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Effective Energy of Neutron Monitors and Cosmogenic Isotopes

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Galactic cosmic ray variations are often quantified with the aid of the modulation potential (ϕ). For more than sixty years ϕ is typically computed using measurements of ground-based energy-integrating detectors, such as neutron monitors, and for the millennial scale by cosmogenic isotopes stored in natural archives. Here we redefine the effective energy of a detector, considering it as the energy at which the cosmic ray flux variability is straightforwardly proportional to that of the detector's count rate. We found that for the standard sea-level polar neutron monitor the effective energy is 11–12 GeV/nucleon, for cosmic ray reconstruction based on 14C data 6–7 GeV/nucleon and for 10Be data 5.5–6 GeV/nucleon. We present results based on various models of local interstellar spectrum (LIS) of galactic cosmic rays, showing that the effective energy is defined robustly against exact LIS model.