cm being applied, the pulses produced by α-rays of polonium or thorium were very sharp. The time constant of the amplifier was 10^{-3} sec.

The number of ions was generally of the same order as measured in an ordinary gas chamber; the number of registered pulses was smaller than the number of the absorbed α-particles.

In spite of the homogenous energy of the α-particles the magnitudes of the single pulses were very different from one another. Special experiments proved that the reason for this result was not the difference in pathway between the place of origin of the electrons and the anode.

Alpha-particles penetrating the crystal either at the anode or at the cathode side produced about the same distribution of pulses.

Single outstanding values of pulses of higher energy than that of a single α-particle were sometimes registered. The same field strength being applied saturation in photoconductivity was measured as expected.

For the explanation of the results the following may be pertinent: The α-particles penetrate only the surface layer of the crystal. Further the density of ionization by light is quite different from the ionization by α-rays which produce local lattice disturbances because of their high ionization density.

A sudden discharge of [the produced] space charge may be considered as an explanation of some of the pulses, especially the larger ones.

Regarding the experiments mentioned above, it is believed that a quantitative measurement of the number and energy of the single α-particles was not achieved.

The diamond crystals investigated up to now for crystal counters have very different properties, although all of them possess photoelectric saturation.

Some of the diamonds are quite insensitive to α-rays (P. J. Van Heerden; Wooldridge, Ahearn, and Burton).

Other crystals show the inhomogenous pulses mentioned above. It is of interest to note from the investigations of Wooldridge, Ahearn, and Burton that diamonds exist which possess the qualities necessary for a quantitative measurement of single α-particles.

[1] P. J. Van Heerden, *The Crystal Counter*, Dissertation, Utrecht 1945; D. E. Wooldridge, A. J. Ahearn, and J. A. Burton, Phys. Rev. **71**, 913 (1947); Robert Hofstadter, Bull. Am. Phys. Soc. **22**, No. 4 (1947).
[2] G. Stetter, Verh. d. D. Phys. Ges. **22**, 13 (1941).

Note on Gamma-Radiation from Europium

J. M. Cork, R. G. Shreffler, and C. M. Fowler
Department of Physics, University of Michigan, Ann Arbor, Michigan
November 19, 1947

On reporting the energies of the gamma-rays emitted by radioactive europium 154 it was noted that two spectral lines had the expected relative intensity and exactly the energy difference to be expected for conversion K and L electrons in the element of atomic number 61. This was interpreted as possibly indicating an impurity of neodymium in the bombarded specimen of europium, although no long half-lived isotope of neodymium is known. Continued observation has shown that this agreement with the K–L difference in element 61 is purely fortuitous and that these two lines have the same half-life as the other europium lines, namely, about 6 years. They are therefore K conversion lines in gadolinium, of energy 197.0 and 235.7 kev derived from gamma-rays of energy 247.3 and 286.0 kev. These new energies lead to an interesting combination as part of a level diagram since the 286 kev added to the previously reported 122.1 kev gives 408.1 kev, which is very close to the previously reported gamma-ray at 407.8 kev.

On Magnetism of Celestial Bodies

Jean Mariani
Institute for Advanced Study, Princeton, New Jersey
November 12, 1947

The proportionality between the magnetic moment and the angular moment of celestial bodies in the case of 78 Virginis has recently been verified by Mr. H. Babcock.[1] It seems possible to give a theoretical interpretation of that new natural law in the following way.[2]

The motion of a continuous, perfect fluid, without internal pressure, in an electromagnetic field not sensibly perturbed by it, is given by the ordinary Lorentz force, which yields the equations:

$$du_i/ds=(\sigma_0/\rho_0c^2)F_{ij}u^j=w_{ij}u^j, \qquad (1)$$

σ_0 being the proper charge density of the fluid, ρ_0 its proper mass density, $u^i=dx^i/ds$ its four-dimensional velocity at each point, $F_{ij}=\varphi_{i,j}-\varphi_{j,i}$ the external electromagnetic field (the gravitation effects being neglected). When σ_0/ρ_0c^2 is constant in the domain occupied by the fluid, we easily get:

$$w_{ij}=u_{i,j}-u_{j,i}=(\sigma_0/\rho_0c^2)F_{ij}, \qquad (2)$$

from analytical dynamics, by writing (1) in canonical form; consequently,

$$u_i=(\sigma_0/\rho_0c^2)\varphi_i+\partial F/\partial x^i. \qquad (3)$$

Thus, u_i may be regarded as a determination of φ_i, which seems to furnish a very natural geometrization of electromagnetic field, but, in classical electromagnetism, we are dealing in this way with several difficulties.

First, in the general case of a fluid charged in the Maxwellian sense σ_0/ρ_0c^2 has an arbitrary value; second, the φ_i are defined in the whole region occupied by the field and the u_i only interior to a certain light cone and require the presence of matter (from a remark of Professor Einstein), but we must notice that electromagnetic field has no existence "in self," contrarily to the classical assumption. For its determination at each point, we need at these points a fluid composed of test particles whose motion is governed by (1), otherwise the field remains indetermined.

In a peculiar case, we may determine uniquely σ_0/ρ_0c^2, in order to satisfy the theory. If we suppose that rotation and electromagnetic field are uniquely associated, when a fluid regarded as neutral in classical theory is in rotational