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2023.2.10 (Fri.) 16:30 ~

Venue: Zoom

A link will be sent @grc-all within 30 minutes before the beginning of the seminar.

Tetrahedral symmetry breaking in SiO_2 glass under pressure as structural origin of the anomalous properties

Understanding the structural origin of the anomalous properties of tetrahedral liquids and amorphous materials at high pressure and/or high temperature conditions is of great interest in wide range of scientific fields. In particular, since SiO_2 is ubiquitous in the Earth, understanding the SiO_2's anomaly is fundamental not only in physics, but also in geophysics to understand nature of silicate magmas in the Earth and planet, and in materials science as a prototype network-forming glass. Theoretical studies of SiO_2 liquid suggests that the second shell structure of silicon is the key to understanding the anomalous properties of SiO_2 liquid at high temperatures and high pressures. However, there has been no experimental observation of the structure of the silicon's second shell in SiO_2 liquid and/or glass at in situ high pressure and/or high temperature conditions. Here we show experimental evidence of a bimodal behavior in the translational order of silicon's second shell in SiO_2 glass under pressure. SiO_2 glass shows tetrahedral symmetry structure with separation between the first and second shells of silicon at low pressures, which corresponds to the S state structure reported in theoretical study of SiO_2 liquid. On the other hand, at high pressures, the silicon's second shell collapses onto the first shell, and more silicon atoms locate in the first shell. These observations indicate breaking of local tetrahedral symmetry in SiO_2 glass under pressure.