Detailed measurement of radial intensity gradients of galactic cosmic rays in the inner heliosphere

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In a series of papers we have measured radial intensity gradients of galactic and anomalous cosmic rays, assuming the gradients to be dependent on heliocentric radial distance r with a functional form of $g_r=dJ/Jdr=G_0r^{\alpha}$ through the heliosphere to ~70 AU. The basic one–dimensional transport model gives the equation, $g_r=CV_{SW}/K_{rr}$ where C is the Compton-Getting factor, V_{SW} is the solar wind velocity and K_{rr} is the radial diffusion coefficient. Near the ecliptic plane K_{rr} is dominated by the parallel diffusion in the inner heliosphere with transition to perpendicular diffusion near 10 AU. In the present paper we measure the gradients in the inner heliosphere (<~5AU) which reflect primarily the parallel diffusion, to confirm that our representation $g_r=G_0r^{\alpha}$ is applicable at small heliocentric distances. In an accompanying paper, we extended the study of the gradients in the outer heliosphere to values of r > 70 AU. Data used for the inner heliosphere study are from IMP 8, Helios and Pioneer 10/11 at the radial location of >0.3 AU over the period of 1973 to 1978.