

Equation of state for interior of giant planets

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We have calculated internal energy, free energy, entropy and pressure of a mixture of the metal hydrogen and atomic helium as the functions of the density and temperature. It is supposed, that the hydrogen presents itself the mixture of protons and electrons. Explored interval of pressures and density corresponds the conditions on the most planets of a solar system – Jupiter and Saturn. The perturbations theory series on degrees of an electron-proton and electron-atom interaction is used for calculation of thermodynamic potentials of mixture of metallic hydrogen and neutral helium. The electron subsystem was considered in the random phase approximation with taken into account the exchange interaction and the correlations in the local field approximation. A proton-proton, proton-atom and atom-atom interactions is taken into account in the hard sphere approximation. For determination of the hard sphere diameter the effective pair proton-proton and atom-atom interactions was used. For numerical calculations was taken into account the zero and second members of the series of a perturbations theory. It is analyzed an applicability of polytropic sphere model for modeling of the interior of Jupiter and Saturn and is offered value of a polytropic index. Founded density, pressure and the temperature on Jupiter as a function of distance from its centre. Evaluated possible hydrogen share in a composition of Jupiter and Saturn.

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