use the new type of cosmological solutions involving the angular momentum of the expanding universe (spinning universe).[5]

More detailed studies of Eqs. (1) leading to the observed abundance curve and discussion of further consequences will be published by one of us (R. A. Alpher) in due course.

* A portion of the work described in this paper has been supported by the Bureau of Ordnance U. S. Navy, under Contract NOrd-7386.

[1] G. Gamow, Phys. Rev. **70**, 572 (1946).
[2] D. J. Hughes, Phys. Rev. **70**, 106(A) (1946).
[3] V. M. Goldschmidt, *Geochemische Verteilungsgesetz der Elemente und der Atom-Arten.* IX. (Oslo, Norway, 1938).
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A Beta-Ray Spectrometer Design of Quadratic Resolution-Solid Angle Relationship

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February 16, 1948

IN a β-spectrometer for use with low intensity sources it is advantageous to collect electrons emitted by the source in as large as possible a solid angle consistent with the required resolution. In conventional spectrometers the usable solid angle, Ω, is proportional to the momentum spread, $\delta p/p$, for small δp. (δp is the half-intensity width observed for a point source of monoenergetic electrons.) The double focusing spectrometer[1] has a more favorable proportionality constant than the constant field magnetic lens ("solenoid") spectrometer. The thin-lens spectrometer has a still less favorable constant.[2] Figure 1 shows approximate Ω *vs.* $\delta p/p$ curves for these designs.

Witcher[3] has shown that the solenoid spectrometer brings monoenergetic rays having nearly the same initial angles with the axis, γ, to a "ring-focus" between the source and counter, nearer the latter (Fig. 2). By placing baffles inside and outside this ring-focus the resolution may be improved without decreasing Ω. The resolution attainable is approximately that shown in Fig. 1 for rays with $30° < \gamma < 60°$, somewhat poorer outside this range. For small Ω, $\delta p = 0(\Omega^2)$. Since the improvement in resolution attainable in this way seems not to be widely appreciated, it may be useful to direct attention to it.

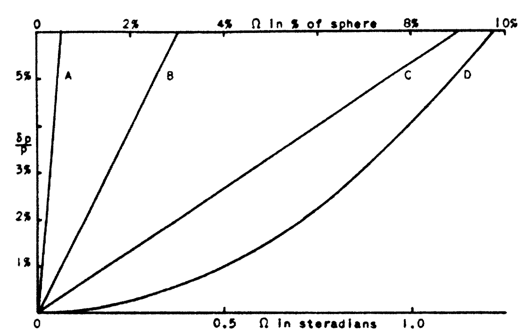

FIG. 1. Momentum resolution, $\delta p/p$, *vs.* solid angle, Ω, of rays used: (A) A typical thin-lens spectrometer.[2] (B) Solenoid spectrometer for small γ. (C) The Siegbahn-Svartholm double focusing spectrometer. (D) The ring-focus baffled solenoid spectrometer. All curves are approximate and refer only to a point source.

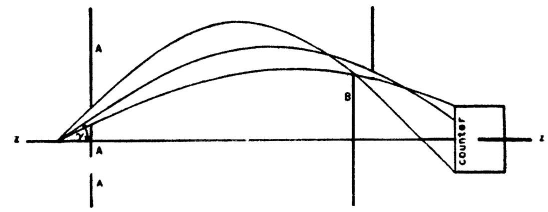

FIG. 2. Paths of electrons in a homogeneous magnetic field. $z-z$, axis of symmetry. Azimuthal motion of electrons not indicated. (A) Baffles defining range of γ. (B) Ring-focus baffles.

Changing the energy of the electrons (or the field strength) without change in the range of γ uniformly expands or contracts the paths shown in Fig. 2 about the source as the fixed point. The best resolution is therefore obtained by placing the ring-focus baffles so that their defining edges lie on a cone with vertex at the source and axis parallel to the magnetic field.

It seems likely that a similar ring-focus exists in a thin-lens spectrometer and has similar favorable properties. Thus it is probably possible to combine the copper and power efficiency of the thin-lens design with a favorable resolution *vs.* solid angle curve. The position and properties of this ring-focus could be found experimentally (e.g., by the use of moveable baffles) or by numerical integration of the electron path equations.

The source diameter just sufficient to impair the momentum resolution is of the order of $(\delta p/p)\cdot\tan\gamma\cdot$(radius of curvature) for the solenoid spectrometer either with or without the ring-focus baffles. Thus when an extended source is desirable (e.g., with a source of low specific activity) the improvement in counting rate at fixed resolution shown in Fig. 2 is genuine, while the improvement in resolution at fixed counting rate is in part specious.

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[3] Clifford M. Witcher, Phys. Rev. **60**, 32 (1941).

The Hard Component of Cosmic Radiation as Affected by the Variation in Air Mass Distribution with Latitude

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IT is the purpose of this note to call attention to a phenomenon which will complicate the interpretation of the latitude effect. The variation in height of the main mesotron production region with geographic latitude introduces variations in the intensity of the hard component comparable to the variations presently attributed to the geomagnetic latitude effect.