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EDITORIAL NOTES

This Newsletter is prepared by the Theosophy-Science Group in Australia for interested members of the Theosophical Society in Australia. The email version is also made available on request to members of the Theosophical Society in New Zealand and USA with the cooperation of the respective national bodies. Members in USA wishing to subscribe should contact: theosci-news@theosophical.org. Members in New Zealand should contact: john@theosophy.org.nz. Recipients are welcome to share the Newsletter with friends but it must not be reproduced in any medium including on a website. However, permission is given for quoting of extracts or individual articles with due acknowledgment. Selected items appear from time to time on the website of the TS in Australia – austheos.org.au.

A Theosophy–Science seminar will be held at the Springbrook Theosophical Retreat Centre, 19-21 May 2006 with arrival Thursday 18 and departure Monday 22. It is desirable to come for the whole time but some may be able to come only for Saturday-Sunday. The last seminar in May 2003 was a great success and all were inspired by the talks, the atmosphere of Springbrook, and the bonding of the Group. We can all contribute to making this one a similar success. In general, we will adopt a pattern which proved very successful last time. Main sessions will be 90 minutes comprising 45 minutes talk with adequate time left for discussion. Some provision may be made for shorter talks. The evening sessions will be for lighter presentations or for general discussion on an appropriate theme. Time will also be made available for enjoying the idyllic surroundings. The cost is $160 for four nights accommodation in comfortable single units with excellent vegetarian food. The Springbrook centre is a sanctuary and alcohol, smoking, non-medical drugs and meat products are not permitted. We are asked to observe this policy and have been comfortable with it in the past.

The Centre is about 50 minutes drive from Gold Coast airport (preferred destination). There is also a train service from Brisbane airport to Robina on the Gold Coast. Arrangements will be made for transport from the Gold Coast. Those driving by car will be invited to assist in return for a minor concession on cost. For those travelling long distances, e.g. Perth or New Zealand, a limited grant towards travel cost may be available to those who need it. The seminar is open to all members of the Theosophy-Science Group and to all recipients of this Newsletter. Other interested members may participate if space is available. Partners of participants are welcome. Early registration is advisable. See the last page.

This Newsletter includes discussion of issues relating to science and religion and touches on the current debate regarding fundamentalism and so-called creation science. To its everlasting credit the Theosophical Society allows and encourages Freedom of Thought. We need to exercise that freedom wisely while standing firm to the Fundamental Principles, but perhaps re-examine some long cherished beliefs in the light of modern science. For example, the concept of predetermined fixed periods for cycles of evolution as in Barborka's Peopling of the Earth can no longer be sustained and is perhaps ripe for some reconsideration.

RELIGION AND SCIENCE

There is a widespread belief by fundamentalist Christians that the world and all living creatures including humans were created about 6,000 years ago, rather than life evolving by natural selection and survival of the fittest. This denial of science is difficult to maintain and a new phenomenon has arisen in the form of so called 'creation science' which purports to demonstrate that rather than life evolving by recognised biological processes, evolution occurred as a result of intervention by an intelligent designer, presumably intended to be God. Does that mean the rejection of a literal interpretation of Genesis or did all the evolution occur in 6,000 years?

Locally, the purveyors of this doctrine have produced a DVD which they have sent to 3,000 schools with the request that it be taught in science classes. Freedom of belief is very important but attempting to undermine the legitimate teaching of science in this surreptitious way is reprehensible. It is also a shallow way of trying to introduce the concept of God or some form of Supreme Being into science. How should scientists respond? Charles Birch who is very interested in religion and science says (Sydney Morning Herald, November 14) that he thinks it would be much better to ignore it than to argue with them, which only gives them publicity which is what they want. He is cited as saying that as a believer in a God of 'purpose' rather than a blueprint wielding designer, he is not drawn to the idea of a deity who is invoked to explain away any scientific mysteries. Birch is also cited as being one of the scientists who helped persuade Pope John Paul II of the strength of evidence for evolution. Paul Davies has also said that Pope John Paul II told him he had no problem with the big bang.

Much better than teaching so called 'creation science' would be finding a way to introduce students to some of the serious attempts being made in recent years to reconcile religion and science or to find common ground, as we have been discussing in this Newsletter from time to time. Writers such as Birch, Kauffman, Conway Morris and Davies come to mind. Especially pertinent is Davies' concept of "teleology without teleology" (See N54) whereby God creates laws which allow complexity to function in such a way as to ensure that desirable outcomes emerge but without specific detailed intervention. Davies has said in The Mind of God, (Orion Publications, 1992) that he does not believe in a personal God but could accept 'an impersonal creative principle'. Apart from many individuals, there are organizations which legitimately try to reconcile religion and science; for example, the Institute of Noetic Sciences and the Templeton Foundation. (The latter was discussed in N55).

Interview with Sir John Templeton

There is a brief report in New Scientist (September 17, 2005) of an interview with Sir John Templeton on what he is trying to achieve. Now 92, Templeton was a highly successful investor and fund manager. In 1999 he sold his Funds and set up the Templeton Foundation. He gives about $40 million a year from an investment of about $1 billion. Several scientists have received Templeton prizes including Charles Birch, Paul Davies and George Ellis. Asked why it is important to bring science and religion together, Templeton says that science creates vast power and massive advances in technology but does not itself create 'stewardship', the wisdom and capability to direct power to beneficent ends. Asked what kind of research he supports, he responds:

"A very promising new line of research we are supporting has to do with the spiritual theme of purpose? Does our universe have or serve a purpose? Do we have a purpose? Can science explore such topics? One area that we are funding that has an impressive scientific record in regard to this is

the so-called bio-centricity hypothesis: are the physical and chemical properties of nature fine-tuned for life, such that if they were slightly different, life could not have existed? Asked about criticism, he rebuts the suggestion of some people that he is pushing a particular religious position. However he also comments that 'some people think that science is a kind of ultimate priesthood in itself, that it should be the ultimate religion and pay no attention whatsoever to God. That is a kind of fundamentalism of its own".

Charles Birch and Paul Davies have both won Templeton prizes for the type of research which Templeton quite rightly especially favours. Charles Birch (now long retired) was Challis professor of biology at Sydney University and has written several books reconciling science and religion. He regards consciousness as primary and says that even the attraction between electron and proton is a primitive form of consciousness. Davies, originally from England but long based in Australia, has published several books on the theme, such as Cosmic Blueprint and The Mind of God. We have followed these and more recent writings in this Newsletter. He says he would like to believe that life and mind are inherent in the universe (See N53, December 2004). American, Stuart Kauffman has contributed to the inevitability of evolution of humanity via complexity theory and more recently Simon Conway Morris from England has pursued the same theme through the phenomenon of emergence in biology. All of these (and others) have been represented in this Newsletter. Could Conway Morris perhaps be due for a Templeton prize?

RECONCILING EVOLUTIONARY SCIENCE AND GOD

A View from the Vatican's Chief Astronomer – George Coyne

In an article in The Tablet (August 6, 2005), the Vatican's chief astronomer, George Coyne attempts to rebut a claim by Cardinal Schönborn (New York Times, July 7, 2005) that neo-Darwinism is incompatible with the Church's belief in God's purpose and design in creation. He draws attention to an International Theological Commission under the presidency of Cardinal Ratzinger (shortly before he became the Pope), which "Issued a lengthy statement in which it saw no incompatibility between God's providential plan for creation and the results of a truly contingent evolutionary process in nature". Coyne also refers to "the epoch-making declaration of John Paul II in 1996 to the Pontifical Academy of Sciences in which he declared that evolution is no longer a mere hypothesis and then proceeded, far from any thought of incompatibility, to draw reasonable implications for religious belief from that conclusion".

Coyne says there are no grounds for a concern within the Church that life evolving over billions of years "through a process of random genetic mutations and natural selection, escapes God's dominion." He comments that science is neutral with respect to philosophical or theological implications. He says that there are three processes involved in evolution of the universe; chance, necessity and the fertility of the universe". Presumably by fertility he means something akin to what Kauffman, Davies and others refer to as complexity, the fact that in complex situations, a new level of order can arise in a manner which is not specifically predictable. Conway Morris takes this further by suggesting that, in the evolution of life, this process inevitably leads to the emergence of appropriate outcomes such as humans.

Coyne continues: "The classical question as to whether the human being came about by chance, and so has no need of God, or by necessity, and so through the action of a designer God, is no longer valid. And so any attempt to answer it is doomed to failure. The fertility of the universe, now well established by science, is an essential ingredient, and the meaning of chance and necessity must be

seen in the light of that fertility. … Chance processes and necessary processes are continually interacting in a universe which is 13.7 billion years old. … While science cannot claim to know all of the links in the evolutionary chain, nor especially the passage to living organisms, there is a very strong evidence for a large degree of continuity in the process. … The search for life's origins may be in vain. There may be no clear origin, no clear threshold as seen by science, between the non-living and the living".

At this point Coyne asks what should we say to the religious believer and he says: "It is unfortunate that creationism has come to mean some fundamentalistic, literal, scientific interpretation of Genesis. Judaeo-Christian faith is radically creationist, but in a totally different sense. It is rooted in a belief that everything depends on God. … If we confront what we know of our origins scientifically, with religious faith in God the Creator – if, that is, we take the results of modern science seriously – it is difficult to believe that God is omnipotent and omniscient in the sense of many of the scholastic philosophers. ...

"This stress on our scientific knowledge is not to place a limitation upon God. Far from it. It reveals a God who made a universe that has within it a certain dynamism and thus participates in the very creativity of God. Such a view of creation can be found in early Christian writings, especially in those of St. Augustine in his comments on Genesis. If they respect the results of modern science and, indeed, the best of modern biblical research, religious believers must move away from a dictator God or a designer God. ... God's revelation of himself in the Book of Scripture would be reflected in our knowledge of the universe, so that, as Galileo was fond of stating, the Book of Scripture and the Book of Nature speak of the same God. ... The Universe as we know it today through science is one way to derive an analogical knowledge of God. For those who believe that modern science does say something to us about God, it provides a challenge, an enriching challenge, to traditional beliefs about God. ... God lets the world be what it will be in its continuous evolution. He is not continuously intervening, but rather allows, participates, loves. Is such thinking adequate to preserve the special character attributed by religious observers to the emergence not only of life but also of spirit, while avoiding a crude creationism? Only a protracted dialogue will tell. But we should not close off the dialogue and darken the already murky waters by fearing that God will be abandoned if we embrace the best of modern science".

EMERGENCE VERSUS REDUCTIONISM

Paul Davies has an interesting but not-easy-to-follow article (New Scientist, March 5, 2005) discussing argument concerning whether there are inherently emergent properties which defy any conceivably possible reductionist explanation, but must rather be regarded as emergent but unpredictable or explicable in terms of bottom-up arguments based solely on physical principles. These are not actually his words but this is what the arguments amounts to. I will attempt to discuss it here because I believe it is relevant to the discussion of religion versus science, and I think Davies would probably agree.

Such things as shoals of fish or ant colonies have collective behaviour which one would not predict from merely observing single fish or ants. But he says there is an argument as to whether such behaviour could in principle be calculable from the laws of physics as reductionists would argue. Many complex systems might in principle be predictable but the calculations are 'exponentially hard' and we can only "watch and see how they evolve". This he says is referred to as "weak emergence." However a handful of scientists (and I suspect that includes Davies himself) want to argue that there

are complex systems which can only be understood by taking account of "organizing principles" which emerge at an appropriate level of complexity. This is "strong emergence" and is anathema to reductionists.

Laplace introduced the concept of an in principle super-intelligent demon which could take account of the position and motion of every particle in the universe and thereby predict the entire future. Computer expert Landauer of IBM stressed that all computations are limited not only by the laws of physics but also by the computational resources available in the real universe. These are limited by Heisenberg's uncertainty principle, by the finite speed of light and by the second law of thermodynamics which treats entropy as the reverse of information. These limits could in principle be overcome, says Davies, if the universe possesses infinite time and resources. However, he goes on to point out that, even if the universe is infinite, the accessible portion of the universe is limited by our cosmological horizon. He states that with a universe 13.7 billion years old, the horizon is 13.7 billion light years. This is a grossly over-simplistic value but nevertheless the point that cosmology provides such an accessibility limit is valid. (See the item on Recession Velocity where Lineweaver and Davis point out (page 10) that our current horizon is 46 billion light years). The cosmological limit thus puts paid to reductionist arguments involving the concept of Laplace's demon or extensions thereof.

Davies then asks: "How does this bear on the question of strong emergence – the idea that there are organizing principles that come into play beyond a certain threshold of complexity? The [cosmological] limit does not prove that such principles must exist, but it disproves the long-standing claim by reductionists that they can't. … There are gaps in which higher level emergent laws can operate. ... Biologists such as Christian de Duve have long argued that life is 'a cosmic imperative' written into the laws of nature, and will emerge inevitably and naturally under the right conditions. ... If there are higher level, emergent laws at work, then biologists like de Duve may be right after all ─ life may indeed be written into the laws of nature." [My emphasis.] It seems that Davies would like to think so.

Always the very thoughtful and fruitful speculator on interesting issues, Davies goes on to speculate on whether complexity may be the key to the understanding of quantum physics; "Could it be that a quantum system becomes classical when it is complex enough for emergent principles to augment the laws of quantum mechanics, thereby bringing about the all-important projection event?"

Again he says: "For 400 years a deep dualism has lain at the heart of science. On the one hand the laws of physics are usually considered universal, absolute and eternal: ... On the other hand, there is another factor in our description of the physical world: its states. These are not fixed in time. ... The laws act on the states to predict how the system will behave. …What the new paradigm suggests is that the laws of physics and the states of the real world might be interwoven at the deepest level".

THE CREATIVE UNIVERSE

Davies has a further short article in an issue of New Scientist focussing on Creativity (October 29, 2005). He says we should not think of the big bang as "the creation" since the universe has never ceased to be creative: 'rather it emerged gradually, over billions of years through a long succession of self-organising and self-complexifying processes. In the early universe, "the dull, uniform distribution of matter" matching the "the near perfect uniformity of the radiation left over from its fiery birth" was "primed to set off a chain reaction of creative processes; ... gravity sculpted complex cosmic sculptures. ... The emergence of life on Earth, and the slow evolution of multicellularity, is just a small branch of the cosmic creativity that began with the big bang. Viewed on a cosmological scale,

the history of the universe appears to be one of increasing complexification". At first sight, he notes, this appears to violate the second law of thermodynamics which requires an increase in entropy or disorder, yet "there is enough useful energy left for the cosmos to create complex phenomena for many trillions of years to come".

Yet he notes that while nature's creativity does not violate the second law, it is not explained by it either. ... "Physicists are far from knowing just what it takes to create order out of chaos. They cannot point to specific characteristics in the laws of physics as 'the source of creativity'. It is not even clear that the whole story lies within the known laws. Some scientists suspect there are undiscovered laws, or overarching principles at work, coaxing clod-like matter toward organized complexity. Sometimes the hypothesized 'principle of increasing complexity' is called the fourth law of thermodynamics".

He goes on to say: "One thing is clear. The simplicity of the primordial universe ensured its eventual complexity. Only these bare beginnings contain such immense creative potential; cosmic creativity was forged in the big bang. Once sentient beings like us emerged, a whole new phase of creativity came with it. Through art, science and technology, humans are refashioning the world. Who can say how far mental creativity will help create the cosmos"? Note the implication of the last sentence; he is apparently suggesting the emergence of mind.

RECESSION VELOCITIES GREATER THAN LIGHT

(Exploring a Case of Scientific Fundamentalism)

This article is somewhat longer than I normally allow for a Newsletter item but, in view of the charge of scientific fundamentalism, I want to explain the situation carefully.

This subject is featured in a major article by Charles Lineweaver and Tamara Davis in Scientific American (March 2005) entitled Misconceptions About the Big Bang. They were invited to write this article based on their cited paper* They were then both at the University of New South Wales in Sydney but by the time of the recent article, they had both moved to Australian National University, Canberra. I will concentrate here largely on the fact that, in the expanding universe, galaxies and quasars beyond a certain distance are receding at velocities (in common parlance, speeds) greater than that of light, in apparent conflict with special relativity.

I briefly discussed this subject in N51, March 2003, p 4, but in view of the recent detailed publications, and also because of a personal interest, I will cover it more extensively. In part the aim is to expose often mistaken scientific concepts which arise from the assumption that special relativity applies in all respects to the understanding of an expanding universe. At issue is the key concept that no velocity can exceed that of light which is a fundamental constant. However, even though it is the rate of distance with time, the recession velocity of distant objects such as galaxies and quasars in an expanding universe, is, for reasons which I shall explain, a special kind of velocity which is not subject to this rule. This is overlooked by a great many writers of student text books and even by professional scientists, who make serious errors as a result. Popular public statements by many scientists are also at fault. This, to my mind, is a serious case of scientific fundamentalism.

* "Expanding Confusion: Common Misconceptions of Cosmological Horizons and the Superluminal Expansion of the Universe": Tamara M Davis and Charles H. Lineweaver, Publications of the Astronomical Society of Australia, Vol 21, No. 1, pages 97-109; February, 2004. Also: http://xxx.lanl.gov/abs/astro-ph/0310808.

Modern cosmology

Modern cosmology arises from an extension of Einstein's general theory of relativity initiated by Einstein himself but further developed by others. In the early 1920's, Russian mathematician Friedman explored the range of possible modern cosmological models based on general relativity. The universe must be either expanding or contracting and the redshifts observed for distant objects tell us that it is in fact expanding. As a partial one dimensional analogy for an expanding universe, consider a series of dots on a rubber band which is being stretched. The dots remain fixed on the rubber band but are getting increasingly further away from each other; i.e. they have a mutual recession velocity (the rate at which their distance apart is increasing). The analogy is not perfect for there is no empty space between the dots on the rubber band. We can imagine ourselves as one of the dots seeing all the others expanding away from us. The greater the separation, the greater their mutual velocity.

Cosmologists have developed equations that enable distance to galaxies and quasars to be calculated from the observed redshift according to the appropriate cosmological model which best fits the observations. This is necessary since there is no way of directly measuring the distance to another galaxy by methods we use on Earth such as measuring rods, return radar signals or even laser range finding. Indeed for a very distant object, there would be no time for a return signal within the age of the universe. The distance we are discussing is known technically as 'proper distance' as there are other forms of cosmological distance used for particular purposes. At one time there was some confusion about this. However, today 'distance' means proper distance unless otherwise stated. Since we have no direct means of measuring this distance (calculated by a formula from the redshift), how do we know that it corresponds to what we normally mean by distance? It has been clearly established that, in principle, this proper distance is conceptually equivalent to the sum of the measurements by a large team of measurers using end-to-end rulers at a given moment of cosmic time. Of course this is not possible in practice.

Note the term 'cosmic time' used above. Those brought up on special relativity are uncomfortable with the notion of universal (or cosmic) time. Yet when we speak of the age of the universe, we are using cosmic time. Herman Bondi in his book Cosmology (C.U. P. 2nd ed, 1960) laments that concepts of universal proper time [now known as cosmic time] and proper distance seem to run counter to the spirit of relativity. However, he acknowledges that no development of cosmology is possible without them. Note that the universality of cosmic time is acknowledged by Edward Harrison (see N51, March 2004). The lessons of special relativity concerning the velocity of light as an upper limit to velocity have been rightly very well learned, but the concept has become so ingrained that scientists find it very difficult to recognise that there are situations in cosmology, such as recession velocity in an expanding universe, where it does not apply. I think theosophists should be very happy with the concept of the universality of cosmic time against the nihilistic philosophical attitude based on special relativity that nothing is universal.

The Misinterpretation of Recession Velocity

The most critical misunderstanding, (indeed misinterpretation) dealt with by Lineweaver and Davis is that concerning the recession velocity of distant objects (specifically galaxies and quasars) in an expanding universe. (Velocity is simply a technical term for speed). Recession velocity is the rate at which such objects are receding (i.e. increasing their distance) from us with time. There is a commonly held mistaken belief that the recession velocity of distant galaxies and quasars visible to us cannot exceed that of light. The lessons of special relativity have been too well learnt, indeed

obsessively so, yet there is no violation of special relativity here since nothing moves in its own environment (technically in its own rest frame) at greater than the speed of light.

The current recession velocity of the distant receding galaxy or quasar can be calculated by multiplying the Hubble constant by the distance obtained from the measured redshift (using the appropriate cosmological model as mentioned above). The Hubble constant measures the current rate of expansion of the universe and massive observational programmes of distant galaxies have been undertaken in recent years to tie down its value to within a couple of percent. (The distance and recession velocity can also be calculated from the appropriate cosmological equation for any particular time, e.g. the time of emission of the light by which we eventually see the object). However, generations of students have been taught to calculate recession velocity using the relationship between redshift and velocity of special relativity which applies locally, but certainly not to recession velocity in an expanding universe. This wrongly interprets recession velocity as a Doppler shift and hence gives a spurious answer which is always less than that of light. Davis and Lineweaver show that for the currently favoured cosmological model, all objects with a redshift greater than about 1.5 are receding with a velocity greater than the velocity of light (in scientific terminology, $v>c$, the standard symbol for the velocity of light being c). How then can we see them? That is not easy to explain qualitatively. Lineweaver and Davis in Scientific American offer the hint 'because the rate of expansion is changing.' Critically, until relatively recently, the rate of expansion was decreasing. Also note that, because of ongoing expansion, the distance at the time the light we now see was emitted was much less than the current distance.

The Thorny Road Toward the True Story

I have a personal interest in this story since I was the first to publish a correct interpretation of recession velocities in 1977. My paper, Recession Velocities Greater than Light, appeared in the Quarterly Journal of the Royal Astronomical Society (1977), 18, 242-247. This came about by a happy coincidence. I was spending some time at the Institute of Astronomy in Cambridge in 1976, as well as attending and speaking at a European Congress of the Theosophical Society at Cardiff. (At the time I was intrigued by Blavatsky's remark that we did not know whether the speed of light is constant beyond our system. While interesting, this remark is too vague to claim any specific verification). I showed the draft of my paper to astronomer Simon Mitton who was Secretary of the Institute and also editor of the Quarterly Journal. He was interested and asked could he have it for the Quarterly Journal. Since published articles must be approved by referees, I had to get approval from two astronomers at the Institute that my paper was worthy of publication, which I did. In view of the problems I and others have had in getting the truth about the matter published, due to non-comprehending referees, the particular circumstances were rather fortuitous. At least students of cosmology at Sydney University have long been taught correctly by a colleague.

I learned my cosmology from a book by G.C. McVittie entitled General Relativity and Cosmology. This was an excellent mathematical treatment and I was able to obtain specific formulae for two cosmological models of interest at that time; the Steady State Theory and the Einstein de Sitter model which deals with the borderline case between eternal expansion and recontraction to a big crunch. McVittie, however, refused to acknowledge that there is anything special about proper distance or even to use the term. He referred to it simply as U distance, one among two other forms of distance used for specific purposes. That was a tenable position at the time but at least the battle for proper distance has long been won. He was the only person to write to me about my paper after publication and critically at that. He no doubt would have rejected it as a referee.

When Edward Harrison published his book Cosmology; Science of the Universe in 1981, and correctly treated the subject of superluminal recession velocity, I believed naïvely that would settle the issue (see N51 for an item on this very perceptive cosmologist). However, Harrison's book made no impact on mainstream astronomers although there have been about three good articles in the American Journal of Physics, a publication oriented toward college professors and not well read by the research community. Harrison had two good articles in the prestigious Astrophysics Journal (published in America) in 1991 and 1993 but remained somewhat of a lone wolf. An exception was a very good article by Ellis and Rothman in the American Journal of Physics in 1993. Ellis is a Templeton prize winner (see N 55). It has not been easy to get the true story acknowledged or discussed. I tried with another paper after I retired which was rejected by several Journals (including the Journal which recently published Davis and Lineweaver). One referee's comment could be summed up as a) I was wrong and b) I was not saying anything different to Harrison.

Lineweaver and Davis

I met Charley Lineweaver, then a research fellow at the University of New South Wales in Sydney through a mutual contact. He had come across my paper when browsing through old issues of the Quarterly Journal and thought it would be a good topic to give a bright honours student to investigate for an honours year essay. Tamara Davis wrote an excellent essay. I visited them both for a good discussion and kept in touch. Tamara told me recently Charley had given her my paper and one by McVittie and said "find out who is right"? McVittie had said in a 1974 paper in the Quarterly Journal that saying quasars could have recession velocities greater than the velocity of light would contradict one of the most basic postulates of relativity – scientific fundamentalism but understandable. Davis went on to investigate the subject thoroughly and it formed a major part of her PhD thesis. At an early stage they both delighted in collecting a great many wrong statements on the subject by prominent people, with the intention of publishing this as a separate paper. However Davis was warned by several people that she was in danger of jeopardising her future career. Bravely she persisted in what she saw as true but sensibly, in the thesis and in the Davis and Lineweaver paper, she presented the concept of recession velocities greater than the speed of light within the context of a much needed detailed study of the current cosmology of a universe whose expansion rate initially slowed, but is now expanding at an increasing rate. This included an appendix of "Examples of misconceptions in the literature" Naturally I feel vindicated but there is no need for hubris. I too make mistakes. In fact there are a few minor errors in my paper but not significant in the present context.

Summing Up

What now? Will the publicity from Scientific American settle the issue of recession velocities greater than light and other related issues? I hope so, but past experience says that this is very doubtful. The very nature of an expanding universe (not to mention an expansion which first slows for a long time and then speeds up) is difficult even for experienced scientists to fully grasp, let alone explain to the public. In The Matter Myth, (Viking, 1991), Davies and Gribbin seem to be equivocating but actually make a subtle point when they say that "we could not observe galaxies that recede faster than light" however "the elasticity of space, a feature of general relativity, allows galaxies to separate from one another faster than the speed of light, without any galaxy passing another at this speed". Should we say 'separation velocity' rather than 'recession velocity'? I think the latter term is too well established. We just have to be sure to use it appropriately.

Statements to the Public

It is a major concern of mine that statements to the public by professional scientists, let alone writers in the press, continue to be made which are completely wrong, largely because they do not take into account the expansion of the universe. These errors not only concern the question of recession velocity. A typical example is that of recent statements by Paul Davies and others that (with the age of the universe being 13.7 billion years) the distance to our present cosmological horizon (i.e. the greatest distance we can see) is 13.7 billion light years. That assumes a static universe, which nobody believes is true. The correct answer, given by Lineweaver and Davis in their Scientific American article is 46 billion light years. That is the nature of an expanding universe. Many such public statements by professional scientists on this and related issues are similarly wrong because they fail to take account of expansion. What is best? Is it better to: a) tell a fairy story because it gives a simplistic answer, but a wrong one, b) give a correct answer, even an approximate one, explaining that it is considerably affected by expansion, or c) refrain from making any such statement at all? Surely b) is not too difficult. Incidentally, the horizon is characterised by infinite redshift. There are no doubt objects beyond our horizon which we cannot observe.

GLOBAL WARMING STARTED THOUSANDS OF YEARS AGO

This is the claim by William Ruddiman in another feature article in Scientific American, July 2005 entitled: How Did Humans First Alter Global Climate? He acknowledges as controversial, his claim that humans have been altering the Earth's climate for millennia. The claim that global warming due to human activity started thousands of years ago challenges the view that global warming started with the industrial revolution. The early start to global warming has been beneficial in saving us from what may well have been an ice age. The ongoing prospect, however, is another matter altogether.

Evidence From the Ice

Geologists in recent years have obtained much information about the past several hundred thousand years by drilling deep into the ice in Antarctica and Greenland. Analysis is made of the air bubbles in the ice to obtain a measure of the original atmospheric concentration of gasses such as carbon dioxide (CO_2) and methane (CH^4). A comparison of isotopes of hydrogen gives a measure of the temperature. Comparable results have been obtained in both places. A striking graph is presented showing superimposed measures of temperature and methane over 11 complete cycles at intervals of 22,000 years. Concentration of methane emitted from marshland and swamps correlates well with high temperature.

There is a problem in the terminology for the 22,000 year cycle in that Ruddiman appears, according to his diagrams, to regard it as a cycle of precession as well as of perihelion, which is the time when the Earth is closest to the Sun in its slightly elliptical orbit about the Sun. In fact, as we saw in N57, the precession cycle is about 26,000 years rather than 22,000. Precession is, nevertheless, the major contributor to the time of year (calendar date) when perihelion occurs, as well as determining the calendar date of the equinoxes. However, there is another much longer 112,000 year cycle in which Earth's orbit slowly rotates in space. This slower cycle adds a little more to the annual shift in the date of perihelion caused by precession, thus shortening the perihelion cycle to 21,000 years, near enough to the 22,000 year cycle observed in the ice. [Authority for the 112,000 year orbital rotation cycle is the Cambridge Encyclopaedia of Astronomy. Authority for the combination of the two cycles

(precession of the equinoxes and orbital rotation) to yield the perihelion cycle is an article by George Kaplan of the US Naval Observatory (USNO), http://aa.usno.navy.mil/faq/docs/seasons_orbit.html].

(As a subsidiary matter of interest, the gradual rotation of the orbit is due to gravitational interaction with the other planets. Physicists were unable to calculate the correct value of orbital rotation for the inner planet Mercury, using Newtonian gravity until the apparent discrepancy was explained by general relativity. This was a triumph for Einstein when he introduced his general theory in 1916. The corresponding general relativistic contribution to Earth's rotation period is very small. To avoid confusion here, I have refrained from using the physicists' term for the orbital rotation: 'precession of perihelion').

Returning to the main story, another graph in the article by Ruddiman shows a somewhat complicated roughly sawtooth pattern formed by a combination of the 100,000 year cycle of changes in the degree of eccentricity of the Earth's orbit and the 41,000 year cycle of the obliquity or tilt of the earth's axis which determines the latitude of the tropics. These Milankovitch cycles were described by Victor Gostin in N57. A technical paper by Pettit et al. (Nature, Vol. 399, 3 June 1999) on the Antarctic ice core data from Vostok base gives a graph showing the result of a frequency spectrum analysis of the various cycles. This is roughly analogous to analyzing a piece of music to find out the relative occurrence of various musical notes. In all of the variables, the 100,000 year signal is strongest and in the main, the 41,000 year cycle is next. Interestingly, while all of the graphs show an approximately 22,000 year cycle, an additional unlabelled peak which looks like the 26,000 years of genuine precession, appears in almost all of them (especially in temperature, CO_2 and methane).

Human Influence?

Has human activity over the last few thousand years saved us from an ice age, as Ruddiman claims? When we note the fact that the last ice age peaked about 20,000 years ago and reflect on the 22,000 year cycle, that does not seem implausible. It has also been claimed that ice ages occur when perihelion occurs near the Northern hemisphere winter solstice, and that warm periods peak when perihelion occurs near the Northern summer solstice. The reason for emphasizing the Northern hemisphere is that it has the largest land mass. Perihelion is currently a couple of days into January, hence satisfying the supposed conditions for an ice age.

Ruddiman argues that without human activity, the natural temperature cycle, after peaking at about 8,000 years BP, would have begun to cool to the point where, about 5,000 BP, the natural start of the next glaciation would begin and thereafter increase towards an ice age. He fleshes this out by saying: "A new ice age would have begun in Northern Canada several millennia ago, at least on a small scale". He continues: "This conclusion is startlingly different from the traditional view that human civilization blossomed within a period of warmth that nature provided. As I see it, nature would have cooled the earth's surface, but our ancestors kept it warm by discovering agriculture"

He notes evidence in the ice that a falling trend in CO_2 suddenly reverses to an increasing trend about 8,000 BP, the first evidence for human influence on global warming. He attributes this to the fact that "Late stone Age Europeans began clearing forests to grow wheat, barley, peas and other non-indigenous crops". Then around 5,000 BP, there was a sudden turnaround in methane from a falling trend to a rising trend when: "farmers in the South of China began flooding lowlands near rivers to grow rice". The combined effect of these trends was to cause an average 0.8^0 increase in temperature up to the industrial revolution. This compares with a 0.6^0 rise in the past century of rapid industrialisation..

Further evidence of human-induced effects is claimed, based on evidence from the ice for a temporary reversal in the temperature increase in periods of major pandemics. Examples are the "black death" in the middle ages which killed 25 to 40 % of Europeans and the 90% death rate in native populations in the Americas in the early 16th century due to the introduction of smallpox and other European diseases.

He suggests that one of the reasons mitigating against taking global warming seriously today is that earlier last century, scientists were warning of a cooling trend toward an ice age. I can remember in my youth when glaciers were said to be increasing, as against today when they are clearly retreating. Speaking of the situation today, Ruddiman comments: "In these kinds of hotly contested topics that touch on public policy, scientific results are often used for opposing ends". While some might emphasise the benefits of warming in the past, others might well note that if so few humans in past centuries could have such a significant effect, we should be more concerned today about the current unparalleled rise of greenhouse gases. He suggests that continuation of current trends will cause a highly significant rise in temperature which will only fall when all fossil fuels are exhausted. (For an enlightening insight into the current and prospective future situation, see the recent book by Tim Flannery The Weather Makers, (Text Publishing, Melbourne, 2005).

Note: My thanks to Victor Gostin for supplying useful information and for considerable discussion and helpful comments on the above as well as other articles in this Newsletter.

REGISTRATION FOR THEOSOPHY–SCIENCE SEMINAR

If you are interested in attending, please respond by email or post to the address below.
If you are not sure whether you will attend, but are considering attending, please respond accordingly and advise again when you definitely decide.
We expect to be able to accommodate all who wish to come; however accommodation is limited and if necessary, preference will be given to Group members and early respondents.

How will you arrive? A) By air to Gold Coast? B) by self-drive? Or C) as a passenger?
If self drive, are you able to pick up one or more others from the Airport? How many?
Would you be prepared to arrive early and return in your car to ferry others in return for a discount on accommodation?

IMPORTANT: Do you wish to give a talk? YES, NO, or Maybe?
If you wish to give a talk, Please give Subject, Title and BRIEF abstract.
If you are not sure, please indicate and give a definite response by January 7 or email by January 12. It is anticipated that TALKS will mainly be given by Group members.

Regards to you all,

Hugh Murdoch.

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