ON THE ORIGIN OF THE UNIVERSE

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Most scientists interested in the problem of the origin of the universe fall into two classifications: those who believe in the Evolutionary Theory and those who are proponents of the Steady-State Theory. The Evolutionary Theory school of thought is generally divided into three subdivisions:

(1) Those who conceive a universe starting at a point origin at a finite time in the past and expanding continuously to become infinitely large after an infinite time.

(2) Those who conceive a universe whose radius has a certain finite value at the initial moment of time, and thence expands to become infinite after an infinite time.

(3) Those who conceive a universe which expands from zero radius to a certain maximum and then collapses to zero again, this process of oscillation being capable of indefinite repetition.

The Steady-State Theory school of thought holds that the creation of matter is taking place continuously, and that although the stars and galaxies evolve from their basic material, the universe, when considered as a large-scale structure, is in a steady state. This group of scientists further holds that individual galaxies change but the average spatial density remains the same, because matter is always in creation in space.

One of the areas for controversy lies in the determination of that "point of origin at a finite time in the past" described above in (1) under the Evolutionary Theory. The effort to date the universe by dividing the distance to the furtherest star by the speed of light is full of errors and pitfalls.

A review of basic physics involving light is in order at this point. We know that studies in light are most effective through the forms of photons (small amounts) and light waves (large amounts). Photons are quanta of matter, or wave-packets. Light waves, as discussed by Huygens and Young, travel at a velocity of 3×10^{10} cm./sec., or 186,000 miles/see. The velocity of light is independent of intensity, and color variations do not affect the velocity of light. In working with photons, we know that their energy (e) is the product of the frequency (f) times the universal constant (h) of 6.56×10^{27} ergs X sec or $e = hf$. Planck attacked the problem of determining theoretically the experimentally known law for radiation of a perfect radiator and in 1900 ascertained that the energy of the atomic radiators could not be very infinitesimal amounts but only in certain steps or units, the size of each unit depending on the frequency of the radiator. Planck proposed that the radiation itself was emitted in small but definite bundles of energy. These units varied in size with the frequency of the radiation in accordance with the relation:

$$\text{Energy} = Ev = hv = h \frac{\text{velocity of light in free space}}{\text{wavelength of radiation}}$$

wherein "v" is frequency of radiation emitted (or absorbed) and "h" is the *Planck Quantum Constant* which is equal to 6.56×10^{-27} erg-sec. The frequency, of course, can be ascertained by dividing the speed of light (c) by the wavelength (L), thus

$$e = \frac{hc}{L}$$

The tools for studying light are photometers, which indicate the brightness of light; radiometers, which denote the heat emitted by celestial bodies; and spectrographs, the equipment which disperses radiation into its constituent wave lengths (spectrum). In recent years, we have seen the promising use of new space physics tools such as the satellite and the space probe.

Of great importance, and to the detriment of all observational data, are the many problems encountered that negate the value of the observed data. The earth's atmosphere has an absorbing and distorting effect on astronomical observations. Even in the space vehicle observations we note the bothersome Doppler shifts produced by orbital velocities and the back-scattered light produced in disturbing amounts by the means of the atmosphere. The observed 'red shifts' might possibly be distortion due to matter in the atmosphere or even true velocities of recession. Rapidly receding nebulae appear fainter than a stationary object at the same distance and a negative correction increasing with distance must be applied to the observed apparent magnitudes. When the correction is applied, the simple linear relationship between velocity and distance no longer holds. The determination that the system of radiation belts and clouds of ionized plasma enveloping our planet and filling a volume in space many thousands times greater than the solid Earth introduces further interference phenomena in the optical, as well as radio astronomy, observational techniques.

When one considers the distances involved when measuring star locations by the methods of parallactic displacement, by apparent brightness comparisons, and the pulsating stars (Cepheid variables), it is little wonder that distance measurement techniques have been questioned by many scientists. In the apparent brightness criteria alone we observe variables among supergiant stars, super-

novae, nebulae, and nebulae clusters. What of the multitude of nebulae numbering thousands, that could be placed in our system?

Current research is dependent upon the tool of radio astronomy to reach out beyond the present limits that optical tools give us. Even now, some researchers are convinced that radio astronomy has enabled them to detect hydrogen gas 'lining the spiral arms of the universe' with strange radio 'noises' coming from the central regions of the universe. These conclusions are based on certain similarities with the size, structure, and composition like Andromeda Nebula. But with the various problems affecting the reception of the data, especially the distortion of light by the atmosphere and the radio interferences, one wonders at the various approaches to the problem.

The writer has long been a proponent of the idea that light is scattered by gas molecules in the atmosphere. In refraction of light studies, we know that the relative index of refraction (n_r) is a function of absolute indices (n_a) of refraction for the media penetrated, or:

$$n_r = \frac{n_{a2}}{n_{a1}}$$

The fact that the velocities of stars are small compared with the velocity of light indicates that the nature of the universe as a whole is at rest. Some will ask is our own galaxy an outrider in a supergalaxy? Are clusters distributed irregularly Or are they scattered at random more or less uniformly through space? I am quite convinced that we are seeing only a small part of the universe, especially when we note that the sun is 8 light-minutes from our earth, 5 light-hours from Pluto, and 4 light-years from the next nearest star.

The invalidity of present-day age determinations of the universe can be summarized rather conclusively as follows:

(1) Satellite investigations of the stars, the nebulae, the interstellar medium, and external galaxies are hampered by the (a) faintness of the sources and (b) the stringent requirements for accurate guidance and control.

(2) The work of Friedman (Naval Research Laboratory) shows that the entire night sky is aglow with diffuse Lyman-a emissions which appear to be solar radiation back-scattered by cold neutral hydrogen either in the interplanetary medium or in a cloud surrounding the earth. Radiation at about 1300 A was detected with a high intensity from several sources, some of which coincide with visible nebulae and others which do not.

(3) The question is raised as to whether the interstellar absorption of neutral hydrogen is not so great as to screen effectively not only Lyman-a from even the near-by stars, but also all radiation for several hundred angstrom units below the Lyman series limit at 912 A.

(4) The absorption of the interstellar medium thwarts abundance studies of the elements of space.

(5) The investigation of galactic and extragalactic sources in radio astronomy techniques below 20 Mc/sec. are turned back by the ionosphere.

(6) Cosmic radio noise, observed on the ground at low frequencies, interferes in radio astronomy studies and are thought to come from thermal and non-thermal processes, as well as from galactic and non-galactic sources.

short. errors in observations through the atmosphere are caused by imperfect transparency, atmospheric dispersion, and night-sky emissions in the red and infrared regions of the spectrum. Errors in observations above the atmosphere, where smaller images are obtained and fainter stars reached, are caused by absorption of the interstellar medium, back-scattered solar emissions, and cosmic radio noise.

I visualize the creation of the universe, as recorded in Genesis, with light waves moving at the instant of the creation of the heavens and the earth. Such an idea should be readily acceptable, since the transformation of the proton (the raw power of the universe) to an atom takes only minutes, and from atom to molecule additional minutes, thence to all matter a few hours. The accurate determination of the age of the universe is dependent upon ascertaining the refraction, diffraction, and diffusion characteristics of light through measured intervals of space. The proper tools and techniques are yet to be found to do this.