Galactic Cosmic Rays: Probes for Space Weather and Climate

Galactic cosmic rays are extremely high energy charged particles accelerated at extra-solar sources such as supernovae, active galactic nuclei, quasars, and gamma-ray bursts. They are modulated by the heliospheric magnetic field. Upon arrival at Earth's atmosphere, they produce a shower of secondary particles, some of which result in energetic neutrons which can be detected at ground level. On centennial and millennial time scales, traces of cosmic rays can be found in terrestrial reservoirs, allowing reconstructions of long-term solar variability. I shall make use of these data to summarise how variations measured in the flux of galactic cosmic rays at Earth can provide information about both long-term evolution of the Sun’s magnetic field and shorter-term enhancements in the heliospheric magnetic field such as coronal mass ejections. In particular I intend to look at cosmic ray modulation on solar cycle time-scales, where we see a 22-year cycle in cosmic ray flux caused by a difference in heliospheric parameters between successive solar cycles, and also over hourly time scales, where cosmic ray data can be used to probe the locations of large heliospheric structures, such as large coronal mass ejections, which are the major driver of space weather.