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Single-Photon Transistor Using a Förster Resonance DANIEL TIARKS, SIMON BAUR, KATHARINA SCHNEIDER, STEPHAN DUERR, GERHARD REMPE, Max-Planck-Institut for Quantum Optics — An all-optical transistor is a device in which a gate light pulse switches the transmission of a target light pulse with a gain above unity. The gain quantifies the change of the transmitted target photon number per incoming gate photon. We study the quantum limit of one incoming gate photon and observe a gain of 20 [1]. The gate pulse is stored as a Rydberg excitation in an ultracold gas. The transmission of the subsequent target pulse is suppressed by Rydberg blockade which is enhanced by a Förster resonance. The detected target photons reveal in a single shot with a fidelity above 0.86 whether a Rydberg excitation was created during the gate pulse. The gain offers the possibility to distribute the transistor output to the inputs of many transistors, thus making complex computational tasks possible.

[1] D. Tiarks et al. PRL 113, 053602 (2014)

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