Cosmic ray astronomy
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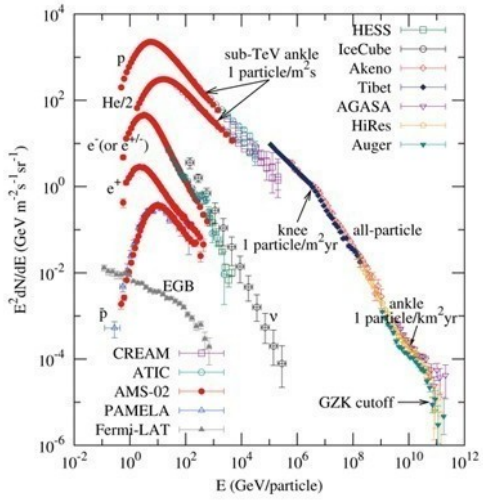
Introduction

Cosmic rays were discovered by Nobel laureate Victor Hess in 1912. Originally they were thought to be electromagnetic radiation but soon after the famous "balloon-born electroscopes" experiment which showed that the rate of ionizing radiation increased at higher altitudes to a few times measured on the ground, and concluded the existence of penetrating radiation atmosphere from above. Cosmic rays are one of the way to directly receive matter from outer solar system and distant galaxies. Since the cosmic rays comprise of charged particles their paths get easily deflected via magnetic fields and due to this till the time they reach Earth their flight path gets so complex that it becomes impossible to know where they originated from.

Proposed research

To study the formation of cosmic rays and how it got evolved with time, as annihilating dark matter particles in many models are predicted to contribute to the cosmic ray positron spectrum in this energy range, a great deal of interest has resulted from this observation [1]. On the other hand the origin of cosmic rays remains a challenging issue in high-energy astrophysics for deflection from the direction of their sources of origin by interstellar magnetic fields [2]. A detailed exploration of these theories and their ability to fit the observed data along with related simulation results should be carried out in this course research project.



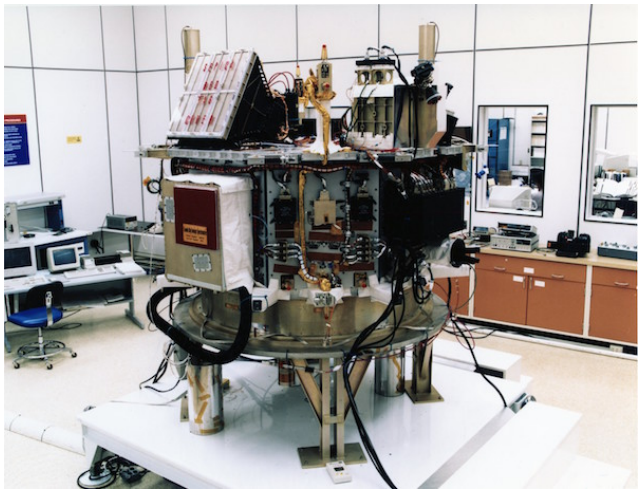


Figure 1: (Left) The flux density of cosmic rays versus energy obtained from various experiments primarily balloon experiments; Credit: YUAN Qiang. The Cosmic Ray Isotope Spectrometer (the box on the leftside with yellow covering) on the Advanced Composition Explorer (ACE) spacecraft which provided measurements of the isotopes of galactic cosmic ray nuclei. ACE was launched in August 1997. (Credit: NASA/Johns Hopkins University Applied Physics Laboratory).

Methods

For the project work many research areas and multiple sources will be required, I am planning to follow the book "Cosmic Ray Astrophysics" by Reinhard Schlickeiser [3].
Currently this field has intrigued me "Simulation of atmospheric cosmic-rays and their impacts based on pre-calculated databases, physical models and computational methods", because performing simulations here will be helpful as we have experimental data to compare.

Timeline

The whole project timeline will be divided into 3 parts, 1st part will be spent for learning all the basics, theories to get the complete understanding of the project topic, in the 2nd part most of the time will be devoted performing the simulations and observing the theoretical and experimental data. In the 3rd part will be completely devoted for the report and getting conclusive results, however during the whole project consult and guidance from the instructor will be required, to get a proper MNRAS format report.

Summary

Here in this project work I propose to review the literature on the topic "Cosmic ray astronomy" along with the ongoing status of research. The project report will be precise enough to provide all details of field and ongoing research projects.

References

[1] Dan Hooper, Pasquale Blasi, and Pasquale Dario Serpico. Pulsars as the sources of high energy cosmic ray positrons. Journal of Cosmology and Astroparticle Physics, 2009(01):025, 2009.

[2] Bulletin of Chienese academics of Sciences. BCAS kernel description, January.

[3] Reinhard Schlickeiser. Cosmic ray astrophysics. Springer Science & Business Media, 2013.