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Stability of Quantum Degenerate Fermi Gases of Tilted Polar Molecules[1] ANTUN BALAZ, VLADIMIR VELJIC, Institute of Physics Belgrade, University of Belgrade, Serbia, AXEL PELSTER, Physics Department, TU Kaiserslautern, Germany — Quantum degeneracy of a dipolar Fermi gas of KRb molecules was achieved at JILA [Science **363**, 853 (2019)], which paves a way towards enabling experimental studies of a strongly dipolar regime and, in particular, many-body phenomena and phases of matter that emerge there. Here we address this topic theoretically and derive a mean-field variational approach based on the Wigner function for the description of ground-state properties of such systems [Phys. Rev. Research **1**, 012009(R) (2019)]. We show that the stability of dipolar fermions in a general harmonic trap is universal as it only depends on the trap aspect ratios and the dipoles orientation. We calculate the species-independent stability diagram and the deformation of the Fermi surface (FS) for polarized molecules, whose electric dipoles are oriented along a preferential direction. Compared to atomic magnetic species, the stability of a molecular electric system turns out to strongly depend on its geometry and the FS deformation significantly increases. We also show that tuning the trap frequencies appropriately reduces the 3D system to a quasi-2D system of either a pancake- or a cigar-shaped gas cloud, which turn out to have smaller stability regions.

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Antun Balaz
Institute of Physics Belgrade, University of Belgrade, Serbia

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