Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

**Controlling vortex lattice structure of binary Bose-Einstein condensates via disorder induced vortex pinning.**[1] BISHWAJYOTI DEY, Department of Physics, SP Pune University, Pune 411007, India — We numerically simulate vortex lattice structures in rotating two-component Bose-Einstein condensates in presence of impurities or disorder. Pinning of vortices by randomly distributed impurities leads to new structures of the vortex lattice. As the ratio of intercomponent to intracomponent couplings increases, the interlocked vortex lattice structure undergo phase transitions from triangular to square, double-core lattices, and eventually develop serpentine vortex sheets. We show that even a single impurity pinning potential changes the vortex lattice structure from triangular to square. Accordingly, single or double impurities significantly change the structure of the vortex lattice in the overlap region having combination of triangular and square lattice. In presence of periodic pinning potential or optical lattice, the vortex lattice structure gets pinned to the optical lattice and acquire its structure. In presence of random pinning potential or disorder, the vortex lattice melts. The melting and loss of long-range order occurs with increasing rotational frequency through two steps. In the first step there is loss of positional order but orientational order is retained and in the second, both positional and orientational orders are lost.

[1]Author would like to thank SERB, India for financial assistance through a research grant No. EMR/2016/002627

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Date submitted: 30 Jan 2020 Electronic form version 1.4