Hydrodynamic instabilities in gaseous Bose-Einstein condensates

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We see various hydrodynamic instabilities every day. For example, rippling waves on the water surface of a lake is caused by the *Kelvin-Helmholtz instability,* which is driven by the shear flow between the water and wind. Another example is water droplets created from a fountain, in which a continuous jet of water splits into small droplets. This is due to the *Plateau-Rayleigh instability* driven by the surface tension of water.

In this talk, these hydrodynamic instabilities are shown to arise in Bose-Einstein condensates (BECs) of ultracold atomic gases. The prominent feature of the quantum fluids is the quantization of circulation, which makes the dynamics of the system quite different from those of classical fluids.

I will give three examples of hydrodynamics instabilities that arise in two-component BECs: Rayleigh-Taylor [1, 2], Kelvin-Helmholtz [3, 4], and Plateau-Rayleigh [5] instabilities. These instabilities are shown to arise at an interface between BECs of different components. Possible experimental setups to observe these instabilities and ensuing dynamics are proposed.

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