

# How do rapidly rotating Bose-Einstein condensates carry angular momentum?

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The energetically favored state of a rapidly rotating Bose condensed gas is, as observed, a triangular lattice of singly quantized vortices. What is the fate of the vortices when the rotation rate  $\Omega$  is sufficiently rapid that the vortex cores would touch? This talk will describe possible fates of the vortex lattice at large rotation in both harmonic and anharmonic traps. The vortex core sizes in a symmetric lattice approach a limiting fraction of the intervortex spacing, precluding a transition associated with core overlap. A system in a harmonic trap at  $\Omega$  very close to the transverse trapping frequency becomes quasi two-dimensional and ultimately should enter a sequence of quantum Hall-like states. On the contrary, a system confined in a trap steeper than harmonic develops a hole along the rotation axis at sufficiently large  $\Omega$ , and should, as numerical as well as variational calculations indicate, eventually make a transition to a multiply-quantized giant vortex state with the vorticity fully contained in the hole.