

**Atelier INTERCOS - Sources
des Rayons Cosmiques
Galactiques, Énigmes et
Avancées Récentes**

**Rapport sur les
contributions**

ID de Contribution: 1

Type: **Non spécifié**

Bienvenue !

mercredi 2 mars 2022 09:00 (15 minutes)

Orateurs: GUÉPIN, Claire (IAP); ALLARD, Denis (APC CNRS/Paris7); CRISTOFARI, Pierre (GSSI)

ID de Contribution: 2

Type: **Non spécifié**

L'origine des rayons cosmiques - On the origin of Galactic cosmic rays

mercredi 2 mars 2022 09:15 (45 minutes)

By using recent measurements of the Galactic cosmic ray composition by the AMS-02, Voyager 1 and SuperTIGER experiments, we have obtained new information on the origin of these energetic particles: they are most likely produced in superbubbles of plasma at millions of degrees that form around massive star clusters. Most of the cosmic-ray particles are accelerated in strong shock waves induced by supernova explosions sweeping across the superbubble plasma. But a small component, which is responsible for the overabundance of ^{22}Ne in the Galactic cosmic ray composition, most probably arises from acceleration of massive star winds in their termination shock.

Orateur: TATISCHEFF, Vincent (CSNSM)

ID de Contribution: 3

Type: **Non spécifié**

Can superbubbles accelerate PeV protons?

mercredi 2 mars 2022 10:00 (45 minutes)

The local cosmic ray spectrum as well as recent gamma-ray observations suggest the existence of galactic sources able to accelerate protons up to at least several PeV, if not tens of PeV. However, these sources are still to be identified. In particular, standard scenarios of particle acceleration, e.g. at supernova remnant shocks around isolated massive stars, struggle to reach PeV bands. On the other hand, most massive stars are not isolated but rather clustered. Clustered stars heat their surrounding medium, which inflates a low-density cavity called a superbubble. After a few Myr, this cavity reaches a size of the order of 100 pc. In the cavity, the stellar feedback is believed to create multiple shocks, strong turbulence, and to amplify the magnetic fields. These are ideal conditions for particle acceleration. In particular, superbubbles have long been thought to be able to accelerate PeV protons. However, the question of the relevant acceleration mechanism is still open.

In this talk I estimate the maximum energy of protons accelerated within superbubbles, considering a number of detailed scenarios. The most promising systems to accelerate PeV protons are the supernovae exploding within compact clusters and evolving in a medium strongly affected by the stellar winds.

Orateur: VIEU, Thibault

ID de Contribution: 4

Type: **Non spécifié**

Gamma-ray observations of Galactic cosmic-ray sources

mercredi 2 mars 2022 13:30 (45 minutes)

Gamma rays allow us to probe the cosmic-ray acceleration sites in the Galaxy, and in particular to search for PeVatrons through the detection of the pion bump feature and an energy reached by particles up to PeV energies. Although supernova remnants (SNRs) have long been thought to be the most likely sources of Galactic cosmic rays, gamma-ray analyses show that even the youngest SNRs do not seem to act as PeVatrons. Recent results from Imaging Atmospheric Cherenkov Telescopes and Extensive Air Shower experiments revealed a list of PeVatron candidates with different associations. I will review the latest observational results on Galactic sources at gamma-ray energies and discuss the potential outcomes from future observations and experiments that will help understand the origin of Galactic cosmic rays.

Orateur: DEVIN, Justine (LUPM)

ID de Contribution: 5

Type: **Non spécifié**

Discussion - part 1

mercredi 2 mars 2022 12:00 (30 minutes)

ID de Contribution: 6

Type: **Non spécifié**

The contribution of supernova remnants to the cosmic ray spectrum

mercredi 2 mars 2022 11:15 (45 minutes)

The role played by supernova remnants in the origin of Galactic cosmic rays is still unclear. Although they have been proposed as major contributor to the cosmic ray spectrum up to the knee, this hypothesis is facing several difficulties.

Orateur: CRISTOFARI, Pierre (GSSI)

ID de Contribution: 7

Type: **Non spécifié**

On the origin of the GCR composition, in the light of the Ne22 excess

mercredi 2 mars 2022 14:15 (45 minutes)

I will discuss the source composition of GCR and the implications for their acceleration site, emphasizing the role of the observed Ne22/Ne20 excess and the observed evolution of the light elements Li, Be and B , produced by GCR spallation reactions.

Orateur: PRANTZOS, Nikos (IAP Paris)

ID de Contribution: 8

Type: **Non spécifié**

Multiwavelength studies of the interstellar contents of gamma-ray bright supernova remnants

mercredi 2 mars 2022 15:30 (45 minutes)

In the era of the Cherenkov Telescope Array, gamma-ray observations of supernova remnants (SNRs) will be performed with increased sensitivity and angular resolution, resulting in an unprecedented volume of data. Thorough interpretations of these new gamma-ray spectra will require to accurately quantify the interaction of cosmic rays with the complex interstellar environment of SNRs. Our goal is to provide as many constraints as possible on the interstellar contents of SNRs (mass, density, kinematics, ionization fraction, magnetic field) in order to pin-point the origin of gamma-ray photons and to disentangle the contributions of the different mechanisms of gamma-ray emission (synchrotron, bremsstrahlung, pion decay and inverse compton scattering). In addition, we want to track possible sources of fresh cosmic rays (embedded protostars, HII regions, shocks). In this talk, I aim to review several methods of detection of the molecular and dust phases in the environment of SNRs, and the corresponding tools used to infer physical parameters from multiwavelength observations. To illustrate the level of description that can be achieved with these methods, I will present our study of the evolved SNR IC443, based on new millimeter observations with the IRAM 30m and APEX telescopes.

Orateur: DELL'OVA, Pierre

ID de Contribution: 9

Type: **Non spécifié**

Discussion - part 2

mercredi 2 mars 2022 16:15 (45 minutes)