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Altering Photon Statistics using Strong Rydberg Interactions JOHANNES OTTERBACH, Physics Department, Harvard University, Cambridge, MA, USA, DAVID PETROSYAN, Institute of Electronic Structure and Laser, FORTH, Crete, Greece, ALEXEY V. GORSHKOV, Institute for Quantum Information, California Institute of Technology, Pasadena, CA, USA, THOMAS POHL, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, MICHAEL FLEISCHHAUER, Department of Physics and Research Center OPTIMAS, TU Kaiserslautern, Germany, MIKHAIL D. LUKIN, Physics Department, Harvard University, Cambridge, MA, USA — The recent advance in coherently controlling and manipulating strong, long-range Rydberg interactions has triggered extensive research in studying interesting many-body effects as, e.g. the use of Rydberg blockade effects for quantum information processing and crystal formation. In this talk I show that Rydberg interactions can be used to alter the photon statistics of a weak probe field after propagating in a coherently prepared atomic Rydberg gas under conditions of Electromagnetically Induced Transparency (EIT). The Rydberg blockade mechanism leads to an effective two-level physics when two photons are separated less than the blockade radius resulting in a strong anti-correlation of two photons separated by an avoided volume. Implications of the formation of such hard-sphere photons for the recent experiment of Pritchard et al. [Phys. Rev. Lett. 105, 193603 (2010)] and the observation of such correlation in future experiments will be discussed.

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