

Abstract Submitted  
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**Dipolar Bose-Einstein condensates as discrete superfluids** RYAN WILSON, JILA and Department of Physics, University of Colorado, Boulder, Colorado 80309-0440, USA, SHAI RONEN, University of Innsbruck and Institute for Quantum Optics and Quantum Information, Innsbruck, Austria, Europe, JOHN BOHN, JILA and Department of Physics, University of Colorado, Boulder, Colorado 80309-0440, USA — We investigate the superfluid properties of a dipolar Bose-Einstein condensate (BEC) in a fully three-dimensional trap. Specifically, we calculate a superfluid critical velocity for this system by applying the Landau criterion to its discrete quasiparticle spectrum. We test this critical velocity by direct numerical simulation of condensate depletion as a blue-detuned laser moves through the condensate. In both cases, the presence of the roton in the spectrum serves to lower the critical velocity beyond a critical particle number. Since the shape of the dispersion, and hence the roton minimum, is tunable as a function of particle number, we thereby propose an experiment that can simultaneously measure the Landau critical velocity of a dipolar BEC and demonstrate the presence of the roton in this system.

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