3. Pauling and Others Comment On the Moon Model

We reprint here a few of the responses received to the 1988 article on the Moon Model by Laurence Hecht ("The Geometric Basis for the Periodicity of the Elements," 21st Century, *May-June 1988, p. 18). This article, available on the* 21st Century *website, was the first published elaboration of Robert J. Moon's hypothesis on the structure of the atomic nucleus. These letters and Hecht's replies appeared in the September-October 1988 issue of* 21st Century.

Pauling: Does It Match Experimental Data?

To the Editor:

. . . It seems to me that while Dr. Moon's ideas about the atomic nucleus in relation to the five Platonic solids might have some aesthetic appeal, it is highly unlikely that they have any significant validity. They seem to me to be incompatible with a great amount of experimental information that exists about the properties and structures of atomic nuclei.

. . . I shall mention one example. There are many experiments, such as the diffraction pattern of high-energy electrons from the nucleus, and the values of the rotational energy levels, that show that lead-208 has essentially a spherical structure in its normal state, and also that the nuclei of radon and protactinium are quite close to spherical. Dr. Moon's structures, shown on page 25, indicate a prolate structure with axial ratio about 2. This is a serious difference with experiment.

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The Author Replies To Pauling's Criticism

Perhaps truth and beauty can, after all, be reconciled.


EIRNS

Linus Pauling (1901-1994)

Dr. Moon points out that the data of high-energy electron diffraction pattern scattering must be interpreted very carefully. According to classical physics, the electron, though of slight mass, is in fact a large object when compared to the nucleus—the exact size depending on various assumptions, including a spherical shape and whether the charge is distributed throughout the whole volume or the shell only. On acceleration, the additional problem presents itself that most of the charge appears, to the slower moving observer, to be flattened out into the shape of a disk.

While a "point" electron could distinguish the finer aspects of shape in the nucleus, we have no justification for assuming that that is its shape. Indeed, just what an electron looks like is among the most speculative and controversial matters in modern science. (For example, see W.H. Bostick, "The Morphology of the Electron," in the *International Journal of Fusion Energy,* Jan. 1985, p. 9.) But assuming an electron somewhat larger than the "ideal point," we see that there are two interpretations that could be given to the appearance of sphericity in the data. A large electron would be unable to distinguish the dumbbell-like shape of two dodecahedra from two spheres, especially where a large number of atoms is being examined.

In that case, the apparent sphericity of 82-lead-208, 86-radon, and 91-protactinium is just as we should expect from Moon's nuclear model: Protactinium is two complete dodecahedra, joined at a single vertex. Radon is two dodecahedra joined at a face. Lead-208 (the most abundant isotope) is one complete dodecahedron and a complete icosahedron, surrounded by a very stable dodecahedral configuration with 16 of the 20 vertices filled.

—Laurence Hecht

Usefulness Questioned

To the Editor:

I do not think that the hypothesis on the structure of the elements is useful. There have been many such attempts before, and complete books have been devoted to listing them. We just have to accept that the microworld in which quantum mechanics operates is different from the world of the scale of our everyday lives.

Similarly, the world on a cosmological scale is again different. Just as man made God in his own image so there is tremendous pressure to make everything else anthropocentrically and it is not necessarily so. I would recommend the textbook *Lectures on Physics* by Richard Feynman as a more reliable guide.

The deficiencies of adequate scientific education at an elementary school level cannot readily be remedied by popular magazines. Look at the state of education in the White House!

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Stuart Lewis/EIRNS

Friedwardt Winterberg in June 1985, at a memorial conference for space scientist Krafft Ehricke.

Does the Nucleus Have Crystal-like Properties?

To the Editor:

The article on the geometric structure of the nucleus is indeed very interesting. It all boils down to the question, does the nucleus (to some extent) have crystal-like properties.

In fact, very recently two other scientists, Cook and Dallacasa, have posed the same question (see "Face-centered-cubic Solid-phase Theory of the Nucleus," *Physical Review C*, Vol. 35, No. 5, May 1987, and "A Crystal Clear View of the Nucleus," *New Scientist*, March 31, 1988).

However, because both the liquid drop and shell models of the nucleus are quite successful as well, these models cannot be suddenly altogether wrong. It may be, as it has been in other areas of science before, that the truth is somewhere in between. The nucleus is almost certainly superfluid, exhibiting a large energy gap, and it may perhaps be a superfluid liquid crystal.

The theory of liquid crystals was pioneered by the Soviet physicist J. Frenkel, but I could not find any reference in his work on superfluid liquid crystals. Only [Richard] Feynman did something along these lines to explain the rotons in superfluid helium predicted by [the Soviet physicist L.D.] Landau.

Dr. Friedwardt Winterberg
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Dr. Moon's Comments on Linus Pauling's Criticism

A summary by Laurence Hecht of a telephone discussion with Dr. Moon on Linus Pauling's criticism of the Nuclear Model, June 8, 1988.

If Linus examines it further, he'll see that the dumbbell shape does not contradict the experimental data. There are two interpretations of the diffraction patterns you can expect from high-energy electrons. Since you are dealing with a large number of atoms and since they are oriented and lined up, it is hard to distinguish a dumbbell from two spheres.

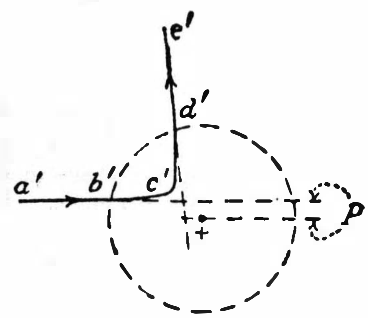
You have the problem: How does a big electron tell you about something so small, in comparison, as a nucleus. The energy of the electron, according to classical theory, is supposed to be added in the form of a ring. If accelerated in an electric field, it polarizes and lines up with the field. Accelerate a spherical electron, which has an electric field in all directions outward from the sphere, and you get a magnetic field perpendicular to the electric field. On acceleration, it flattens out so most of the charge is in the shape of a disk. Most things under high energy do this.

A point electron could distinguish the finer points of shape in the nucleus, but not a fast one. The question is, how does the shape of an electron appear to an object it is approaching at near the speed of light. You [Larry] should look up how this is regarded in quantum mechanics in regard to the electric and magnetic dipole moments—particularly, is the magnetic dipole a thin disk?

You can also look at the scattering of neutrons. Rutherford did this, but using only classical mechanics without the acceleration term from Weber. When [Dr. Moon] took into account the acceleration term, [he] found a very different size for the nucleus than is commonly accepted. Rutherford's paper on the "Distance of the Closest Approach" has never been corrected for this. (Cf. p. 41.)

You thus get something very fundamental here which could open up a lot of important things.

MOON'S CORRECTION OF THE RUTHERFORD ATOM



Source: Richtmyer and Kennard, *Introduction to Modern Physics* (New York: McGraw-Hill, 1947)

The diagram depicts an alpha particle (double positively charged helium nucleus) sharply deflected, along the path from a' to e', by the positively charged nuclear core. In Rutherford's classic experiment of 1910, alpha particles were aimed through a sheet of metallic foil and detected on a screen placed normal to the path. From the measured angular deflection of the particles, conclusions could be deduced about the nucleus. However, Rutherford assumed that no effect resulted from the relative velocity and acceleration of the charged particles. Moon's calculations taking this into account, showed a much closer approach to the nucleus.