Ecole Doctorale des Sciences Fondamentales

Title of the thesis: 3D Volcano Imaging Using Transmission Muography

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Summary :
High energy atmospheric muons have high penetration power and are naturally present in the Earth atmosphere, rendering them appropriate for geophysical studies. In particular, they can provide high resolution density imaging for volcanic edifices. The atmospheric muon flux transmittance through an edifice is measured with muon telescopes deployed remotely at various distances from the target (up to few kilometres). From this measurement a radiographic projection (2D) of the edifice density structure is reconstructed by solving an inverse problem. 3D imaging can be inferred from several radiographic images, especially when combined with gravimetric data.

We propose to perform precise density images of the inner structure of some volcanoes with a high performance muon telescope based on GRPCs, by using already existing data (on the French volcano Puy de Dôme) or data that will be acquired in the near future (on the italian volcanoes Vesuvius and Stromboli). The PhD will actively take part in all stages of the planned for measurements, from the commissioning and calibration of the muon detector, its operation and monitoring on site, to the very high level, end analysis. He/she will have the rare opportunity to closely work with a running detector and at the same time to develop generic methods and software tools for muon radiography.

The PhD will work in the muography team at LPC, team with an internationally recognised expertise in muography. The LPC team collaborates with particle physicists, geophysicists and volcanologists from France, Belgium, Italy and Portugal. The PhD will therefore have the opportunity to work in an interdisciplinary and international environment.

Standard knowledge in particle physics, data analysis and programming are required. C/C++ knowledge is preferred; notions of python are an advantage.