Probing Mars' interior structure and planetary seismicity / tectonics

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Project Description

Planetary crusts form as a result of early mantle differentiation and subsequent magmatic processes, including partial melting of mantle reservoirs that may continue to the present day. Crustal structure is therefore intimately related to the thermal and magmatic history of a planet, and in many cases bears evidence of early conditions and impact history.

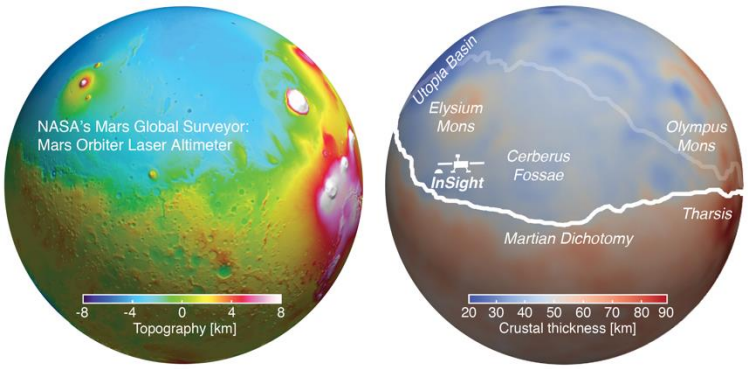

***Figure 1**: Topographic variation and global crustal thickness on Mars. After Kim et al., (2023).*

Measurements of seismic wave arrival times collected by the *InSight* mission to Mars have led to foundational discoveries about the spherically symmetric structure of the crust mantle, and core. Because more than three quarters of these measurements are predominantly sensitive to the lithospheric structure between Elysium Planitia and Cerberus Fosse, inferences about global structure assume that the crustal structure directly beneath the landing site of *InSight* is representative of average Martian crust. This assumption can significantly bias our models of the global interior structure and dynamics as well as seismo-tectonic constraints on Mars.

The aim of this project is to take advantage of a range of recently developed 3-D seismic models of crustal structure on Mars (**Figure 1**) to refine and verify our previous radially symmetric models of the planet's interior structure beyond crustal depths but also to improve relatively under-constrained marsquake locations and mechanisms. The expected outcome includes but not limited to understanding: (1) composition of the interior structure of Mars constrained by available geophysical and geological observations with a primary focus on its crust for future In-Situ resource utilization (ISRU) exploration targets such as volatile deposits or magma-tectonic systems (https://twitter.com/reuters/status/1661759025640267776?s=46&t=c0wzCRRwcNOp35juvgXDGQ)and (2) a global view on seismicity and tectonics on Mars (through a robust event classification and focal mechanism computation). Above topics will not only improve the reliability of our present knowledge about Mars' interior structure and tectonics but also make valuable contribution to resource exploitation and the characterization of hazards for future manned missions to Mars and beyond.

The successful candidate will join, and be supported by, a vibrant and dynamic research group. The candidate will have the opportunity to develop their career and profile by presenting at international conferences and publishing in high impact journals.

Candidates for PhD positions should have a good mathematical background and a degree in an appropriate field such as earth science, physics, mathematics, computer science or engineering.