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A controllable single photon beam-splitter as a node of a quantum network.[1] SANTOSH KUMAR, University of Oklahoma, Oklahoma, USA, GAURAV GAUTAM, SAIKAT GHOSH, Indian Institute of Technology, Kanpur, India, DEEPAK KUMAR, Jawaharlal Nehru University, New Delhi, India, INDIAN INSTITUTE OF TECHNOLOGY, KANPUR, INDIA COLLABORATION, JAWAHARLAL NEHRU UNIVERSITY, NEW DELHI, INDIA COLLABORATION — A theoretical model for a controlled single-photon beam-splitter is proposed and analysed. It consists of two crossed optical-cavities with overlapping waists, dynamically coupled to a single flying atom. The system is shown to route a single photon with near-unity efficiency in an effective "weak-coupling" regime. Furthermore, two such nodes, forming a segment of a quantum network, are shown to perform several controlled quantum operations. All one-qubit operations involve a transfer of a photon from one cavity to another in a single node, while two-qubit operations involve transfer from one node to a next one, coupled via an optical fiber. Novel timing protocols for classical optical fields are found to simplify possible experimental realizations along with achievable effective parameter regime. This model can be extended to various other physical systems including gated quantum dots, circuit-QED or opto-mechanical elements.

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