Western Science

Department of Earth Sciences

M.Sc. Geophysics Public Lecture

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High Pressure Phase Transitions of Solid and Liquid Fe-Si Alloys with Applications to Planetary Core Composition

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Abstract

The magnetospheres of terrestrial planetary bodies are generated by convective dynamo action within their liquid metallic outer cores. The presence of potential light elements, such as silicon, within these outer cores is crucial for this dynamo process. By experimentally determining the solid-liquid phase transitions of core-relevant alloys, such as those in the Fe Si binary alloy system, the likely compositions of these terrestrial cores may be constrained. Experiments were conducted on Fe-Si alloys in the range of Fe-5 wt% Si to Fe-33 wt% Si (FeSi) using a 1,000-ton cubic anvil press, for pressures up to 5 GPa and temperatures into the liquid state. The solidus and liquidus were mapped across the aforementioned composition range for each of 3, 4, and 5 GPa. Using P, T estimates from modeling studies, Si ranges were suggested to be between 8-13 wt%, ≤7 wt%, and ≤8 wt% for the Moon, Mercury, and Vesta, respectively.

ALL WELCOME!

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