Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

3D Roton-Excitations and Supersolid formation in Rydberg-excited BECs NILS HENKEL, REJISH NATH, THOMAS POHL, MPI for the Physics of Complex Systems — We study the behavior of a Bose-Einstein condensate in which atoms are weakly coupled to a highly excited Rydberg state. Since the latter have very strong van der Waals interactions, this coupling induces effective interactions between the dressed groundstate atoms. Albeit its asymptotic short-range nature the induced interaction is shown to have dramatic consequences, such as the appearance of a roton-maxon excitation spectrum and a transition to a super solid state in three dimensional condensates. The presented analysis of decoherence and loss mechanisms, suggests that these phenomena are observable with current experimental capabilities.

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Date submitted: 22 Jan 2010 Electronic form version 1.4