Interior of Jupiter and new equations of state: what consequences for exoplanets?

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The Juno mission has completely revolutionised our vision of the interior of Jupiter. One of the main findings of Juno, thanks to very accurate measurements of Jupiter's gravity field, is the presence of a dilute core inside the planet. However, the size of this dilute core is still a matter of debate and constraining its extent is key to understand the formation and evolution of the planet. Since Jupiter is mostly composed of hydrogen and helium, it is essential to use an appropriate equation of state (EOS) to precisely access the structure of the planet. In the last decade, with the improvement of ab initio simulations and experimental facilities, several new EOSs have been proposed for hydrogen and helium. While linear mixing is usually employed in interior models, I will show the importance of taking the non-ideal mixing effects into account to properly model the behaviour of a H-He mixture. We propose a new equation of state that includes the H-He interactions and remains valid for any mixture of hydrogen and helium. We ran MCMC simulations to study a wide range of interior models of Jupiter. I will present and compare results of interior models using different EOSs as well as our new EOS. We obtain a relatively wide range of dilute cores extending between about 20% to 70% of Jupiter's mass. We are thus able to find solutions in relatively good agreement with formation models as well as Saturn interior models, which favour small dilute cores. This work on Jupiter's interior and the H-He equation of state has direct consequences to the study of exoplanets, notably on the mass-radius relationship.