

Pratap C. Adak

Postdoctoral Researcher, City College of New York, CUNY



Title: Magnon-mediated exciton-exciton interactions in a van der Waals antiferromagnet

Abstract: Excitons significantly influence the optical properties of semiconductors, with their interactions often driving optical nonlinearity and novel phases of matter. Our study explores a new mechanism for excitonic interactions in CrSBr, an antiferromagnetic semiconductor, where magnons mediate excitonic interactions, resulting in pronounced nonlinear optical effects. Although excitons and magnons typically remain independent due to their differing energy scales, we demonstrate an exciton-density-dependent energy shift via magnon-induced spin canting angle adjustment. Our experimental results are supported by theoretical model that captures this coupling, explaining nonlinear responses, including the contrasting behavior of distinct excitons due to their magneto-optical properties. Our findings reveal quasiparticle-mediated interactions in quantum materials, enabling potential applications like quantum transducers bridging GHz to optical frequency.