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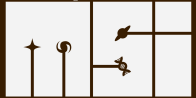
## Origin of Volatiles in Earth's Mantle

Tuesday, 17 September 2019 • 3:30 pm

*MSI Conference Room • 3550 University*

Volatiles in Earth's interior place first order constraints on planet formation models, including accretion timescales, thermal evolution, composition, and bulk planetary redox states. The ratio of the two primordial neon isotopes,  $^{20}\text{Ne}/^{22}\text{Ne}$ , provides a powerful tool to assess the source(s) contributing volatiles to Earth's mantle as the  $^{20}\text{Ne}/^{22}\text{Ne}$  ratio is significantly different for the three potential sources: nebular gas, solar wind irradiated material, and CI chondrites. However, accurately determining the  $^{20}\text{Ne}/^{22}\text{Ne}$  ratio of Earth's interior is challenging because of pervasive atmospheric contamination and the low abundance of neon in mantle-derived basalts. In this presentation, I will show new high-precision neon isotopic measurements that provide robust evidence for a reservoir of nebular gas preserved in Earth's deep mantle today. This observation requires the proto-Earth to have grown large enough to have gravitationally captured and dissolved nebular gases into a magma ocean prior to dissipation of nebular gas in the protoplanetary disk. This is consistent with the inference of planet formation at  $\sim 1$  AU in a gas-rich, nebular environment using the Atacama Large Millimeter Array. Therefore, the gravitational capture of nebular gases could be a common feature associated with the embryo stage of terrestrial planet formation. Finally, I observe distinct  $^{20}\text{Ne}/^{22}\text{Ne}$  ratios between mantle plumes derived from the Earth's lower mantle and mid-ocean-ridge basalts that samples the upper mantle, requiring limited mass exchange between these reservoirs over Earth's history. Addition of a chondritic component to the shallower upper mantle during the later stages of Earth's accretion and recycling of seawater-derived neon during plate tectonic processes can explain the distinct  $^{20}\text{Ne}/^{22}\text{Ne}$  ratio.

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