Thermodynamics of dense hydrogen - influence of Pauli blocking

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We discuss several problems connected with the theory of high pressure hydrogen in the region where recent experiments have shown a transition from insulating behavior to metal-like conductivity. In particular we discuss the influence of the Pauli exclusion principle in the transition region. We show that the phase space occupation of the neutrals and the Fermi pressure of the electrons are the basic effects leading to the destruction of neutrals and ions at high density. By an approximate solution of the effective Schrödinger equation, we study the influence of Pauli blocking on the ground state energy level and compare with other approaches including the confined atom model. In order to calculate the thermodynamic functions we apply the chemical picture, comparing the SAHA approach with the direct minimization of the free energy. For the components we use advanced formulae for the neutral and the charged components taking into account the Pauli effects. We present the result of explicit calculations in the region of temperature 5000 K < T < 20000 K and density $0.1 < \rho < 1$ g/cm^3 including the transition from a neutral hydrogen gas to a highly ionized plasma. We calculate several thermodynamic functions including the entropy and show that isentropic compression is the most efficient way to reach the transition to metal-like conductivities.