I222-010 **Room: 303** **Time: May 16 9:00-9:30**

Some fundamental mineral physics issues in inferrng water content in Earth”s mantle

Shun-ichiro Karato[1]

[1] Yale University, Department of Geology and Geophysics

Inferring the distribution of water in the mantle is critical to our understanding of structure and evolution of Earth. However, the physical basis for such an inference is not easy to establish a number of issues remain. I will review some recent results on experimental mineral physics that provide improved understanding of physical basis for such an attempt.

Electrical conductivity in minerals such as olivine is sensitive to water (hydrogen) content as proposed by Karato (1990). However, experimental tests of this hypothesis have been made only recently (Huang et al. (2005), Wang et al. (2006)). These studies have shown the basic validity of my old hypothesis, but in detail, they show major modifications: the major charge career is not all the hydrogens but only a fraction of hydrogen and hence the activation energy and the water content sensitivity are different from the original simple model. Also this difference implies that the anisotropy in electrical conductivity can be different from what is expected from my original model. Some applications of these new results to infer water content in the upper mantle and the transition zone will be discussed.

Seismic wave velocities and attenuation are also sensitive to water content. A major progress has been made to reveal the dependence of seismic anisotropy on water content (and other variables). Briefly, the relative easiness of deformation by various slip systems in olivine changes with water content and other variables tat leads to fabric transitions. We have established a three-dimensional fabric diagram for olivine as a function of temperature, water content and stress. The physical basis for such a map is analyzed including the nature of scaling law. The results are applied to interpret the observed seismic anisotropy in the upper mantle. We suggest that the complicated patterns of shear wave splitting can be attributed to spatial distribution of water, temperature in a subduction zone upper mantle, and the anisotropy of the asthenosphere is best explained damp olivine.