# Room temperature Tamm-Plasmon Exciton-Polaritons with a $WSe_2$ monolayer

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We discuss the observation of Tamm-Plasmon Exciton-Polaritons with a $WSe_2$ monolayer at room temperature. The high thermal stability and large oscillator strength of excitons in monolayers of transition metal dichalcogenides make them ideal candidates for room temperature polaritonics. Recently, photoluminescence emission in the strong coupling regime was reported for a $MoSe_2$ monolayer at 4 K [1]. Compared to $MoSe_2$, $WSe_2$ monolayers exhibit a strongly enhanced photoluminescence (PL) yield at room temperature and a significantly narrower PL emission linewidth compared to $MoS_2$ [2]. We thus embedded a $WSe_2$ monolayer in a compact Tamm structure, which consists of a distributed Bragg reflector, onto which the monolayer was exfoliated. The monolayer was capped by layer of poly(methyl methacrylate) and the device was completed by a gold layer. This photonic micro-structure provides a small volume which enhances light matter coupling.

We confirmed strong coupling conditions at ambient conditions, and mapped out the characteristic exciton-polariton dispersion relation by in-plane momentum-resolved PL and reflection spectroscopy. Figure 1a shows the PL spectra for various in-plane momenta. Fitting the peak energies allows to plot the full dispersion relation presented in figure 1b (symbols). The acquired dispersion relations can be well fitted with a coupled-oscillator model (solid lines in figure 1b) featuring a Rabi splitting of 23.5 meV and a distinct potential minimum at zero momentum. Moreover, we discuss a theoretical model for the population of the polariton states, assuming a Boltzmann distribution with a temperature of 300 K, which shows excellent agreement with the experimental results.

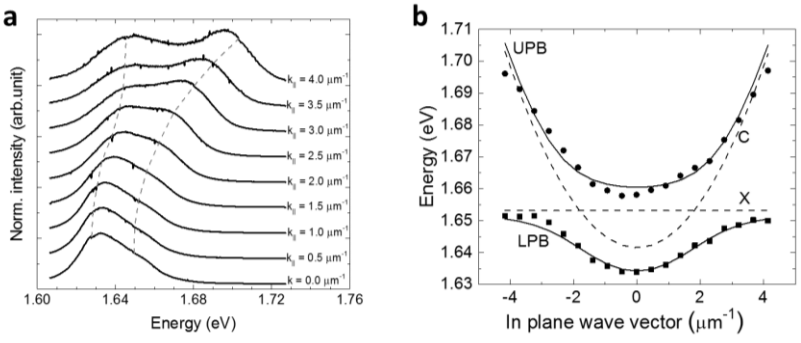


Fig. 1. a, PL spectra at various in-plane momenta. b Polariton dispersion relations at 300 K.

[1] Dufferwiel, S. *et al.,* Nat. Commun. **6,** 8579 (2015
[2] Wang, G. *et al.,* Nat. Commun. **6,** 1–9 (2015)