetism in a 2D layer coupled to a nanoparticle array self-assembled on its surface. These results hold promise for the development of topological spintronic devices for applications including single-molecule Raman spectroscopy and computing with arrays of spin torque oscillators.



SPEAKER BIO: Richard A. Kiehl received his Ph.D. in electrical engineering from Purdue University and spent 20 years as a member of technical staff at national and corporate research laboratories (Sandia National Laboratories, Albuquerque; Bell Laboratories, Murray Hill; IBM Research, Yorktown; Fujitsu Laboratories, Atsugi) before moving to academia (Stanford University; University of Minnesota; University of California, Davis, Arizona State University). He played a leading role in the pioneering Bell Labs and IBM work on heterostructure electronics. His work explores new device concepts, circuit architectures and self-assembly techniques for the development of nanometer-scale electronics.

He is currently a professor at Arizona State University where his research is focused on self-assembled hybrid ferromagnet/semiconductor nanostructures incorporating magnetic nanoparticle arrays, 2D materials and topological insulators. He is a member of the American Physical Society and the American Chemical Society, and a Fellow of the Institute of Electrical and Electronics Engineers.