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Spontaneous formation of polar superfluid droplets in a p-wave interacting Bose gas ZEHAN LI, University of Pittsburgh, JIAN-SONG PAN, National University of Singapore, W. VINCENT LIU, University of Pittsburgh, W. VINCENT LIU TEAM — We study the quantum fluctuations in the condensates of a mixture of bosonic atoms and molecules with interspecies p-wave interaction. Our analysis shows that the quantum phase of coexisting atomic and molecular condensates is unstable at the mean-field level. Unlike the mixture of s-wave interaction, the Lee-Huang-Yang correction of p-wave interaction is unexpectedly found here to exhibit an opposite sign with respect to its mean-field term above a critical particle density. This quantum correction to the mean-field energy provides a remarkable mechanism to self-stabilize the phase. The order parameter of this superfluid phase carries opposite finite momenta for the two atomic species while the molecular component is a polar condensate. Such a correlated order spontaneously breaks a rich set of global U(1) gauge, atomic spin, spatial rotation and translation, and time-reversal symmetries. For potential experimental observation, the phenomenon of anisotropic polar superfluid droplets is predicted to occur when the particle number is kept finite.

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