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Probing Atomic Dynamics and Structures Using Optical Patterns[1] BONNIE L. SCHMITTBERGER, DANIEL J. GAUTHIER, Duke University Physics Department and Fitzpatrick Institute for Photonics — Pattern formation is a widely studied phenomenon that can provide fundamental insights into nonlinear systems. Emergent patterns in cold atoms are of particular interest in condensed matter physics and quantum information science because one can relate optical patterns to spatial structures in the atoms. In our experimental system, we study multimode optical patterns generated from a sample of cold, thermal atoms. We observe this nonlinear optical phenomenon at record low input powers due to the highly nonlinear nature of the spatial bunching of atoms in an optical lattice.[2] We present a detailed study of the dynamics of these bunched atoms during optical pattern formation. We show how small changes in the atomic density distribution affect the symmetry of the generated patterns as well as the nature of the nonlinearity that describes the light-atom interaction.

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[2]B. L. Schmittberger and D. J. Gauthier, Phys. Rev. A **90**, 013813 (2014)

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