Lunar Seismology: Past, Present and Future

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In the late 1960s and early 1970s, Apollo astronauts deployed seismometers on the surface of the Moon. From 1969 to 1977, the seismometers recorded over 13,000 events on the mid-period seismometers and many more on the short-period instruments. These events included moonquakes, artificial impacts and meteoroid impacts. Meteoroids have bombarded the Moon throughout its history, which has left a highly-fractured layer near the surface. Energy from seismic events is highly scattered. The result is that lunar seismograms look very different from terrestrial seismograms. The Apollo experiments, and many others, transformed our understanding of the structure of the Moon. However, many questions remain unanswered.

The Farside Seismic Suite (FSS) is a new lunar seismic mission designed to answer some of these questions. The FSS will be delivered to Schrödinger Crater (Fig. 1) on the Moon's farside in 2025. Two seismometers will be deployed on the deck of a Commercial Lunar Payload Services (CLPS) lander.

The FSS has three primary science objectives:

1. To investigate the asymmetry between near and farside. The Apollo seismometers observed very few moonquakes on the Moon's farside. However, since the seismometers were deployed on the nearside, farside events would be much harder to observe, and the seismic energy may have been attenuated by a partial melt layer above the core. At the surface, there are many asymmetries between the near and farside of the Moon. The mission will investigate the asymmetries beneath the surface.
2. How do impact processes shape the lunar crust inside and outside Schrödinger Crater? In particular, we will determine the thickness of the crust at this location and use it to improve the estimates of crustal thickness for the whole Moon.
3. Seismic noise on the Moon, known as the Lunar Background Hum, is mainly driven by the impacts of micrometeorites. We will better constrain the impact rate for the smallest micrometeorites using seismic noise measurements.

This talk will briefly introduce lunar seismology and discuss its past, present, and what we can hope to learn in the future.

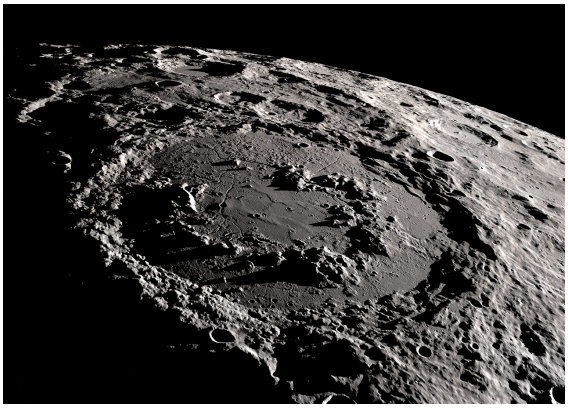

Figure 1: Schrödinger Basin, the destination for the Farside Seismic Suite. The basin is 3.8 Ga, has a diameter of 320 km and a peak ring which is 2.5 km high. Image Credit: NASA Scientific Visualization Studio (NASA SVS).