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Path Integral Monte Carlo Calculations of Thermodynamic Properties of Dense Hydrogen-Helium Plasma VLADIMIR FILINOV, IHED RAS, PAVEL LEVASHOV, IHED RAS, MICHAEL BONITZ, Christian-Albrechts-Universität zu Kiel, VLADIMIR FORTOV, IHED RAS — In this work we present new results of *ab initio* calculations of thermodynamic properties of dense hydrogen-helium plasma with helium concentration corresponding to that in the higher layers of the Jovian atmosphere at temperatures from 10^4 K to $2 \cdot 10^5$ K and electron particle densities from 10^{20} to 10^{24} cm^{-3}. The calculations were made by path-integral Monte Carlo method in a cubical cell using periodic boundary conditions. To correctly take into account exchange effects at high values of the degeneracy parameter we used a special correcting procedure. At temperature higher than $5 \cdot 10^4$ K the calculation results are practically coincides with computations by the equation of state based on the chemical plasma model. However at temperatures 10^4 and $2 \cdot 10^4$ K in the density range from 0.5 to 5 g/cm^3 we found a phase transition region positioned in a good agreement with other theories and the experimentally revealed region of the sharp electrical conductivity rise. Along the isotherm 10^4 K in the density range from 0.01 to 0.2 g/cm^3 we found one more region of bad convergence to the equilibrium state. We also present first simulation results for helium plasma in comparison with other models and experimental data. The authors are grateful to the Russian Science support foundation for financial support of the work.

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