MINISYMPOSIUM ON VARIABLE CONSTANTS—III

CHANGING CONSTANTS AND GRAVITATION

DON B. DEYOUNG*

Received 11 September 1989; Revised 8 November 1989

Abstract

Implications of variation in physical constants are discussed. Efforts to measure change in the gravitational constant are summarized.

Introduction

Some physical constants are not really permanently invariable. For example, the *Hubble constant* supposedly relates the speed of galaxies with their distance from Earth. However, the Hubble value is very uncertain and is changed drastically from time to time, sometimes by doubling or halving. The *solar constant* is a measure of sun power that arrives at the Earth's surface. Since the sun is somewhat variable in its light output, the solar constant varies continually on a small scale. Most other constants, from the electron mass to the Boltzmann constant, are measured to many decimal places and have always been assumed fixed. This assumption is seldom questioned, although it has recently been of interest to both creationist and secular scientists.

Implications

Table I summarizes the positive and negative sides to the issue of constancy in nature. From the Biblical perspective, one cannot argue dogmatically that the constants of nature should or should not vary. Scripture makes no explicit statements as to the constancy of light speed or gravity. In view of the overall deterioration of Creation, theological support is somewhat in favor of nothing being absolutely constant in nature. However, creationists need to be reminded of the seriousness and the implications of challenging science with respect to the values of basic constants. It should never be done lightly or in an *ad hoc* way to solve present problems. Most constants, including the speed of light, have been tested over many years of experiments. Creationists have grown accustomed to questioning mainstream science, and rightly so. In doing so, however, clear, strong unambiguous evidence needs to be present.

Table I. Summary of Ideas in Support of Changing Constants and Related Cautions (see article for explanation).

Perspective	In Support of Change	Caution
Biblical	Since the curse, the entire physical creation is degenerating.	The Creator upholds (bears, carries) all things by the word of his power (Heb. 1:3). The Lord does not change (Mal. 3:6).
Creation science	A slowing c solves several problems.	Not all implications of a changing c have been considered. A decreasing G, as a different example, would support the self-formation of stars in the past.
General science	Many constants are currently being checked for variation or modification: c, G, proton lifetime, etc.	Beware of joining the bandwagon of contemporary science.

c—speed of light; G—gravitational constant.

Gravitation

If one is looking for "variable constants," the universal gravitational constant G would seem a likely candidate. The value of G is remarkably independent of all the other physical constants, which typically form interconnecting sets (Cook, 1987, p. 71). That is, a change in value of the speed of light or the electron mass has consequences for several other constants. A variation in G, on the other hand, is not "locked in" to other physical constants. The constant G controls the force F of gravitational attraction between any two objects of mass m_1, and m_2, separated by distance d,

$$F = \frac{Gm_1m_2}{d^2} \qquad (1)$$

G was first measured by the English physicist Henry Cavendish, nearly a century after Newton had first announced the gravitational relationship in 1687. Cavendish used a torsion balance to detect small changes in the gravitational attraction between metal spheres. This method continues today with precision to four decimal places (Cook, p. 74),

$$G = 6.6726 \times 10^{-11} \frac{\text{newton} \cdot \text{meter}^2}{\text{kilogram}^2}$$

This value is less precise than most other constants, which are often known to six or more decimal places. The problem is that the local gravity force is very weak, and a torsion balance experiences competing forces from convection currents.

There are two chief reasons why theoretical science is in favor of a decaying G value. This does not simply refer to a change in local gravitational acceleration values due to density, or to some "non-newtonian" addition to equation (1). Instead, the reference here is to a basic universal variation in gravity. The *first* reason for support of change is that decaying gravity is basic to many theories of a slowly evolving universe, including some of the currently popular "grand unified theories" (Will, p. 202). The *second* reason is that a stronger gravitational attraction in the past

*Don B. DeYoung, Ph.D., is editor of the *CRSQ*.

could be responsible for the initial formation of stars and galaxies. Astrophysicists have always had difficulty explaining the presence of these compact objects in a universe which is dissipating, or "thinning out" (DeYoung, 1989, p. 76).

Experiments to determine a change in the value of G have thus far been unsuccessful. Methods include analysis of ancient eclipse data, and lunar laser-ranging experiments. Will lists 10 tests performed on G during the 1970's (Will, 1981, p. 203). Three of the results hint at a possible G variation of infinitesimal range, but other researchers have pointed out errors in these reports (Will, p. 203). The constant G has not cooperated in showing a decay that would be beneficial to either universal evolution or spontaneous star formation.

Conclusion

The search for a variation in the gravitational constant has proved negative. This has implications for current creationist thinking. If natural constants do indeed change, gravity should be one of the best candidates. Also, if a particular constant such as the speed of light does indeed change, others would also likely change. This is not the case for the universal constant of gravitation.

References

DeYoung, Don B. 1989. Astronomy and the Bible. Baker Book House. Grand Rapids, MI. (available from CRS Books)

Cook, A. H. 1987. Experiments on gravitation. Hawking, S. W. and W. Israel (editors). Three hundred years of gravitation. Cambridge University Press. New York.

Will, Clifford M. 1981. Theory and experiment in gravitational physics. Cambridge University Press. New York.

PANORAMA OF SCIENCE

Lucifer on the Loose

When you excite *Cypridina,* Lucifer's on the loose.

Well, perhaps that needs some explaining; but the word to express it probably is not much help either. The answer to the riddle hides under the diabolical-sounding title of bioluminescence.

By the time you have waded through those six or seven syllables, no doubt you are ready to turn out the light. But that is what it is all about. Here is a beastie that can turn himself on, as that six-cylinder word refers to living organisms which can generate their own light.

And this one can light up even after it is dead. The tiny crustacean *Cypridina* illustrated on the cover lives in the ocean and is only about the size of a pinhead. Yet it has the unique property of providing its own light as it comes out to feed at night. This is accomplished by a chemical reaction triggered by an enzyme.

The shells of this amazing flashlight retain their light-giving quality even after being dried; they may be stored and kept for years, yet will glow with a soft blue light when moistened again. A cupful will produce enough light to read two paragraphs. In fact during World War II, Japanese soldiers used a handful of dried *Cypridina* to read their maps during blackout when conventional flashlights were too risky.

One of the remarkable aspects of this bioluminescence is the amazing diversity of organisms that have "developed" this bewildering ability to generate light. They include members of almost all the so-called "simple" animals and plants, such as clams, crustaceans, fungi and insects, to name just a few. Representatives of the evolutionary tree from amphibian up through mammal are conspicuously absent from this flashy fraternity.

Why has not man developed some kind of spotlight on his head to guide him in the night? Ludicrous? The beetle *Phrixothrix* has both head and tail lights! Surely man should be able to outdo some baroque bug. Evolution is supposed to progress from the simple to the complex, and here is a process that is far from simple. One of the criteria for the age and arrangement of the geologic column is the degree of complexity. Certainly *Cypridina* and its "simple" cousins should upset the strata. Dare we say that they could throw a lot of light on the subject?

Many of those animated sparklers use their unique beacon to aid in feeding or flirting; but for some, notably the bacteria and fungi, there seems to be no apparent purpose or necessity for this ability. The burning (no pun!) question of course, is why and how these seemingly naive organisms were able to compound some rather exotic chemicals to produce a cold light, plus a triggering mechanism to turn it on and off.

But the most acrid accent of that light is the chemical which is secreted to produce it. Ironically, it is called Luciferin, which means "brightness" or "light-bearer"—named after Lucifer who was Satan, the fallen angel of light that rebelled against God. With its enzyme luciferase, one molecule of luciferin will produce one photon of light. The genus *Cypridina* refers to Aphrodite, the licentious goddess of love and fertility. Thus we are reminded of a false light, typical of the Devil's deception. Satan's delusions are always counterfeit. This light substitute has no vital power of radiation and cannot promote life. Its only function in these animals is to perplex and confuse. It can only disturb and distract. Nor can we generate our own spiritual (or even scientific) light; it would only deceive ourselves as well as others around us; a deception which is amplified by rejection of God's light and revelation of creation.

Willis E. Keithley*

*1819 N.W. 25th, Lincoln City, OR 97367.

Evolutionism: Punctuational Gradualibria?

The evolutionist camp would seem to be divided into two major factions. There are those who continue to hold to the tenet of uniformitarianism, the notion that evolution has proceeded in small, gradual steps over vast periods of time. The opposing forces have proposed long periods of stasis for evolution, punctuated by short (in geological terms) dramatic changes. Such debate, however, would seem to be nothing more than a simple rehash of an old idea under a new label.

> On November 23, 1859, the day before his revolutionary book hit the stands, Charles Darwin received an extraordinary letter from his friend