i.e., the probability integral. If

$$E_\gamma(E_\nu - E_\gamma)/\Delta Mc^2 \gg 1, \tag{12}$$

and if we take into account the fact that the resonance is sharp, the integration limits can be replaced by $\pm\infty$ and

$$\mathcal{J} \approx \pi^{1/2}\Delta Mc^2/E_\gamma E_\nu. \tag{13}$$

If $E_\nu = E_\gamma$, then the upper limit in (11) is zero and

$$\mathcal{J} \approx \pi^{1/2}\Delta Mc^2/2E_\gamma E_\nu. \tag{14}$$

In order to obtain the sign of B_+, one has only to perform two measurements at 0 and π, i.e., for two opposite orientations. If $\langle J_z \rangle /J$ is large enough, the relative variation of σ may reach several tenths of a percent. Obviously, as is the case in other experiments of this kind, quantitative results can be obtained only if the mean lifetime of the level is smaller than the mean time interval elapsed until the first collision of the recoil nucleus occurs.

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COSMIC-RAY-PRODUCED Si^{32} IN NATURE

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The radio-isotope Si^{32}, expected to be produced in the nuclear spallations of atmospheric argon by cosmic rays, has been detected in the marine environment. Its half-life, which is as yet only known approximately as 700 years,[1] lies between those of two cosmic-ray-produced isotopes, C^{14} (5570 years) and H^3 (12.5 years). This isotope, therefore, bridges the gap in time periods which can be adequately studied by the latter nuclides. The potential significance of Si^{32} in the studies of geophysical and geochemical processes such as circulation and mixing within the oceans, and chronology of rapidly accumulating siliceous marine sediments, ice caps, etc., will be discussed elsewhere.

The production rate of Si^{32} has been calculated on the basis of the existing cosmic-ray data and the observed fall-out of another cosmic-ray-produced isotope, P^{32} arising from spallation of atmospheric argon. The global production rate thus obtained is 2.0×10^{-4} Si^{32} atoms/cm^2 sec. The corresponding inventory of Si^{32} on the earth is 28 kilocuries or 1.75 kg.

The principal exchange reservoir for Si^{32} is the marine hydrosphere, which probably receives most of its activity via the oceanic rains. Using its calculated production rate and the known concentration of silicon in oceanic waters, we estimate that approximately 100 and 40 tons of surface and deep waters, respectively, are required to yield an activity of one disintegration per minute. Sponges which lay down an opaline (silicon dioxide) skeleton derived from the silica in marine waters provide a truly natural means of concentration.

Approximately 200 grams of silicon dioxide were obtained after thorough cleansing of three inshore sponges dredged from the Gulf of California in 1956. The activity of Si^{32} was measured by counting the activity of its daughter nuclide P^{32} by milking after a period of three months. The results, to be described in detail elsewhere, conclusively proved that the observed activity was due to P^{32} produced in the decay of its parent nuclide Si^{32}.

The observed activity of 19.6 disintegrations/minute per kg Si is consistent with that calculated on the basis of the estimated production rate of Si^{32} and a mean mixing time of 2000 years between the deep and surface oceanic waters.

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