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**Continuum Mechanics of An Inhomogeneous System**[1] JIANMIN TAO, GIOVANNI VIGNALE, University of Missouri-Columbia — Starting from the hydrodynamical form of the Heisenberg equations of motion, we develop the continuum mechanics of inhomogeneous quantum many-body systems subject to weak time-dependent external potentials. The formalism allows excitation energies and transition currents to be obtained from the solution of an eigenvalue problem. First, we express the noninteracting kinetic part of the stress tensor in terms of the ground-state density and the transition current exactly, while leaving the correlation part treated approximately with the assumption of local isotropy of the correlation hole. Then we treat the linear response of the exchange part employing the first-order perturbation theory. The resulting eigenvalue problem is a fourth-order differential equation. This theory is exact for one-electron systems and expected to be accurate for many-electron systems.

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Jianmin Tao
University of Missouri-Columbia

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