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Exchange Energy Density Functionals that reproduce the Linear Response Function of the Free Electron Gas DAVID GARCÍA-ALDEA, J.E. ALVARELLOS, Dept. Fisica Fundamental. UNED — We present several nonlocal exchange energy density functionals that reproduce the linear response function of the free electron gas. These nonlocal functionals are constructed following a similar procedure used previously for nonlocal kinetic energy density functionals by Chacón-Alvarellos-Tarazona, García-González et al., Wang-Govind-Carter and García-Aldea-Alvarellos. The exchange response function is not known but we have used the approximate response function developed by Utsumi and Ichimaru, even we must remark that the same *ansatz* can be used to reproduce any other response function with the same scaling properties. We have developed two families of new nonlocal functionals: one is constructed with a mathematical structure based on the LDA approximation – the Dirac functional for the exchange - and for the second one the structure of the second order gradient expansion approximation is took as a model. The functionals are constructed is such a way that they can be used in localized systems (using real space calculations) and in extended systems (using the momentum space, and achieving a quasilinear scaling with the system size if a constant reference electron density is defined).

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