

Project Title 1	Modelling the modulation of light cosmic ray isotopes
Description:	<p>Galactic cosmic rays (GCRs) are fully charged energetic particles (matter) and anti-particles (anti-matter) that originate from various sources in the Galaxy and beyond. As they travel through interstellar space they arrive at the heliosphere – a region of space surrounding our solar system, which is formed by the outward expanding solar wind. When entering the heliosphere GCRs undergo convection, diffusion, adiabatic energy losses and drifts as they encounter an outward flowing SW and its embedded turbulent magnetic fields. As a result, this interaction reduces the GCRs intensities, depending on solar activity, as a function of kinetic energy, position and time - a phenomenon called heliospheric modulation of CRs.</p> <p>Observations made by AMS-02 reveal the spectral shape and features of galactic deuteron over the rigidity range 1.92 GV – 21.1 GV, whereas those from PAMELA are at a lower rigidity, from 0.75 GV – 2.5 GV. These observations provide interesting surprises leading to subsequent challenges to the established paradigm of the secondary origin of deuterons. In particular, the rigidity dependence of GCR deuteron was observed to differ considerably from that of helium-3, which is unexpected from the Physics contained in Galactic Propagation models. In this Honours project, a well-established comprehensive three-dimensional numerical model that has been previously applied to study the modulation of galactic protons and helium isotopes is expanded to include the heliospheric modulation of deuterons. The modeling result will be compared to observations made by PAMELA and AMS-02 detectors. The main objective of this project is to uncover how differently the deuteron-to-proton and helium-3 to helium-4 ratios evolve at different rigidities over changing solar activity.</p>
Required knowledge and competencies	Very good mathematical and programming skills in c++ and python.
Prerequisite Modules	3 rd year Physics and mathematics; and 1 st year computer science or any programming language.
Required/desired skills	Programming experience is highly recommended with an aptitude for both theoretical work and data analysis. Spacecraft data to be provided via international co-workers.

Supervisor Details:

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