

## Energetic particles of the magnetosphere

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The energetic particles in the magnetosphere have various origins:

- cosmic rays emitted in our galaxy by novae and supernovae;
- galactic particles accelerated inside the solar system;
- particles from the Sun corona emitted during a solar flare;
- particles trapped in the Van Allen radiation belts.

The nature and the energy of these particles depend on their origin.

The particle energy is generally expressed in electron-Volt (eV). One eV is the kinetic energy that an electron would have when it is accelerated by a potential difference of one Volt. By way of comparison, in a television tube, the electrons are accelerated upto 30 keV (30.000 eV) before beating the cathode screen to produce an image. The thermal energy of molecules in the air (on the Earth surface) is only about 0.025eV. On the Sun surface (temperature of 5500°C), this thermal energy is about 0.5eV.

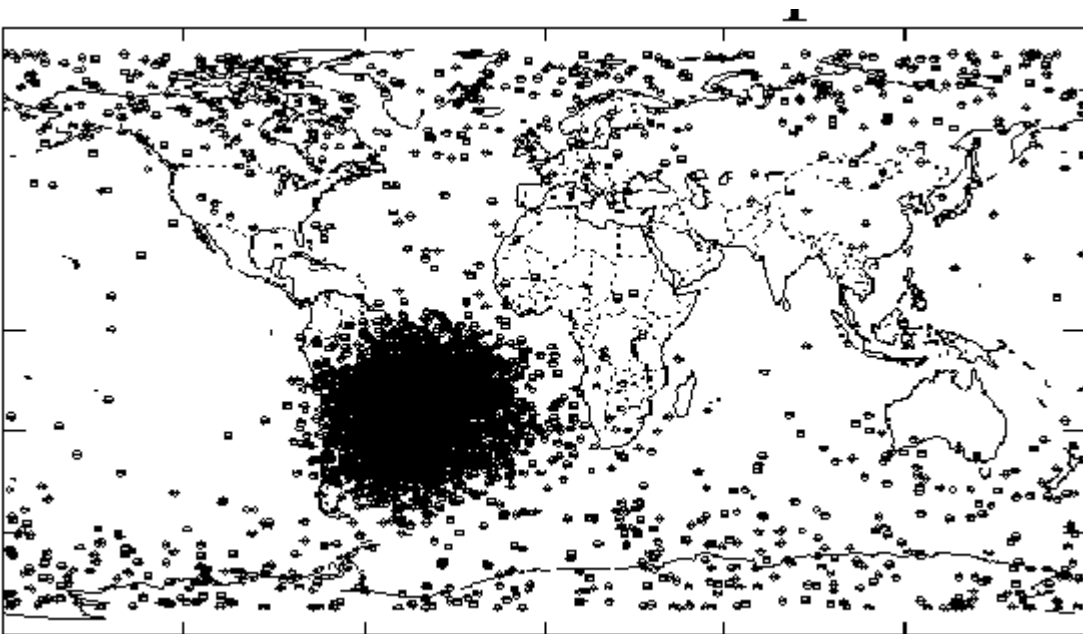
For the energetic particles in the magnetosphere, one speaks of mega-electronvolt (1MeV = 1.000.000 eV) or even of giga-electronvolt (1 GeV = 1.000.000.000 eV). In the Van Allen Belts, the electron energy varies between 100 keV and 5 MeV, the proton energy between 10 and 300 MeV. For cosmic rays, the ion energy is higher than GeV, i.e. 1.000.000.000 eV.

These energies are gigantic, but by contrast: A snail of about 14 g, moving with a speed of 5 cm/min, has a kinetic energy of 30 GeV. Much more than the particles in the Van Allen radiation belts!.



However electrons and protons from the Van Allen radiation belts are not as inoffensive as our snail. An aluminium shielding of about one centimetre thickness is necessary to stop a 50 MeV proton!

Satellites do not have usually such a thick shielding and endure the flux of these particles. This flux damages the various materials of which a satellite is made up. It can interfere with onboard electronics. On the map below, each point corresponds to an error that occurred in the memory of the UOSAT-3 satellite (a 45kg in orbit at 780 km altitude).



The errors observed between Brazil and South Africa are due to protons of the inner radiation belt. The errors observed close to the Poles are due to cosmic rays.

