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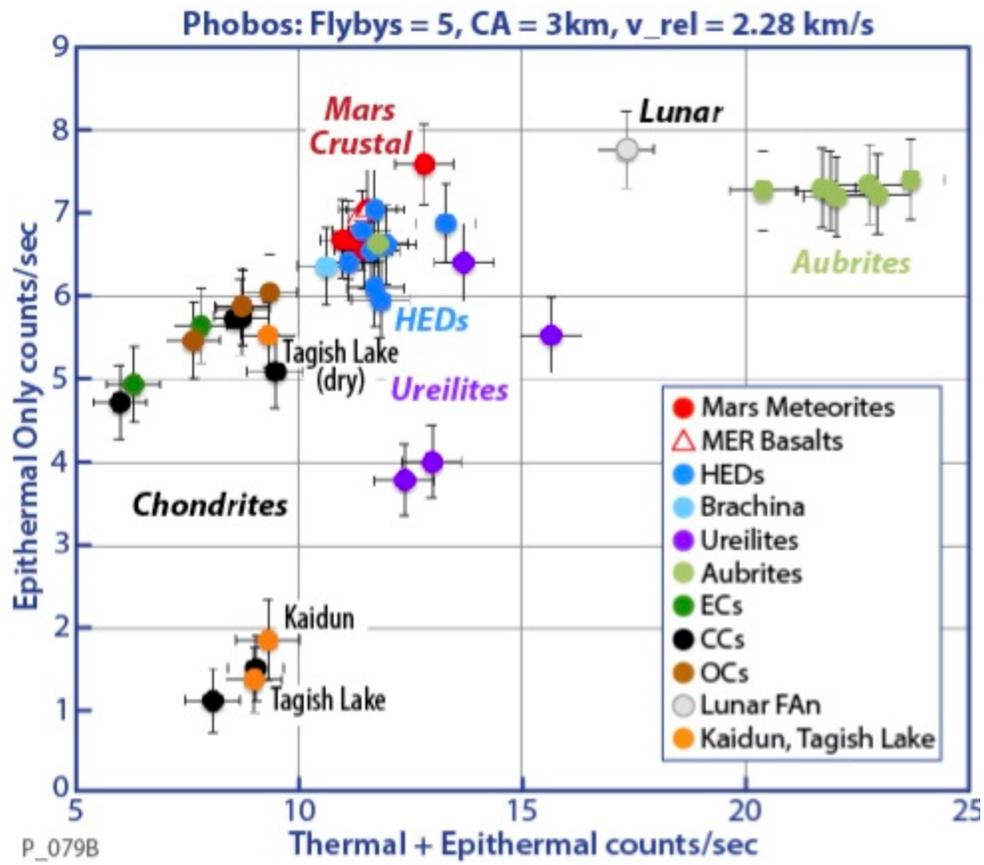
### **Using Neutron Spectroscopy to Constrain the Composition and Provenance of Phobos and Deimos**

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#### **Abstract Text:**

The origin of the martian moons Phobos and Deimos is obscure and enigmatic. Hypotheses include the capture of asteroids originally from the outer main belt or beyond, residual material left over from Mars' formation, and accreted ejecta from a large impact on Mars, among others. Measurements of reflectance spectra indicate a similarity to dark, red D-type asteroids, but could indicate a highly space-weathered veneer. Here we suggest a way of constraining the near-surface composition of the two moons, for comparison to known meteoritic compositions. Neutron spectroscopy, particularly the thermal and epithermal neutron flux, distinguishes clearly between various classes of meteorites and varying hydrogen (water) abundances. Perhaps most surprising of all, a rendezvous with Phobos or Deimos is not necessary to achieve this. A low-cost mission based on the LADEE spacecraft design in an eccentric orbit around Mars can encounter Phobos every 2 weeks. As few as five flyby encounters at speeds of 2.3 km/sec and closest-approach distance of 3 km provide sufficient data to distinguish between ordinary chondrite, water-bearing carbonaceous chondrite, ureilite, Mars surface, and aubrite compositions. A one-Earth year mission design includes many more flybys at lower speeds and closer approach distances, as well as similar multiple flybys at Deimos in the second mission phase, as described in the Phobos And Deimos Mars Environment (PADME) mission concept. This presentation will describe the expected thermal and epithermal neutron fluxes based on MCNP6 simulations of different meteorite compositions and their uncertainties.



**Topic Selection:** The Science of Exploration as enabled by the Moon, Near Earth Asteroids and the moons of Mars

**Title:** Using Neutron Spectroscopy to Constrain the Composition and Provenance of Phobos and Deimos

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**Preferred Presentation Format:** Assigned by Program Committee (Oral or Poster)

First Presenting Author

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***Presenting Author***

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