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A nonlocal kinetic energy functional for an inhomogeneous two-dimensional Fermi gas

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The average-density approximation (ADA) is used to construct a nonlocal kinetic energy functional for an inhomogeneous two-dimensional Fermi gas. This functional is then used to formulate a Thomas- Fermi von Weizsa ¨cker-like theory for the description of the ground state properties of the system. The quality of the kinetic energy functional is tested by performing a fully self-consistent calculation for an ideal, harmonically confined, two-dimensional system. Good agreement with exact results are found, with the number and kinetic energy densities exhibiting oscillatory structure associated with the nonlocality of the energy functional. Most importantly, this functional shows a marked improvement over the two-dimensional Thomas-Fermi von Weizs ¨acker theory, particularly in the vicinity of the classically forbidden region. We also present semi-analytic results for the exact effective potential, and compare it with the ADA effective potential.

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