Laser-Driven Dynamic Compression of Planetary Materials

Donghoon Kim, Princeton University

Ramp compression combined with *in situ* X-ray diffraction allows observation of the structural behavior, phase transitions, and kinetics of planetary materials at extreme conditions. In this talk, laser-driven ramp-compression experiments with *in situ* X-ray diffraction were performed to explore the structural behavior and phase transitions in silicon carbide, SiC, and germanium dioxide, GeO_2. For SiC, the rocksalt (B1) phase was observed from 140 - 1500 GPa. Using the equation of state of B1 SiC measured here I determine mass-radius curves for carbon-rich planets which are found to have a lower density (~10%) than Earth-like planets.

For GeO_2 which serves as an analog for SiO_2, I have examined its crystal structure up to 882 GPa. My X-ray diffraction results show that GeO_2 adopts the HP-PdF_2-type structure under ramp loading from 154 GPa to 436 GPa. Above 436 GPa, I observe evidence for a post-HP-PdF_2 phase in GeO_2. The best candidate for this new phase is the cotunnite-type structure. These results offer a test of theoretical calculations as well as insights into possible high-pressure behavior of SiO_2.