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**Controlling interactions between coupled photonic crystal cavities using photochromic tuning** TAO CAI, RANOJOY BOSE, Department of Electrical Engineering, University of Maryland, College Park, GLENN SOLOMON, Joint Quantum Institute, University of Maryland and National Institute of Standards and Technology; National Institute of Standards and Technology, EDO WAKS, Department of Electrical Engineering, University of Maryland, College Park
— Strongly coupled photonic crystal (PhC) resonator systems provide a promising platform for studying cavity quantum electrodynamics (QED) using semiconductor quantum dots (QDs). These device structures enable important applications such as photon blockade, quantum simulation, quantum-optical Josephson interferometer, and quantum phase transition of light. Many of these applications require the ability to accurately tune the resonant frequencies of individual cavities in the array, which provides a method to control their coupling interactions. This tuning method must be sufficiently local to address individual cavities spaced by less than 1 micron spatial separation. Here, we present a method for controlling the coupling interaction of photonic crystal cavity arrays by using a local and reversible photochromic tuning technique. By locally altering the refractive index of the photochromic material all-optically, the coupling interaction between two cavity modes could be modified over a tuning range as large as 700 GHz. By using this technique, we demonstrate the ability to couple photonic crystal cavities with a normal mode splitting of only 31.50 GHz. We further demonstrate that this tuning method can be extended to control the coupling interaction in larger cavity arrays.

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