TABLE I. Thresholds for photo-nuclear reactions.

Parent isotope	Activity detected	Observed threshold (Mev)	Other work* (Mev)
I^{127}	13 d. β^-	9.45 ± 0.20	
Pr^{141}	3.5 min. β^+	$9.8\ \pm0.3$	9.40 ± 0.1
As^{75}	16 d. β^-, β^+	$10.3\ \pm0.2$	
Zr^{90}	4.5 m. e^- 78 h. β^+	$12.1\ \pm0.1$ \} Average $11.9\ \pm0.3$ \} 12.0 ± 0.2	12.48 ± 0.15
Ni^{58}	36 h. β^+	$11.7\ \pm0.2$	

* Hanson, Duffield, Knight, Diven, and Palevsky, Phys. Rev. **76**, 578 (1949).

The results are shown in Table I. Zirconium[90] decays either by 78-hour positron emission, or by 4.5-minute internal conversion or K-capture. The apparent threshold for the photo-disintegration of Zr^{90}, as determined by observation of the 78-hour period, was slightly less than that determined by observation of the 4.5-minute period. If the 4.5-minute period represents the decay by isomeric transition into the 78-hour isotope, one would expect the threshold observed by means of the 78-hour period to be somewhat less than that observed by the 4.5-minute period. However, since the errors quoted for the thresholds overlap, it is probably more logical to take 12.0 ± 0.2 Mev as a mean value for the gamma-n threshold of Zr^{90}.

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[1] J. Mattauch, *Nuclear Physics Tables* (Interscience Publishers, Inc., New York, 1946).
[2] McElhinney, Hanson, Becker, Duffield, and Diven, Phys. Rev. **75**, 542 (1949).

True Magnitude of the Geomagnetic Secular Variation

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In order to analyze the geomagnetic secular variation in physical terms one extrapolates the surface field so as to obtain the field at the boundary of the earth's core[1] (this boundary, designated here by C, is almost halfway down to the earth's center). It follows from potential theory that the secular field at C is uniquely determined by the corresponding surface field under the highly plausible assumption that there are no sources of this field in the intervening layer. The extrapolation is usually carried out by means of a spherical harmonic analysis, but at C the series converges too slowly to be of much use. Vestine's[2] detailed maps of the secular variation show that the phenomena may be graphically described by a number of moderately rounded "hills", some positive, some negative, where the lines of constant rate of change of the field or potential are the contour lines of the hills. There are some 10 to 11 hills and dales on the whole earth at the present time.[3]

It is possible to achieve projection upon C of an individual "hill" having a circular boundary; for this purpose we employ solutions of the potential equation which vanish at the surface of a cone of half-angle ϑ_0. They are

$$\psi=r^{-n-1}P_n{}^m(\cos\vartheta)e^{im\varphi},$$

where n is non-integral, defined by $P_n{}^m(\cos\vartheta_0)=0$. The surface harmonics form an orthogonal set over the circular section of the sphere cut out by the cone. For not too large values of ϑ_0 (up to about 55°), $P_n{}^m$ is well approximated by the Bessel function, $J_m[n^{\frac{1}{2}}(n+1)^{\frac{1}{2}}\vartheta]$. In practice the leading term of this series is by far the most useful, as for the higher terms n is so large that r^{-n-1} varies too rapidly to be significant, given the limited accuracy of the data. It follows from the orthogonality that the magnitude of the leading term furnishes, at any level below the surface, a lower limit for the r.m.s. value of the potential or field over the circular area. Numerical tests show that the observed hills, on averaging over the deviations from roundness, are well approximated by the lowest term in J_0.

For preliminary computations we have used Vestine's[2] maps of the variation of the vertical field component. These were replaced by an assembly of 10 to 11 circular regions whose aggregated area about equals that of the earth. The size of each region and the difference of the field at the center and at the circumference were chosen to correspond to the actual features of the maps. The radii of the regions range from 23° to 50°; the first term of each expansion gives an r.m.s. value at C, ranging between about 0.15 and 1.5 gauss/century, for individual regions. The grand total r.m.s. value is near 0.7 gauss/century (estimated error, 20 percent). Now the mean lifetime of these centers of secular variation is somewhat less than a century; hence on integrating over the mean lifetime it may be concluded that the secular variation corresponds to a fluctuating field at C whose vertical component has an r.m.s. magnitude of at least 0.5 gauss. The r.m.s. value of the vertical component of the main dipole field at C is 1 gauss; hence the variable part of the field is certainly not small compared to the constant part at C. These results seem to favor the explanation of both parts of the field by a common hydromagnetic mechanism proposed by one of us[1] as compared with the assumption of a separate "fundamental" origin of the dipole component parallel to the earth's axis.

[1] W. M. Elsasser, Rev. Mod. Phys. **22**, 1 (1950).
[2] E. H. Vestine, Carnegie Institution of Washington Publications, Nos. 578 and 580 (1948).
[3] See some of Vestine's maps reproduced in reference 1.

A Determination of the Dipole Moment and Molecular Structure of Fluorosilane

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We have measured and identified the three rotational absorption lines arising from the $J=0\rightarrow1$ transitions of $Si^{28}H_3F$, $Si^{29}H_3F$, and $Si^{30}H_3F$. The spectrum consisted of a single absorption line for each molecular species and so is in harmony with present ideas that the Si^{28} and Si^{30} spins are zero and that Si^{29} spin is 1/2. It is possible that these spins might be incorrect if the nuclei had very small quadrupole coupling constants which resulted in an unresolvable hyperfine structure. The measured and derived constants are listed in Table I.

In principle one could determine unambiguously the three structural parameters of such a symmetric top molecule since moments of inertia have been measured for structures corre-

TABLE I. Molecular constants for SiH_3F (transition $J=0\rightarrow1$).

Species	ν_0(mc/sec.)	$I_B\times10^{40}$ (g-cm²)	B_0 (mc/sec.)
$Si^{28}H_3F$	$28{,}655.80\pm0.1$	58.555	14327.9
$Si^{29}H_3F$	$28{,}393.4\ \pm0.2$	59.096	14196.7
$Si^{30}H_3F$	$28{,}145.2\ \pm0.2$	59.617	14072.6