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Vortex lattice melting in a stack of Bose Einstein Condensates
MICHIEL SNOEK, HENK STOOF, Utrecht University — The observation of fractional Quantum Hall liquids in rapidly rotating ultracold Bose gases is a long desired goal. Until now the experimentally accessible ratio of the numbers of particles to the number of vortices is far too high to melt the vortex lattice and to observe these states. This can be solved by means of an one-dimensional optical lattice, which divides the condensate in a stack of two-dimensional condensates in which the number of particles is strongly reduced and the quantum fluctuations are enhanced. We study the melting of a vortex lattice in such a configuration by calculating the quantum fluctuations around the classical Abricosov lattice for realistic numbers of particles and vortices. We find that the fluctuations are inhomogeneous and the lattice melts from outward to inward. Coupling neigbouring pancakes by tunneling reduces the anharmonicity as well as the size of the fluctuations and brings in the 3D regime.

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