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All-optical switch and transistor gated by one photon

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The realization of an all-optical transistor where one ‘gate’ photon controls a ‘source’ light beam, is a long-standing goal in optical science. By slowing and stopping a light pulse in an atomic ensemble contained inside an optical resonator, we realize a device in which one stored gate photon controls the resonator transmission and reflection of subsequently applied source photons. More than 1000 source photons can be switched by just one stored gate photon. If retrieval of the stored gate photon is required, more than two source photons can be switched.