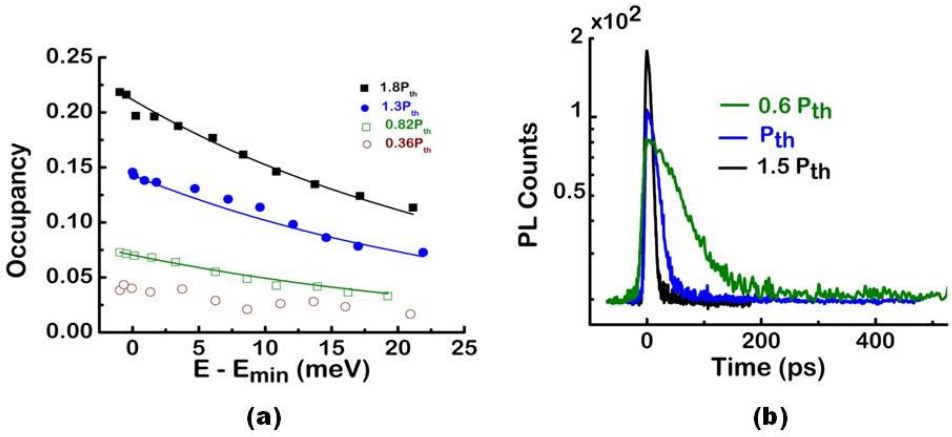

Fig. 6. (a) Occupancy of LPB as a function of pump power obtained from angle-resolved photoluminescence measured below, at, and above threshold. The solid lines are theoretical fits based on MB or BE distributions (see text); (b) Time resolved photoluminescence measured normal to the sample (from $k_{||} = 0$) below, at, and above threshold with a streak camera having an overall resolution of 5 ps.

taking into account the $k_{||}$-dependent density of states and the LP radiative lifetime weighted by the relative Hopfield coefficients [32]. In Fig. 6(a), the LP number density per k-state is plotted as a function of the energy difference with $E(k_{||} = 0)$ for different excitation levels. The plots are analyzed by using the Maxwell-Boltzmann (MB) distribution, $N_{MB}(k) = N_0 \exp(-E/k_B T_{LP})$ or the Bose-Einstein distribution: $N_{BE}(k) = 1/[\exp(E/k_B T_{LP})(1 + N_0^{-1}) - 1]$, where T_{LP} is the effective polariton temperature, $N_0 = N_{LP}(k_{||} = 0)$, and the LP ground state energy is used as the zero energy reference. Far below threshold ($0.36P_{th}$), neither distribution fits the data well; just below threshold ($0.82P_{th}$), the data can be fitted with the MB distribution using $T_{LP} = 323$K; and above threshold, a good fit to the data is obtained with a BE distribution, using $T_{LP} = 380$ and 415K, for $P = 1.3P_{th}$ and $1.8P_{th}$, respectively. These values of T_{LP}, significantly larger than 300K, indicate that the polariton condensate at $k_{||} \sim 0$ is not in equilibrium with the lattice, but only in self-equilibrium [33]. Such a dynamic condensation process is sufficient to reach quantum degeneracy, but is not adequate for achieving an equilibrium Bose condensate at $k_{||} \sim 0$ [32,33]. In the second experiment we have performed time-resolved PL (TRPL) measurements with a streak camera to determine the LP relaxation time. The system has an overall temporal resolution of ~5 ps. The transient data for excitation powers below, equal to, and above threshold power are depicted in Fig. 6(b). The rise time, which principally reflects the filling of the exciton reservoir, in all instances is limited by the system resolution. On the other hand, with increase in excitation power the decay times decrease rapidly due to enhanced polariton relaxation from the exciton reservoir to the $k_{||} \sim 0$ states.

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