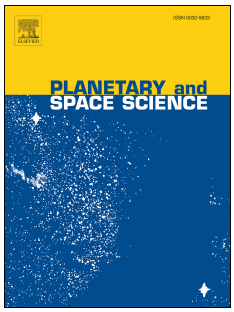
# Accepted Manuscript




Probing the internal structure of the asteriod Didymoon with a passive seismic investigation

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# Probing the internal structure of the asteriod Didymoon with a passive seismic investigation

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**Abstract**

Understanding the internal structure of an asteroid has important implications for interpreting its evolutionary history, for understanding its continuing geological evolution, and also for asteroid deflection and in-situ space resource utilisation. Given the strong evidence that asteroids are seismically active, an in-situ passive seismic experiment could provide information about the asteroid surface and interior properties. Here, we discuss the natural seismic activity that may be present on Didymoon, the secondary component of asteroid (65803) Didymos. Our analysis of the tidal stresses in Didymoon shows that tidal quakes are likely to occur if the secondary has an eccentric orbit. Failure occurs most easily at the asteroid poles and close to the surface for both homogeneous and layered internal structures.

Simulations of seismic wave propagation in Didymoon show that the seismic moment of even small meteoroid impacts can generate clearly observable body and surface waves if the asteroid's internal structure is homogeneous. The presence of a regolith layer over a consolidated core can result in the seismic energy becoming trapped in the regolith due to the strong impedance contrast at the regolith-core boundary. The inclusion of macro-porosity (voids) further complexifies the wavefield due to increased scattering. The most prominent seismic waves are always found to be those traveling along the surface of the asteroid and those focusing in the antipodal point of the seismic source. We find also that the waveforms and ground acceleration spectra allow discrimination between the different internal structure models.

Although the science return of a passive seismic experiment would be enhanced by having