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Hybrid interlayer excitons with tunable dispersion relation BRIAN SKINNER, Massachusetts Institute of Technology — When two semiconducting materials are layered on top of each other, interlayer excitons can be formed by the Coulomb attraction of an electron in one layer to a hole in the opposite layer. The resulting exciton is a composite boson with a dispersion relation that is a hybrid between the dispersion relations of the electron and the hole separately. In this talk I show how such hybridization is particularly interesting when one layer has a Mexican hat-shaped dispersion relation and the other has a conventional parabolic dispersion. In this case the interlayer exciton can have a range of qualitatively different dispersion relations, which can be continuously altered by an external field. This tunability in principle allows one to continuously tune a collection of interlayer excitons between different quantum many-body phases, including Bose-Einstein condensate, Wigner crystal, and fermion-like moat band phases.

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