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MP2 and RPA applied to solid state systems[1] MARTIJN MARSMAN, Faculty of Physics, University Vienna, ANDREAS GRUENEIS, JUDITH HARL, GEORG KRESSE — We present *ab initio* total energy calculations at the level of Hartree-Fock + 2nd-order Møller-Plesset perturbation theory (HF+MP2), and the random-phase-approximation within the framework of the adiabatic-fluctuation-dissipation-theorem (ACFDT-RPA), for extended systems under periodic boundary conditions, using plane wave basis sets. We characterize and compare the accuracy of these methods with respect to their description of the lattice constants, bulk moduli, and atomizations energies of several archetypical solid state systems. Furthermore we present calculations of HF+MP2 quasiparticle gaps and compare them to results obtained within the GW approximation to the electronic self-energy.

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