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Dynamics of self-gravitating media and dark energy

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The low-energy dynamics of a generic self-gravitating media can be studied by using effective field theory in terms four derivatively coupled scalar fields and naturally gives rise to an interesting model of dark energy. Depending on internal symmetries, the theory describes fluids, superfluids, solid and supersolids. Dynamical and thermodynamical properties are also dictated by internal symmetries. In the unitary gauge, where the scalar fields' fluctuations are gauged away, the most general medium can be equivalently described as rotational invariant massive gravity with six propagating degrees of freedom. In the scalar sector, besides the gravitational potential, a non-adiabatic mode $\delta\sigma$
corresponding to entropy per particle perturbations is present. Perfect fluids and solids are adiabatic with constant in time $\delta\sigma$, while for superfluids and supersolids $\delta\sigma$ has non-trivial dynamics. Tensor perturbations are massive for solids and supersolids. A special subclass of media with an exact equation of state $w = -1$ but with nontrivial perturbations can be consistently constructed.

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