IRFU : Institut de recherche sur les lois fondamentales de l'univers

Saclay

Recherche d'emission de rayons gamma des sursauts radio rapide avec H.E.S.S.

Spécialité Astrophysique

Niveau d'étude Bac+5

Formation Master 2

Unité d'accueil

Candidature avant le 30/06/2018

Durée 3 mois

Poursuite possible en thèse non

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Résumé

Sujet détaillé

voir descriptif en anglais

Mots clés

Compétences

Logiciels

C++/ROOT Python

Search for high-energy emission of Fast Radio Bursts with H.E.S.S.

Summary

Fast Radio Bursts (FRBs) are extremely powerful and very short bursts in the radio domain. Their origin remains enigmatic. H.E.S.S. is actively participating in follow-up observations of these events. We here exploit a novel idea to search for FRBs exploiting spatial and temporal correlations of events detected by the H.E.S.S. telescope system.

Full description

H.E.S.S. is a system of Imaging Atmospheric Cherenkov Telescopes that investigates cosmic gamma rays in the energy range from 10s of GeV to 10s of TeV. The name H.E.S.S. stands for High Energy Stereoscopic System, and is also intended to pay homage to Victor Hess , who received the Nobel Prize in Physics in 1936 for his discovery of cosmic radiation. The instrument allows scientists to explore gamma-ray sources with intensities at a level of a few thousandths of the flux of the Crab nebula (the brightest steady source of gamma rays in the sky). H.E.S.S. is located in Namibia, near the Gamsberg mountain, an area well known for its excellent optical quality. The first of the four telescopes of Phase I of the H.E.S.S. project went into operation in Summer 2002. A much larger fifth telescope - H.E.S.S. II - is operational since July 2012, further improving sensitivity, extending the energy coverage and allowing for very rapid reactions to transient events. The H.E.S.S. observatory is operated by the collaboration of more than 170 scientists, from 32 scientific institutions and 12 different countries.

The H.E.S.S. collaboration is actively participating in follow-up observations of Fast Radio Bursts. Several radio observatories have detected these very powerful but very short bursts over the last years but their origin remains enigmatic. These searches have very recently led to a first joint publication between H.E.S.S. and the SUPERB team at the Parkes radio telescope. This program continues and has been extended to other radio telescopes like the SKA pathfinder ASKAP and the UTMOST observatory (both in Australia).
During the internship the obtained high-energy gamma-ray data will be analyzed. We'll first follow well-established analysis guidelines dedicated to short transient phenomena and might then work towards possible improvements. These might for example include the use of dedicated and novel analysis methods searching for variable emissions.
Another novel and so far unexplored possibility to detect Fast Radio Bursts (and similar, rapid transient phenomena) might also be pursued: we'll scan the stream of events recorded by the H.E.S.S. telescopes and search for gamma-ray events arriving close in space and time. If a significant excess of these coincident events is found, the student will search archival information and astrophysical databases for potential astrophysical counterparts and sources.

The tools to perform the proposed analyses are readily available within the group at CEA-Saclay but might need some adaption and verifications.

Keywords

astroparticle physics, transients, radio bursts

Skills

data analysis using C++ and/or Python tools basic knowledge of astrophysics and/or astroparticle physics

Softwares

C++/ROOT Python