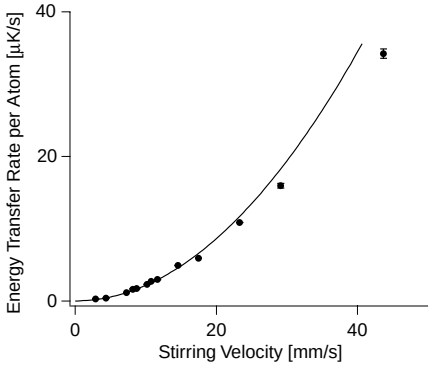
Dissipation in a stirred dilute Bose gas

We studied dissipation in a dilute Bose gas induced by the motion of a macroscopic object [1]. A blue-detuned laser beam focused on the center of a trapped gas of sodium atoms was scanned both above and below the BEC transition temperature. Measurements below the transition temperature confirmed the existence of a critical velocity [2, 3]. Above the transition temperature, we found a quadratic dependence of the dissipated energy on velocity, in agreement with a simple model.

These measurements allowed for a comparison between the heating rates for the superfluid and normal gas. Outside the superfluid regime, well above the critical velocity, the intrinsic heating of the condensate (normalized for geometry) was seen to be similar to the heating of the normal component. In both cases, each collision with the stirrer at velocity v transfers an energy of about Mv^2 to the gas.

Heating of the normal gas. The energy transfer rate per particle versus velocity of the moving laser beam shows a quadratic dependence.



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