

Investigation of Mars Seismic Attenuation Using InSight SEIS Data.

*Taichi Kawamura¹, Ludovic Margerin², Mélanie Drilleau¹, Sabrina Menina¹, Philippe Henri Lognonné¹, Nicholas C. Schmerr³, Simon Stähler⁴, Martin van Driel⁴, Doménico Giardini⁴, William Bruce Banerdt⁵

1. Institut de Physique du Globe de Paris, 2. Institut de Recherches en Astrophysique et Planétologie, 3. University of Maryland, 4. ETH Zurich, 5. Jet Propulsion Laboratory

NASA InSight (the Interior Exploration using Geodesy and Heat Transport) has placed the first broadband seismometer (SEIS) on the Martian surface and now continuously monitoring Martian seismic activity. Since the first detection of a marsquake in March 2019, SEIS detected more than 200 marsquakes and Mars has been revealed to be a seismically active planet. The dataset can now be used to perform the seismic investigation of the Mars interior and interpret this in a comparative manner by referring to the examples from the Earth and the Moon. In this study, we investigate the seismic attenuation on Mars and compare this with the Earth and the Moon. Attenuation can be described as a combination of inelastic absorption and elastic diffusion of energy. Such properties will give important constraints on the composition of the Mars interior and also its thermal state. Another interesting aspect will be to discuss the water content with respect to the attenuation. Given the large variety of water content for the Earth, the Moon and Mars, the attenuation feature will be likely to differ significantly between these planets and satellite. Here we use the seismic dataset obtained by InSight SEIS and construct a 1D structure of seismic attenuation on Mars. Then we refer to the values obtained for the Earth and the Moon to discuss the possible implication on their differences and similarities. The presentation aims to summarize the results from different approaches taken by the authors. The approach includes; 1) spectral analyses of seismic signals and spectral decay fitting, 2) seismic coda analyses with coda rise time and decay, 3) numerical coda simulation with diffusion theory on seismic energy. With these approaches we will be constraining seismic quality factor Q and diffusivity D for different depth range. Different approaches have sensitivities to different depth and parameters and we aim to provide our view on the martian attenuation and diffusion to date by summarizing the obtained results.

Keywords: Mars, Seismology