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DOPING DEPENDENCE OF TRIONS AND OPTICAL SPECTRA IN MoS_2

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Transition metal dichalcogenide monolayers are semiconductors with a direct transition at the K-point of the Brillouin zone. The band structure of these materials has unique features that makes them ideal candidates for valleytronics. Tightly bound negative trions, a quasiparticle composed of two electrons and a hole, can be optically optically created with valley and spin polarized holes. They possess a large binding energy and large oscillator strength, such that they dominate optical spectra even at room temperature. Here, we solve Bethe-Salpeter equation for three particle wavefunction at finite momentum [1]. Our results enable us to explain existing data on temperature and doping dependence and predict new spectroscopic features in doped MoS_2 [1,2], as shown in Fig. 1.

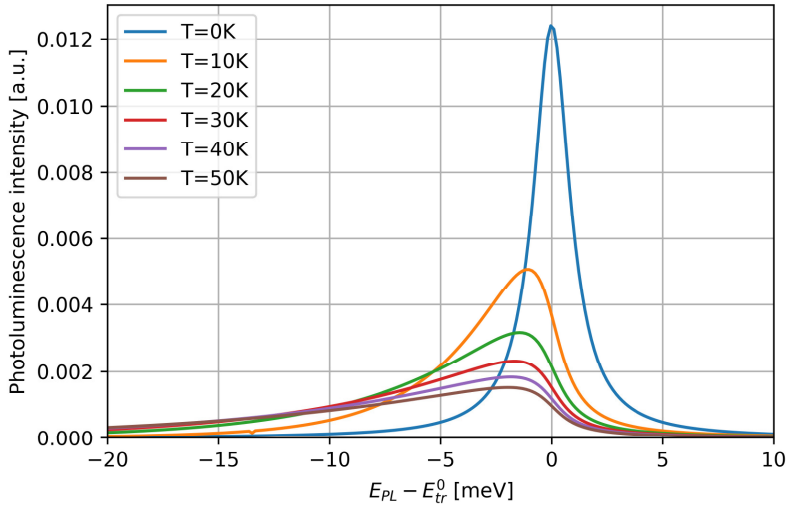

Fig.1: Temperature dependence of the calculated photoluminescence of a doped MoS_2. As the temperature increases, we find an asymmetric broadening and red shift of the emission peak.

References

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