

# Thermodynamic limit of non-degenerate hydrogen plasma using quasi-classical molecular dynamics

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In this study, we perform a quasi-classical molecular simulation of a hydrogen plasma in the weak degeneracy regime over a wide range of coupling parameters. The simulations utilize the improved Kelbg pseudopotential [1], which incorporates the quantum uncertainty principle, provides an accurate treatment of bound state formation, and enforces the Pauli exclusion principle to prevent same-spin electrons from occupying identical states. Furthermore, we employ the improved Kelbg-AAE pseudopotential using KelbgLIP [2], which accurately accounts for interactions with all periodic images.

Our findings are compared with Path Integral Monte Carlo simulations by Filinov and Bonitz [3]. We analyze the stability of hydrogen plasma, addressing the challenge of cluster formation at temperatures below 50 kK [1], and explore the dependence of equilibrium energy on the number of particles. The results confirm the effectiveness of the pseudopotential approach in describing systems with strong long-range interactions. The work is supported by the Russian Science Foundation (project No. 24-19-00746).

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