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ISSUES IN COSMOLOGY

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The Big Bang is the most widely accepted theory among scientists for the origin of the universe. It specifies that the universe began as a very small speck of space filled with incredibly dense matter. Then the universe began expanding at an astounding rate; in a billionth of a trillionth of a second, the newborn universe doubled and redoubled 100 times over, stretching each atom-sized volume to the size of a galaxy.¹ This was the so-called "inflation phase" in which the universe expanded much faster than the speed of light. This cosmology assumes that quantum fluctuations in the early universe led to the distribution of galaxies in the universe.

The Big Bang theory is actually very logical; the red shift seems to imply that the universe is expanding now, and if this expansion took place in the past then the universe must have been much smaller at one time. Many astronomers have been deeply impressed by the thought that the universe had a beginning, and many have become believers in God. Also, the Bible says, "I have made the earth, and created man upon it: I, even my hands, have stretched out the heavens, and all their host have I commanded." (Isaiah 45:12) This verse is consistent with a past expansion of the universe. Of course, the Big Bang theory cannot explain where the original matter or the laws of the universe came from. These limitations may be problems for secular scientists, but not for Christians. However, there are some other problems with the Big Bang theory, and even many scientists question it. In 1989 came the discovery of the "Great Wall" of galaxies, a sheet of galaxies 500 million light-years long, 200 million light-years wide, and approximately 15 million light-years thick. The universe has too much such large-scale structure to form from a Big Bang type explosion and to form if the background radiation is as smooth as it is.² The Big Bang theory

explains large structures by assuming that the original speck of matter was "lumpy" before it started expanding. Another problem is that the physics of inflation is rather mysterious. Why did the universe suddenly start expanding so fast, and why did it stop? Also, the Big Bang has more parameters than independent observation; the current theory has 18 parameters, 17 of which are independent, but only thirteen independent observations.³ In fact, cosmology has always had fewer observations than free parameters. Parameters are numerical quantities like the speed of the inflation phase, how long it lasted, and how big the universe was before expansion started. It seems that with every new observation a new parameter is added to the theory. Each parameter means that a new feature has been added to the theory. This is not a characteristic of a sound scientific theory. If this continues, this means that more parameters and more features will have to be added, so that the current theory is incomplete. Also, a recent article suggests that the universe may have a center, that it may be rotating, and that cosmology may not be a science.¹ If these things are true, they could pose problems for the Big Bang theory or require more parameters be added to it. In addition, the Big Bang theory has some strange assumptions, such as the "dark energy" that is causing the expansion of the universe to accelerate. It is also interesting that two of God's greatest miracles, the creation of the universe and the creation of life, are areas that science has the greatest difficulty explaining. Both the Big Bang theory and the theory of evolution have serious problems. Perhaps the Lord is trying to reach us in this way and lead us to acknowledge His existence.

A professor at Stanford, Andrei Linde, has developed a new "chaotic inflation" theory that he feels overcomes some problems with the Big Bang.⁴ In his theory, some portions of the universe expand faster than others in the

¹ Cho A (2007) A Singular Conundrum: How Odd Is Our Universe. *Science* 317(5846):1848-50

² Promise M (2007 Feb 1) A Biblical and Scientific Analysis of the Big Bang. *TASC Newsletter*, Feb; also <http://tasc-creationscience.org/index.php?option=com_content&task=view&id=167&Itemid=44> Accessed 2008 Apr 21

³ Disney MJ (2007) Modern Cosmology: Science or Folk-tale? *American Scientist* 95(5): 383 – 385

⁴ Shackelford S (2007) Worlds Without End, *Stanford Magazine* Nov/Dec, 56-62; also <<http://www.stanfordalumni.org/news/magazine/2007/novdec/features/universe.html>> Accessed 2007 Apr 20

inflation phase. According to this theory, universes like ours are continually being produced from other universes from the places that expand very fast. Thus there is a self-reproducing eternally existing "multiverse." This means that there has always been a yesterday and there will always be a tomorrow. All the matter in the universe gets created from the negative energy in the gravitational field. Each universe within the multiverse can have a different set of constants and physical laws. In fact, there are an infinite number of such universes. This theory avoids the need for a creation altogether, and makes matter eternal. Andrei Linde says that no other theory can explain why the universe is so homogeneous and also the ripples in the cosmic microwave background radiation in the universe.

It is interesting that Prof. Linde feels that his theory explains the cosmic microwave background radiation and the homogeneity of the universe, which the Big Bang cannot. This is often the case; scientists will say that a theory explains the data until others propose new theories because the old theory does not explain the data. If the Big Bang theory really cannot explain the ripples in the background radiation, then perhaps it should be abandoned.

Also, one wonders how a process of expansion of universes as in Linde's theory could go on forever. This seems to violate the conservation of energy and also the second law of thermodynamics that says that entropy continually increases. In addition, we have not seen any of these other universes and have no evidence that they even exist, so how do we know that they are there?

Another point is that with an infinite number of universes, even very improbable events could take place. Thus the chaotic inflation theory gives a way to get around the improbabilities in the theory of evolution. But if this is the case, how can one reason about the past at all, if any improbability can be justified by the assumption of infinitely many universes? One could even justify Biblical miracles in this way, for example.

Linde's theory puts matter in the place of God and also, by the existence of so much chaos, obscures the beauty of God's creation that reveals His character of wisdom, love, and power.

Let us now return to a consideration of the Big Bang theory, which has implications for the age of the universe because it asserts that the universe is about 13 billion years old. It would take this long for light to reach us from distant regions of space if the speed of light has not changed, because of the vast size of the universe. However, from a theological standpoint, it seems strange for the Lord to create something that couldn't be seen for 13 billion years. "By the word of the

LORD were the heavens made; and all the host of them by the breath of his mouth. ... For he spoke, and it was done; he commanded, and it stood fast." (Psalms 33:6, 9) In the Bible God's acts of creation seem to be instantaneous and result in fully formed structures, as in the creation of life in the six day creation. Waiting for 13 billion years for the creation to be complete seems out of character.

Also, the Bible never mentions a period of millions or billions of years. The longest time periods in the Bible are in thousands of years. But in some ways the universe appears old: light travel time issues, radiometric dating, and others. How can this situation be resolved from a Biblical standpoint?

Adam and Eve and the trees and animals were created fully grown, with the appearance of age. Perhaps the universe was also created recently with the appearance of age. It would be as simple for God to choose an apparent age for the universe as for us to choose a background color for a slide. If the universe were created young it might have been too hot and violent and radioactive for life to survive.

There are also other possibilities. The universe may be young, but light may have traveled faster in the past, and the radioactive decay rate may have been faster. In fact there is good evidence now that the rate of radioactive decay was greater in the past. As for the speed of light, some secular scientists have proposed that light traveled faster in the past, including a team of Australian scientists.⁵ This could explain how large scale structures arose in the universe, without assuming that the original speck of matter was lumpy before it started expanding. "For example, varying light speed could explain why two distant and causally unconnected parts of the universe can be so similar even if, according to conventional thought, there has not been enough time for light or other forces to pass between them."⁶ Some creationists believe in an old universe and a young earth, or an old universe and an old earth without form and void, but on which life was created very recently. We now know that time can progress faster in some places than others. Humphreys has a "white hole" cosmology for the creation in which time travels at different speeds in different places.⁷ (A white hole is the opposite of a

⁵ (2002 August 08) Einstein's theory may be relatively wrong. <<http://archives.cnn.com/2002/WORLD/asiapcf/auspac/08/07/australia.lightspeed/index.html>> Accessed 2008 Apr 21

⁶ MSNBC.com (2007) Speed-of-light debate flashes again; now available at <<http://planetpreterist.com/news-601.html>> Accessed 2008 Apr 21.

⁷ Humphreys R (1994) *Starlight and Time*, Master Books, Colorado Springs, CO

black hole.) Thus the earth could be young even while the universe is very old, if time traveled much faster in the distant universe than on earth.

In the remaining time I want to talk about another potential solution to the light travel time problem. Lijun Wang of the NEC Research Institute in Princeton, New Jersey did some experiments in which a pulse of light appeared to go at 300 times the speed of light.⁸ The main part of the light pulse exits the far side of a chamber even before it enters at the near side. This has caused a lot of controversy, concerning whether information can flow faster than the speed of light, or even whether information can flow backwards in time, because information appears to be traveling backwards in time. Most scientists think that information cannot flow faster than the speed of light or go backwards in time, but some are not so sure. This recalls the limerick:

There was a young lady named Bright,
Whose speed was far faster than light;
She set out one day,
In a relative way,
And returned home the previous night

The way Wang's experiment works is by creating something called "anomalous dispersion" in which longer wavelengths (red) are delayed more and the shorter wavelengths (blue) are delayed less. When this happens, then the overall pulse appears to go faster and information appears to flow faster than the speed of light.⁹ The mathematics has to do with how various wavelengths combine to produce a pulse, and what happens when different frequencies are shifted by different amounts. Ordinarily, when light flows through a prism, for example, the shorter wavelengths are slowed more and bend more, and the longer wavelengths are slowed less and bend less. This is called ordinary dispersion. "But the NEC team's laser-zapped cesium vapor produces the opposite outcome. It bends red more than blue in a process called "anomalous dispersion," causing an unusual reshuffling of the relationships among the various component light waves. That's what causes the accelerated re-formation of the pulse, and hence the speed-up."¹⁰

⁸ Glanz J (2000 May 30) Light Exceeds Its Own Speed Limit, or Does It? <<http://partners.nytimes.com/library/national/science/053000sci-physics-light.html>> Accessed 2008 Apr 21

⁹ Wright EL (2000) Anomalous Dispersion, not Faster than Light, <<http://www.astro.ucla.edu/~wright/anomalous-dispersion.html>> Accessed 2008 Apr 20

¹⁰ Suplee C (2000) The Speed of Light Is Exceeded in Lab; Scientists Accelerate a Pulse of Light, *Washington Post*, July 20

Now, there is actually some evidence that anomalous dispersion takes place as radio waves travel through outer space. For example, it has been observed that for pulsars, as observed on Earth, the components of each pulse emitted at higher radio frequencies arrive before those emitted at lower frequencies.¹¹ Thus the lower frequencies (longer wavelengths) are slowed down more, and one has anomalous dispersion. This dispersion occurs because of the ionized component of the interstellar medium, which makes the "group velocity" frequency dependent. From Wikipedia:

Since radio waves are a very low frequency form of light/electromagnetic radiation (i.e. photons), they are nothing more than an oscillating electric and magnetic field. In the presence of charged particles such as protons and electrons, the electrostatic interaction between the light and the charged particles causes a delay in the propagation of the light, with the delay being a function of radio frequency and the masses of the charged particles. More energetic photons tend to push past the free electrons with little effect on their speed, whereas lower frequency photons are more significantly delayed.¹²

However sometimes the reverse kind of dispersion seems to occur:

High-energy photons were discovered to move slower than low-energy photons. Nanopoulos thinks this may be the result of interstellar "friction" due to microscopic quantum fluctuations that respond differently to photons of varying energies. This runs counter to prior theory which maintained that the speed of all electromagnetic radiation—no matter what the frequency or wavelength—was precisely the same.¹³

Note that Nanopoulos is proposing ordinary dispersion that would not (apparently) cause information to flow faster. But anomalous dispersion may also operate or have done so at some time. At least Nanopoulos' findings raise the possibility that the speed of light may be frequency dependent. It is possible that something similar happens as light travels through outer space.

¹¹ Pulsar Dispersion Measure, *Cosmos: The SAO Encyclopedia of Astronomy*, Swinburne University of Technology <<http://astronomy.swin.edu.au/cms/astro/cosmos/P/Pulsar+Dispersion+Measure>> Accessed 2008 Apr 20

¹² Online Article, Dispersion (optics), Wikipedia <http://en.wikipedia.org/wiki/Dispersion_%28optics%29> Accessed 2008 Apr 20

¹³ Morledge P (2001) *Cosmology: Rethinking Einstein*, www.astronomy.com, Science News: Feb. 14, 2001. Now available as (2001) *Viewfinder* 22: 13 at <<http://union.ic.ac.uk/rcc/astrosoc/viewfinder/issue22.pdf>> Accessed 2008 Apr 21

Could it be that this causes information to flow on the light beam faster than the speed of light? Could it be that this actually causes information to flow into the past, so that we are seeing the distant universe not as it is now, but as it will exist in the future? Perhaps we can see the distant universe as it would appear if we traveled there at the speed of light, for example. If information on a light beam can travel faster than the speed of light then this would solve the problem of how we could see the distant universe in a young universe and also would explain how the universe can appear old, if we are seeing it as it would appear in the future. Such possibilities will need further study, but it is an interesting thought. Perhaps this idea can be combined with a slowdown in the speed of light and other mechanisms to obtain a total explanation of the age of the universe in a recent creation Biblical framework. Another possibility is that the red shifting of light affects different frequencies differently, leading to anomalous dispersion.

Several scientists other than Wang and his group have also apparently transmitted pulses faster than the speed of light; one researcher sent signals faster than the speed of light with equipment costing just \$500.00.¹⁴ Physicist Alain Hache at the University of Moncton in Canada thinks that it may be possible to use this reflection technique to boost electrical signal speeds in computers and telecommunications grids by more than 50 per cent.

Another group demonstrated a possible faster than light transmission of information; a group of physicists performed experiments which seem to suggest that faster than light communication by quantum tunneling is possible.¹⁵ They claim to have transmitted Mozart's 40th Symphony through a barrier 11.4 cm wide at a speed of 4.7c. Their interpretation is, of course, very controversial. Most physicists say this is a quantum effect where no information can actually be passed at faster-than-light speeds because of the Heisenberg uncertainty principle. If the effect is real it is difficult to see why it should not be possible to transmit signals into the past by placing the apparatus in a fast moving frame

of reference.¹⁶ Still other scientists have performed similar experiments with microwaves.¹⁷

Clearly there are many things about the universe that we do not fully understand. Perhaps some kind of anomalous dispersion will explain how the universe can be young even with the light travel time problem. Or perhaps there is some other explanation that we have not thought of yet. But though science changes, the word of God is eternal. "Heaven and earth shall pass away, but my words shall not pass away." Matthew 24:35. It would be a tragedy to give up our faith in God because of a perceived conflict between the Bible and science, as many young people do in our secular universities. We should base our faith on God's word and not on the changing views of science. God's thoughts are far above ours, and we should have faith in Him. ☩

COMING EVENTS

Thursday, May 8, 7:00 P.M., Providence Baptist Church, 6339 Glenwood Ave., Raleigh, Room 631
Javier Valdivieso. Topic to be determined.

¹⁴ Choi C (2002 Sep 16) Speed of light broken with basic lab kit <<http://www.newscientist.com/article/dn2796-speed-of-light-broken-with-basic-lab-kit.html>> Accessed 2008 Apr 20

¹⁵ Heitmann W, Nimtz G (1994) On causality proofs of superluminal barrier traversal of frequency band limited wave packets. *Phys. Lett. A* **196**:154-158

¹⁶ Enders A, Nimtz G (1993) Evanescent-mode propagation and quantum tunneling. *Phys Rev E Stat Phys Plasmas Fluids Relat Interdiscip Topics* **48**(1):632-634

¹⁷ Ranfagni A, Mugnai D (2004) Superluminal behavior in the near field of crossing microwave beams, *Phys. Lett.A*, **322**:146-149

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