Material properties for the interiors of massive giant planets and brown dwarfs.

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We present thermodynamic and transport properties for the extreme conditions prevalent in the interiors of massive giant planets and brown dwarfs [1]. They are obtained from extensive molecular dynamics simulations based on density functional theory for hydrogen-helium mixtures along the isentropes of three representative objects: KOI-889b (M~10 M_J), Corot-3b (M~22 M_J), and Gliese-229b (M~46 M_J). In particular, we determine the heat capacities, the thermal expansion coefficient, the isothermal compressibility, and the sound velocity. Important transport properties such as the electrical and thermal conductivity, electronic opacity, and shear viscosity are calculated as well. Further results for associated quantities including magnetic and thermal diffusivity, kinematic shear viscosity, the static Love number k_2, and the equidistance are discussed.
Overall, the behavior inside massive giant planets and brown dwarfs is stronger dominated by degenerate matter than in Jupiter mass planets, see [2]. Based on our *ab initio* data we discuss the possible dynamics and magnetic field structure in massive giant planets and brown dwarfs. The consistent data set presented here may serve as starting point to obtain material and transport properties for other substellar H-He objects with masses above one Jovian mass M_J.

REFERENCES

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