A Common Misconception

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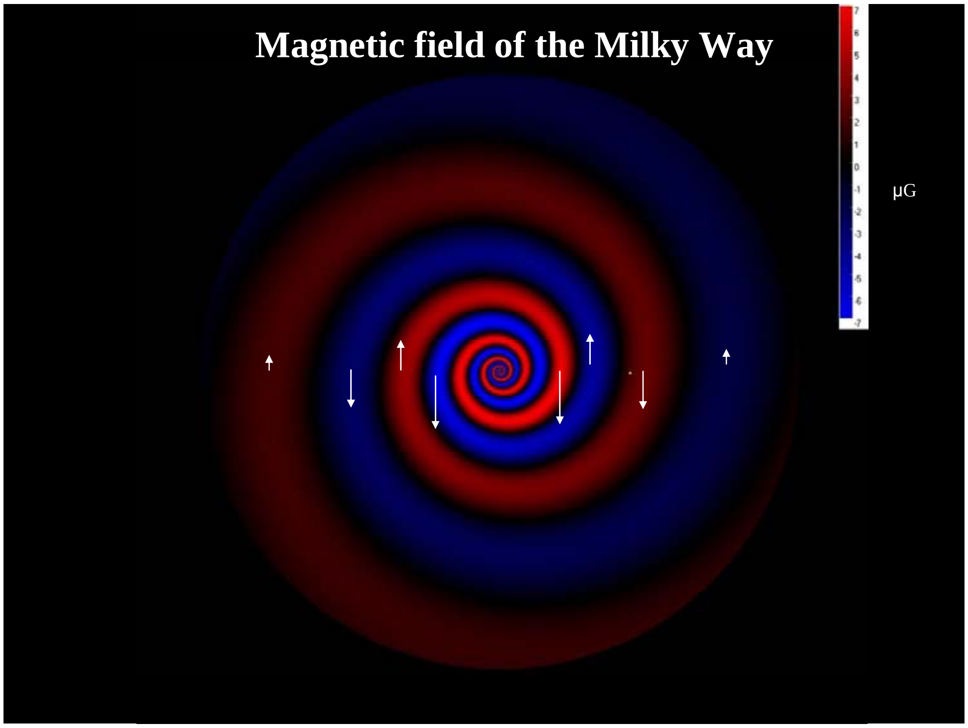
There is a common misconception concerning supernova explosions than can lead to an underestimation of the danger they pose to planet Earth and its inhabitants. Galactic cosmic rays (GCR) are believed to be the by-products of an exploding star, called a supernova. GCR consists of 98% baryons and 2% electrons. The baryons comprise 87% protons (hydrogen nuclei), 12% alpha particles (helium nuclei) and about 1% heavier nuclei.

In general, supernova explosions are viewed as an expanding spherical wave in 3-dimensional space. And thus, the concentration of GCR should fall off as a function of the inverse cube of the distance from the supernova event. But this is a common misconception. GCR are charged particles. When charged particles pass through a magnetic field, their path is deflected. Even though the galactic magnetic field strength is fairly weak ~1.4 micro Gauss (μG) near our solar system, this galactic field has the ability over time to deflect GCR path in the direction of the galactic magnetic field lines.

The following drawing depicts the magnetic field of the Milky Way. The magnetic field lines flow in one direction within the spiral arms and in the opposite direction between the spiral arms.



Source: Andrii Elyiv and Bohdan Hnatyk, *The Propagation of Ultra High Energy Cosmic Rays in the Galactic Magnetic Fields*, 2-13 July 2004, International School of Cosmic Ray Astrophysics, 14th Course: "Neutrinos and Explosive Events in the Universe", A NATO Advanced Study Institute

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The concentration of GCR radiation from a supernova event will take on the shape similar to a high-powered flashlight or more exactly a particle beam many light years across in width as it travels out of the pipe of the spiral arm. As a result, the burst of GCR radiation from a supernova can travel vast distances within the Milky Way without significantly diluting its concentration. GCR radiation can be viewed in geological time as a steady state background of low-energy radiation (100 MeV - 10 GeV), a period of relative calm, with intermittent large bursts of high-energy radiation triggered by supernovae that quickly taper off in energy levels within years/decades.