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Dynamical properties of the unitary Fermi gas: collective modes and shock waves

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The unitary Fermi gas made of dilute and ultracold atoms with an infinite s-wave inter-atomic scattering length is discussed. First we introduce an efficient Thomas-Fermi-von Weizsacker density functional which describes accurately the density profile of the unitary Fermi gas trapped by an external potential. Then, the collective frequencies of monopole, quadrupole and octupole oscillations are derived from superfluid hydrodynamic equations which are the time-dependent extension of the Thomas-Fermi-von Weizsacker density functional. Finally, we show that this amazing Fermi gas supports supersonic and subsonic shock waves.

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