

India-JINR workshop on elementary particle and nuclear physics, and condensed matter research

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Non-linear Hall effect

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It has recently been realized that the first-order moment of the Berry curvature, namely the Berry curvature dipole (BCD) can give rise to non-linear current in a wide variety of time-reversal invariant and non-centrosymmetric materials. While the BCD in two-dimensional Dirac systems is known to be finite only in the presence of either substantial spin-orbit coupling where low-energy Dirac quasiparticles form tilted cones or higher order warping of the Fermi surface, In this talk, I will show that the low-energy Dirac quasiparticles arising from the merging of a pair of Dirac points without any tilt or warping of the Fermi surface can lead to a non-zero BCD. Remarkably, in such systems, the BCD is found to be independent of Dirac velocity as opposed to the Dirac dispersion with a tilt or warping effects. I will further show that the proposed systems can naturally host helicity-dependent photocurrent due to their linear momentum-dependent Berry curvatures. Finally, I will discuss an important byproduct of this work, i.e., nonlinear anomalous Nernst effect as a second-order thermal response.

Presenter: SAHA, Kush (NISER)

Session Classification: Plenary