# Title:

# Advanced Reprocessing and Integration of Exploration Seismic Data for the Geological and Structural Characterization of the Phlegraean Caldera

# Advisor:

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# Research Proposal:

This PhD proposal aims to review the active seismic data acquired by Agip-ENI, OGS, and other public research institutions in past years in the Phlegraean area and surrounding regions, both offshore and onshore. The goal is to provide an updated analysis of the geological and structural framework using modern seismic processing and interpretation techniques. The project intends to identify new details and correlations to better understand the geodynamic processes related to Phlegraean volcanism. This study will provide information for volcanic risk management in this strategic region, a highly relevant topic given the evolving unrest in the Campi Flegrei.

# Research Program:

The PhD proposal focuses on the analysis and reprocessing of seismic data from various key sources in the Gulf of Naples region and the Phlegraean offshore. The data sources include:

* Reflection seismic data in digital pre-stack format acquired by OGS in the 1970s in the Phlegraean offshore and the Gulf of Naples.
* Crustal-scale seismic data in digital pre-stack format acquired as part of the "Serapis" research project (Zollo et al., 2001) in 2001 in the Phlegraean offshore.
* Offshore seismic data in digital pre-stack format acquired by ENI in the 1980s and 1990s in the Phlegraean onshore, north of the Island of Ischia up to the mouth of the Volturno.
* Geophysical logs and stratigraphies from numerous wells in the study area, essential for interpretation.

The primary objective is to reprocess the seismic data to improve the signal-to-noise ratio of 2D and 3D seismic images and integrate data at different scales, providing a solid basis for structural and stratigraphic reinterpretation across the entire Phlegraean Caldera. This will be achieved through up-to-date data processing techniques, adapted to the technological limitations of the period when the various data types were acquired. For example, due to restrictions from acquisition parameters and analog filtering used in the past, the processing approach for OGS data will focus on algorithms that enhance structural interpretability rather than preserving the fidelity of relative amplitudes.

If the data allow, the goal is to obtain depth-migrated images (using pre-stack or post-stack techniques), to obtain "angle stacks (AVO)," and to apply post-stack acoustic impedance inversion, as variations in amplitude with incidence angle and acoustic impedance are correlated with petrophysical properties such as porosity, lithology, and fluid saturation (Latimer et al., 2020).

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