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Probing Many-Body Interactions in Monolayer Transition-Metal Dichalcogenides BENEDIKT SCHARF, State University of New York at Buffalo; University of Regensburg, ZEFANG WANG, The Pennsylvania State University, DINH VAN TUAN, University of Rochester, JIE SHAN, KIN FAI MAK, The Pennsylvania State University, IGOR ZUTIC, State University of New York at Buffalo, HANAN DERY, University of Rochester — Many-body interactions in monolayer transition-metal dichalcogenides are strongly affected by their unique band structure. We study these interactions by measuring the energy shift of neutral excitons (bound electron-hole pairs) in gated WSe₂ and MoSe₂. The gate-induced charge density screens the electron-hole Coulomb attraction and renormalizes the bandgap energy via exchange and correlation interactions. We compute the energy shift of neutral excitons as a function of charge density with the Bethe-Salpeter equation. Moreover, we study the effects of dynamical screening in the lowest order. We resolve the contributions of the bandgap renormalization and dynamically screened potential by comparing the results of WSe₂ and MoSe₂, due to their distinct spin-split conduction bands.

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