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Impurity and Dislocation Mediated Vortex Lattice Melting in Bose-Einstein Condensate[1] BISHWAJYOTI DEY, Department of Physics, SP Pune University, Pune 411007, India — We present a numerical study of a Bose condensed gas in a harmonic trap potential in presence of impurities and dislocations in two-dimensions at zero temperature. The impurity is modeled by a Gaussian function and the line dislocation is modeled by a 'Dirac comb' potential. Such potentials can be created experimentally by laser light. We solve the time-dependent Gross-Pitaevskii equation in two-dimensions using split-step Crank-Nicolson method. To characterize the melting of the vortex lattice we calculate the structure factor and from this the angular distortion of the vortex lattice. We also calculate the histogram of distances between each pair of vortices. The angular distortion of the vortex lattice shows large variations with changes in the impurity or dislocation positions. Also, the angular distortion of the vortex lattice increases with increase in the strength of the impurity and dislocation potentials and shows a jumps to a higher value at a particular strength indicating vortex lattice melting. Large distortion of the vortex lattice is also seen with variations of the number of dislocations and their positions with respect to the Abrikosov lattice. The histogram shows absence of separated peaks indicating the melting of the vortex lattice.

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