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Ab initio equation of states for planetary and exoplanetary modeling

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Using ab initio molecular dynamics simulations, we recently calculated equations of state for the main constituents of planetary interiors: H, He, H2O, MgSiO3(MgO,SiO2) and Fe. These equations of states are multi-phases, include liquid and solid phases, and aim at building planetary and exoplanetary interior models solely based on ab initio predictions. This talk will concentrate on Jupiter. We will review how our current understanding of the behavior of these basic constituents at extreme density temperature conditions has modified our current understanding of Jupiter interior, not only for the envelop where metallization of hydrogen and hydrogen-helium demixing is the issue but also for the core where the high pressure melting properties of iron, water and silicates bring a new understanding on the nature of giant planet cores. This work is supported in part by the French Agence National de la Recherche under contract PLANETLAB ANR-12-BS04-0015.