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A dielectric superfluid of polar molecules[1] SETH RITTENHOUSE, ITAMP, Harvard-Smithsonian Center for Astrophysics, RYAN WILSON, JOHN BOHN, JILA and the Department of Physics, University of Colorado — We consider a Bose-Einstein condensate of heteronuclear molecules in an applied electric field. In the strong field regime, the molecules are fully polarized and produce fields that tend to be weak compared to the applied field. However, in weaker applied fields the internal fields due to the polarization of the molecules can become comparable to the applied field, and the system develops a dielectric character. We derive a set of self-consistent mean-field equations that couple the condensate density to its polarization field, leading to the emergence of polarization modes that are coupled to the quasiparticle spectrum of the condensate. While the roton instability is suppressed in this system, the coupling gives rise to a phonon-like instability that is characteristic of a dielectric material with a negative static dielectric function.

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