Subject offered for a contract starting October 2019

THESIS TITLE: Ionospheric detection of natural hazards

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Financing: Doctoral contract with or without teaching assignment

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Presentation of the subject: (1 or 2 pages)

Ionosphere is the ionized region of the Earth's upper atmosphere that is located between ~60 to ~800 km of altitude. The ionosphere is primarily formed by the solar UV radiation, and is largely controlled by the solar and magnetic activities, and by the thermosphere (neutral upper atmosphere). Besides these large-scale and global processes influencing from above, the ionosphere can be more "locally" perturbed from below by geophysical phenomena (e.g., earthquakes, tsunamis, volcanic eruptions, severe tropospheric weather events), and man-made events (e.g., explosions, rocket and missile launches, mine blasts). From below, the disturbances arrive in the ionosphere as acoustic and gravity waves.

The branch of Geophysics that studies ionospheric disturbances generated by natural hazards is known as Ionospheric Seismology, or "seismology without seismometers", or Space detection of NH. It aims to study ionospheric perturbations generated by NH, to localize NH from the ionosphere and, more recently and if/when applicable, – to provide information about the NH source from the ionosphere. Ionospheric response to these NH is sufficiently well studied, however there are still some major gaps in our knowledge of the seismo-ionospheric coupling.

The main aim of this PhD thesis is to work on the fundamental questions of the Ionospheric Seismology, and to develop new and/or to improve the existing methods of ionospheric detection of natural hazards such as earthquakes, tsunamis, volcanic eruptions.

The ionospheric data to be primarily used are those of the total electron content (TEC) measured by GNSS, high-rate 1Hz data are of special interest. In addition to these data from ground-based GNSS-receivers, plasma measurements from satellite missions (e.g., Swarm, CSES-01, etc.) can be useful. To better understand the observed signals, models previously developed in the Department of Planetology and Space Sciences (merely, the normal modes approach and the Ray-tracing technique) should be applied.