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All Optical Switching Using Exciton-Polariton Renormalization in Microcavities[1] M. STEGER, B. NELSEN, C. GAUTHAM, D. SNOKE, University of Pittsburgh, L. PFEIFFER, K. WEST, Princeton University — We report on a method of all-optical switching based on resonantly pumped exciton-polariton microcavities. Depending on geometry, each optical transistor could be used to make an AND or an AND NOT gate. Optical switching in these samples may be limited by the lifetime of the polaritons, allowing for near THz frequency switching. These gates could be used for fast signal processing or optical computing. Where optical computing calls for signals and gates to be at the same wavelength, we can use a gate beam at an angle, since the dispersion relation of polaritons allows for the absorption of a gate higher in energy than the k=0 state. High exciton and free carrier densities lead to a renormalization of the lower polariton (LP) and increase its energy. If the k=0 LP becomes resonant with the signal beam, then the gate may be used to turn on transmission (or consequently turn off reflectivity) of that signal. We will present achievable on/off ratios and switching speeds as well as discuss modulating an intense signal with a weaker gate.

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