Department of Physics
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Speaker: Jennifer E. C. Scully, California Institute of Technology

Exploring New and Familiar Worlds with Planetary Geologic Mapping

Friday, September 11, 2026, 1:30 pm, PSB 160/161

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Meeting ID: 972 7170 4305 Passcode: 430

Abstract:

In this talk I will focus on my recent work of geologic mapping and interpretation of the new world of asteroid (52246) Donaldjohanson, target of NASA's Lucy mission, and of the Marius Hills region of our familiar neighboring world, the Moon.

The Lucy mission will study the Jupiter Trojan asteroids, which are early Solar System relics yet to be explored by a spacecraft (Levison+2021). Prior to the first Trojan encounter, Lucy flew by two never-before-visited main-belt asteroids: asteroid (152830) Dinkinesh in 2023 (Levison+2024) and asteroid (52246) Donaldjohanson in 2025 (Marchi+2026). Here I will present the first geologic map of the observed portion of Donaldjohanson, which is ~8 km long and appears to be an elongated contact binary composed of two lobes (the bigger named Olduvai Lobus and the smaller Afar Lobus) joined by a narrower neck (named Windover Collum). We infer that mass wasting flowed from Olduvai Lobus to Windover Collum and from Windover Collum to Afar Lobus. We also observe that the chains of depressions and grooves have a preferred orientation and potential en echelon patterns, which we interpret as pit chains (see also Nichols-Fleming+2026). We use boulders to estimate the thickness of the outer layer of looser material to be between ~17 m to ~33 m deep. We also discuss how these geomorphological observations correlate with modeling of the spin period and surface acceleration of Donaldjohanson.

The Marius Hills pit is within the large Marius Hills volcanic plateau on the Moon and is often interpreted as a lava tube entrance, making it a feature of interest for future human exploration (Haruyama et al., 2009; Robinson et al., 2012; Wagner and Robinson, 2022). I will present our regional geologic map of the area surrounding the Marius Hills pit to provide a contextualizing geologic history. We describe in detail features representing an earlier stage of higher viscosity volcanism and a later stage of lower viscosity volcanism. The pit may be formed by collapse into an underlying lava tube, suggesting lava tube stacking. Using our geologic map and relevant datasets, we develop suitability models for potential future landing sites and traverses, which would visit key locations for scientific exploration while avoiding hazards. We therefore provide a foundation for potential future exploration of this pit, which is timely given the current interest in non-polar locations for future lunar exploration and because such lunar pits provide a tantalizing option for human settlement protected from many of the hazards of the lunar surface.

BIO:

I am a planetary geologist with expertise in geologic mapping, geomorphologic analysis of impact craters and mass wasting deposits, analysis of structural features (e.g., fractures and faults) and laboratory experiments. I am a member of the science teams of the Lucy, Europa Clipper and Dawn NASA missions. I have worked on many mission concepts to explore ocean worlds and small bodies, with a focus on science formulation and planning landing and/or sampling site reconnaissance and selection. I am working, or have worked on, scientific research projects about Ceres, Europa, the Trojan asteroids, the Moon, Vesta, Uranian moons, Mercury and Mars.