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Tuning the structural and dynamical properties of a dipolar Bose-Einstein condensate: Ripples and instability islands[1] M. ASAD-UZ-ZAMAN, D. BLUME, Washington State University — It is now well established that the stability of aligned dipolar Bose gases can be tuned by varying the aspect ratio of the external harmonic confinement. Our work extends this idea and demonstrates that a Gaussian barrier along the strong confinement direction can be employed to tune both the structural properties and the dynamical stability of an oblate dipolar Bose gas aligned along the strong confinement direction. In particular, our theoretical mean-field analysis, in which the condensate is described by a single macroscopically occupied wave function, predicts the existence of instability islands immersed in otherwise stable regions of the phase diagram. Dynamical studies indicate that these instability islands are associated with the going soft of a Bogoliubov-de Gennes excitation frequency with radial breathing mode character. Furthermore, we find dynamically stable ground state densities with ripple-like oscillations along the radial direction. These structured ground states exist in the vicinity of a dynamical radial roton-like instability. We are currently developing a complementary approach, in which the system is assumed to consist of two spatially separated clouds that are described by a set of coupled mean-field equations.

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