Supplemental Material for Chapter 6, "Creationist School"

Details of RATE Group Suggestions for Mechanisms of Accelerated Decay

Version 1.0

The RATE (Radioisotopes and the Age of The Earth) group has offered a number of suggestions for the mechanism of accelerated decay, one of which involves a small change in the nuclear (strong) force, which would effectively change the radii of atomic nuclei.* This is significant, because half-life of radioactive isotopes is extremely sensitive to *R*. Creationists observe that standard quantum mechanics allows us to calculate these half-lives, and this calculation has been done for radium 226 (Ra^{226}). [1] If the radius of this isotope's nucleus doubled, corresponding to a reduction in meson mass by a factor of two, its half-life would decrease by a factor of several trillion, going from billions of years to merely days. The assumption (or working hypothesis) is that during some part of Creation Week, "…God changed meson masses [which affects the radius], and possibly other factors to a lesser degree."[2] This of course would account for the old dates of rocks given by radiometric measurements, but requires that God change them multiple times as indicated in Figure 6-8 of the book. But it does not entirely solve the problem, however, for the following reasons:

(1) It does not account for the old dates assigned to fossils by the radiometric methods, unless they formed prior to the accelerated decay period.

(2) It does not explain what happened to all of the heat which would be generated by the accelerated decay.

(3) It does not deal with other crucial effects, such as the possible disintegration of all matter entailed by such a change in the strong force, or the effects of accelerated nuclear reactions in stars.

Creationists have addressed (2), at least, by postulating rapid expansion of the cosmos at the same time. Item (3) is addressed but only speculative answers are given, such as God

---

* This is done by changing the mass of the gauge bosons, and specifically, the π meson. The radius *R* of the nucleus depends on the cube root of the atomic number, *A*, and inversely on the mass of the π meson, m_π,

$$R \propto \frac{A^{1/3}}{m_\pi}$$

This explanation is for one type of nuclear decay, that by emission of alpha particles, or α-decay, as it is known. Another type, β decay, operates by emission of an electron, but is not as well understood.

changing the range of all forces, not just the strong nuclear force. Creationists speculate that if the change in meson mass occurred later as well, it may have triggered "catastrophic plate tectonics events which brought about the Genesis Flood",[3] as well as "catastrophes in the solar system, such as cratering, volcanoes, and the past tectonic activity on Mars and Venus".[4] There is, however, no corroborating evidence for the proposed catastrophic events. Moreover, the increased radiation may have killed Noah and his family on the Ark.[5] Such a late period of accelerated decay, however, may help to resolve (1). As far as experimental tests are concerned, some ideas are mentioned, but nothing which could be regarded as definitive.

Another approach to the problem deals with the Kaluza-Klien theory, which can be used to derive the fine structure constant α. The reason this is important is that the fine structure constant is intimately involved with the rate of radioactive decay. If the fine constant varied in the past (there is no direct evidence for this) then the rate of radioactive decay could have been greatly accelerated. The challenge to those who advocate this theory, as with any physical theory, is to develop it further and seek such empirically testable predictions. In addition, all the problems mentioned with the proposed change in the nuclear (strong) force still remain unresolved with this approach.

An alternative explanation, which does not require any change of physical constants, makes use of recent evidence that under the proper conditions, some types of radioactivity can accelerate by up to nine orders of magnitude (one billion times).[6] Decay rates can also be accelerated substantially at high temperatures, with an isotope of lutetium, Lu^{176}, decaying by a different path of half-life 3.68 hours instead of 41 billion years—a change of 14 orders of magnitude.[7] However, this line of reasoning quickly runs into insuperable difficulties. The reason is that the temperatures involved are so high—200 million to 600 million K—that they would instantly vaporize any matter present (note that the temperature of the sun's core is only about 15 million K).

---

[1] Humphreys, 2000, p. 361, after Evans, R. D., *The Atomic Nucleus*, New York: McGraw-Hill, 1955, p. 77.
[2] Humphreys, D. Russell, "Accelerated Nuclear Decay: A Viable Hypothesis?", *Radioisotopes and the Age of the Earth*, ed. by Larry Vardiman, Andrew Snelling, and Eugene Chaffin, El Cajon: Institute for Creation Research, 2000, p. 360.
[3] Humphreys, 2000, p. 369.
[4] Humphreys, 2000, p. 356.
[5] Humpheys, 2000, p. 373-374.
[6] Woodmorappe, John, "Billion-fold acceleration of radioactivity demonstrated in laboratory", *Creation Ex Nihilo Technical Journal* **15**(2):4-6 (2001).
[7] Kappeler, F., Beer, H., and Wisshak, K., "S-process nucleosynthesis—nuclear physics and the classical model", *Reports on Progress in Physics* **52**:1006-1008, 1989.