

Master 2 research internship - First semester 2024

Simulation and data analysis of a particle detector for volcano monitoring

Laboratory: Laboratoire de Physique de Clermont, Clermont-Ferrand, France

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As part of the SPAGHETTI¹ collaboration between several laboratories at the University of Clermont Auvergne and French volcanological and seismological observatories, the LPC is developing a new generation of instruments to monitor the radioactivity of volcanic fluid emissions (high-temperature acid gases and liquids).

The proposed internship is part of this project and aims to contribute to the ongoing development of a scintillating detector adapted to the extreme conditions encountered on active volcanos. Initially, the student will develop a Monte-Carlo simulation of the instrument, including the various sources of energy deposition in the detector. This work will enable him/her to work with a wide variety of natural processes and particles (including gamma photons, alpha particles, electrons and muons), and to familiarise himself/herself with various codes, including Geant4, Corsika and others developed in the laboratory.

Efforts will then focus on setting up the data analysis needed to separate the targeted signal from the background and to determine the various isotopic signatures that volcanologists are looking for. This part will use probabilistic inversion methods that will be tested and validated on real data obtained in the field.

The subject requires solid statistical skills, as well as programming skills (Python, C++). Previous experience of Geant4 and Root will be an asset. Finally, the ability (or at least the motivation) to work and collaborate in a cross-disciplinary context will be necessary to thrive in the team.

Depending on his/her affinities and interests, the student will have the opportunity to take part (for a limited period of time) in all of the project's activities, including field campaign (in Auvergne and/or active volcanoes) and instrumentation work (e.g., thermal calculations, mechanics, laboratory tests, electronics).

The internship could lead to a doctoral thesis (funding acquired).

¹Spectral Panoptic Analysers of Gamma-rays in Hydrothermal Environments for Transport Time Inference (funded by the french national research agency).