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Fast rotation of a superfluid in a shell

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Quantum gases provide us with a very convenient and widely tunable system for the study of superfluidity. In particular, they can be confined in a large variety of traps, enabling the study of superfluid dynamics with specific geometry. In this talk I will present the behaviour of a superfluid quantum gas confined at the surface of an ellipsoid: the atoms can move freely in directions parallel to the surface and are strongly confined in the transverse direction. The atoms initially at rest at the bottom of the shell -because of gravity- are set into rotation. At moderate rotation frequencies, a vortex lattice develops, and melts for large rotation speeds or low atom numbers. We explore the transition from a vortex crystal to a disordered vortex and eventually random phase fluctuations. At large rotation frequencies, the centrifugal force leads to the formation of a metastable dynamical ring which rotates with linear speeds widely exceeding the speed of sound in the gas.

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