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LETTER TO THE EDITOR

The absolute cosmic ray flux at sea level

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Abstract. The absolute integral fluxes of cosmic ray muons above 0·35 GeV/c at sea level are presented. The values are by 13% higher than the standard values quoted by Rossi in 1948.

The cosmic ray flux at sea level is an important geophysical quantity. The value widely used today (Barash–Schmidt 1974) is given by Rossi (1948) and is based upon measurements of Greisen (1942) with a Geiger–Müller counter telescope. Recently accurate measurements of the absolute cosmic ray flux have been performed at sea level at definite momentum intervals around 1 GeV/c (Allkofer *et al* 1970, 1971b, Ashton *et al* 1972, Ng *et al* 1974, De *et al* 1972). These measurements agree that the intensity at 1 GeV/c given by Rossi (1942) at high latitudes is too low by 25%. Using the measured relative and absolute momentum spectra and the absolute 1 GeV/c intensity we derived new values for the following quantities of the hard component as defined by Rossi (1942):

the vertical integral intensity $I_v(\mathrm{cm}^{-2}\,\mathrm{sr}^{-1}\,\mathrm{s}^{-1})$,

the total flux $J_1 = \int I(\theta)\cos\theta \mathrm{d}\omega\ (\mathrm{cm}^{-2}\,\mathrm{s}^{-1})$,

the integrated intensity $J_2 = \int I(\theta)\mathrm{d}\omega\ (\mathrm{cm}^{-2}\,\mathrm{s}^{-1})$.

The hard component is defined as the flux penetrating an absorber of 167 g cm^{-2} of lead. The new intensities have been obtained in the following way. The absolute ADC spectrum (Allkofer *et al* 1971) was integrated down to the low momentum limit of 0·35 GeV/c; this spectrum is composed of different measurements, performed with different magnetic spectrometers in the momentum range 0·2–1000 GeV/c. A form-fit (Allkofer and Jokisch 1973) to the same data in the range 0·2–10 GeV/c yields exactly the same value. Using an angular dependence $\cos^n\theta$ with $n = 2{\cdot}1 \pm 0{\cdot}1$ (Crookes and Rastin 1971), the following standard fluxes have been derived:

$$I_v = (0{\cdot}94 \pm 0{\cdot}05) \times 10^{-2}\,\mathrm{cm}^{-2}\,\mathrm{sr}^{-1}\,\mathrm{s}^{-1}$$

$$J_1 = (1{\cdot}44 \pm 0{\cdot}09) \times 10^{-2}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$$

$$J_2 = (1{\cdot}90 \pm 0{\cdot}12) \times 10^{-2}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$$

The vertical intensity is confirmed by the HW spectrum (Hayman and Wolfendale 1962) if normalized to the absolute measurements of Ashton *et al* (1972) and Ng *et al* (1974). Also the corrected measurements of Crookes and Rastin (1972) yield the same value:

$I_v = (0{\cdot}94 \pm 0{\cdot}12) \times 10^{-2}\,\text{cm}^{-2}\,\text{sr}^{-1}\,\text{s}^{-1}$. The old values of Greisen (1942) have been corrected for multiple scattering by Crookes and Rastin (1971) and give $(0{\cdot}96 \pm 0{\cdot}3) \times 10^{-2}\,\text{cm}^{-2}\,\text{sr}^{-1}$. The new values for the muon intensities above 0·35 GeV/c at sea level are by 13% higher than the standard values given by Rossi. To have corrected values for the soft and total component as well, more accurate measurements with up-to-date detectors should be performed.

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