Subject offered for a contract starting october 2015

SUBJECT TITLE: Effect of the North/South dichotomy on the thermal structure and evolution of Mars

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IPGP- Equipe de Planétologie et Sciences Spatiales – UMR7154
DLR - Institut für Planetenforschung, Berlin, Allemagne

Financing: **LABEX Univearths / DLR Berlin**

For more information go to http://ed560.ipgp.fr, section: Offres de these (PhD offer), You must apply on the Doctoral School website

Presentation of the subject: (1 or 2 pages)

The InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) mission is a NASA Discovery Program mission that will place a single geophysical lander on Mars to study its deep interior. The mission's objective is to study the geological evolution of Mars using a seismometer (SEIS instrument, built at IPG Paris) and heat transfer probe (HP^3 instrument, built at DLR Berlin).

The purpose of the PhD is to build thermal models for the Martian crust and mantle to be used to predict both heat flow and seismological data that will be measured by the HP^3 and SEIS instruments.

One of the main objectives of the PhD is to understand the potential consequences of the North/South dichotomy of Mars on its internal thermal structure. Indeed, Mars is characterized by two very different hemispheres. The Northern hemisphere is covered by large lava plains and is lower in elevation and younger in age than the Southern hemisphere that is much more craterized. The dichotomy might only be a surface feature but it could also reflect differences in density and composition in between the Northern and Southern crust and lithosphere of Mars. In particular, evidences for the presence of felsic rocks at the surface of Mars have been found all in the Southern hemisphere. The InSight landing site is located close to the dichotomy boundary. As a result, the to-be measured heat flow and seismicity will be influenced by the physical properties of both hemispheres.

We seek a highly motivated PhD candidate with a strong physics or geophysics background. The PhD student will develop 2D and 3D numerical thermal models and run 3D mantle convection simulations using the GAIA code developed at DLR, Berlin to understand

the potential consequences of the differences in density and composition in between the Northern and Southern crusts and lithospheres of Mars on the regional heat flow and seismic velocities close to the dichotomy boundary. These models will be used as tools to test, using measured heat flow and seismicity, whether the dichotomy of Mars is only a surface feature or if it extends at depth.

This PhD is a co-funded PhD in between the IPG Paris and DLR Berlin. The successful candidate is expected to spend half of its time at IPG Paris, France, and half of its time at DLR, Berlin, Germany. This work also includes collaboration with Matthew Siegler from the Planetary Science Institute, Dallas, USA. The proposed work is half funded and part of a multi-disciplinary program in Earth Sciences and Astrophysics within the Labex (Laboratory of Excellence) UnivEarths.