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On the link between experiments and interior models: the example of carbon enriched systems

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High-pressure experiments play a critical role in the investigation of a planet's deep interior. By providing insights about the mantle and core chemistry, structure and dynamics at depth, they have been instrumental to our knowledge of planetary evolution. Laboratory experiments and computational modeling applied to the Earth's interior have contributed to study of multiple chemical and physical processes taking place in the mantle or in the core, such as volatiles cycles, plate subduction (e.g., Poli, 2015) and mid-ocean ridge dynamics, core crystallization and the activation of a geodynamo (e.g., Badro et al., 2016). The exploration of the deep interior of other terrestrial planets, inside and outside the Solar System, also requires the combination of experiments and modeling, and is necessary to interpret field observations from space missions (e.g., Vander Kaaden et al., 2020).

In this contribution, we focus on the investigation terrestrial cores by combining different experimental case studies, with a focus on multi-component phase diagrams, thermal equation of state parameters for the stable phases and the melting curve of different alloy compositions. Results from in situ X-ray diffraction experiments conducted at different large scale facilities using laser heated diamond anvil cells will be presented and complemented by chemical analyses. We will first show how variation in composition can be related to core dynamic. The results will then be implemented in planetary interior models to investigate the effect of core chemistry on the structure and properties of planetary interiors.

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