SOURCE ENERGY SPECTRA FOR INTERACTING AND ESCAPING SOLAR PROTONS

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It is widely believed now that a significant fraction of the solar energetic particles (SEPs) following major solar flares are actually accelerated at a CME-driven shock. Thus, the SEPs observed at 1 AU and those that interact at the Sun may represent quite different populations. In addition, in the emerging new paradigm for SEP acceleration in different sources at/near the Sun, the existence of two classes of flares (impulsive and gradual) is recognized. They differ, in particular, by the elemental abundances of SEPs, their ionization states and electron content measured near the Earth. Evidently, the modern picture of the SEP events should include characteristics of the particles escaping into interplanetary space and that of interacting at the Sun to produce gamma-ray emission and neutrons. From this point of view, we analyze available data on source proton spectra (SPS) reconstructed earlier for 80 solar proton events (SPEs) of 1949-1991. It is suggested that the SPS may be separated and classified depending on the source type (its location, flare or CME associations, *etc*.) and conditions of SEP propagation in the interplanetary space (shocks, magnetic traps, *etc*.). We argue that interacting and escaping particles are distinguishable, by means of their SPS, in some well-connected, spatially and temporally extended gamma-ray events. The derived source spectra for several proton events (4 August 1972, 7 December 1982, 29 September 1989, and 4 June 1991) are presented in detail, those spectra being treated in terms of the concept of multiple acceleration processes.