Cosmologists can't agree and are still in doubt

John G. Hartnett

The problems facing the standard cosmological big bang model of the origin and evolution of the universe by no means have been resolved. Despite what the media, and in this case a particular article hosted by NYTimes.com, may say, cosmologists continue to disagree on what the theory is and what the observations mean. A number of the key parameters are reviewed and it is shown how little is really known. These parameters involve the recent observations of high-*z* redshifted supernovas, upon which so much hope has been placed for the determination of the density of matter in the universe. Unresolved issues such as the meaning of normal and anomalous redshifts, dark matter and dark energy, the curvature of spacetime, the meaning of the structure in the cosmic microwave background radiation and a number of exotic theories are discussed. Competing plausible cosmological models and interpretations of the same data, consistent with a recent Creation are presented. Whatever, the final outcome is of a true description of the origin and structure of the universe, the big questions of *why* can only be ultimately answered by the One who was there at the Beginning.

On 23 July 2002, NYTimes.com hosted an article entitled 'In the Beginning ...' by Dennis Overbye. This was an attempt to put down any belief that science doesn't have the answers, i.e. it was a defence of *scientism*. The article pushes the point that even though, in the past, cosmologists may have been divided and lost on explanations of the origin, age and evolution of the universe, now this is not so.

Agreement on fundamental cosmic numbers?

Overbye says cosmologists are now united and in agreement on the details of the big bang origin of the universe:

> 'Dr Allan Sandage, the Carnegie Observatories astronomer, once called cosmology "the search for two numbers"—one, the Hubble constant, telling how fast the universe is expanding, and the other [the cosmic deceleration parameter] telling how fast the expansion is slowing, and thus whether the universe will expand forever or not.'

This is hardly the case. I can only think of a few numbers on which most cosmologists agree and the deceleration parameter is not one of them. However, one may be the Hubble parameter (H_0), which relates the speed that an object is receding to its distance from Earth. They currently claim $H_0 = 80 \pm 10$ km s^{-1} Mpc^{-1}, which is about a 12% error margin, but they still argue over what weighting factor one applies to the distance data that determines the parameter.

Another number is the cosmic microwave background (CMB) temperature of $T_0 = 2.73$ K. A third is the average density of visible normal matter in the current universe.

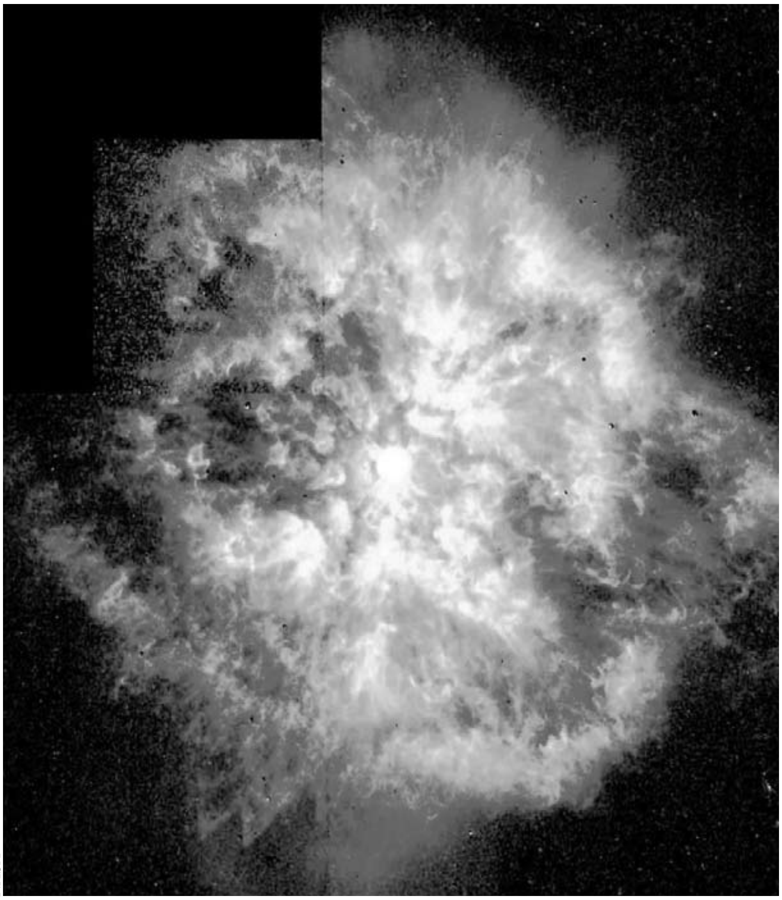
Many other parameters are unknown, such as the curvature of space, or the amount of normal matter in the universe expressed as a fraction of the total amount necessary for the universe to collapse back on itself, represented by the symbol (capital omega). This is actually one of the major debates among cosmologists: If < 1, then the universe is open and space has a hyperbolic geometry; if > 1, the universe is closed and space has an elliptical geometry. For any oscillating universe theory to work, the universe must be closed. But currently fashionable 'inflationary' models predict that the universe's density is just below the threshold of collapse, i.e. = 1—a geometrically 'flat' universe.[1]

Then there are the issues of dark matter, the interpretation of peculiar redshifts, even the interpretation of redshifts themselves that are not agreed upon by cosmologists.

I am reminded of a plenary talk that I heard delivered by Ron Ekers of the Australia Telescope National Facility at the Conference on Precision Electromagnetic Measurement, held in the Hilton Hotel, Sydney in the middle of 2000. This was a conference bringing together mostly physicists involved with making very precise measurements of quantities like mass (kilograms), time (seconds), frequency (hertz), resistance (ohms), capacitance (farads) etc. Generally they would report measurements with errors like 0.00000001% (or 1 part in 10^{10}) or less. In his talk, titled 'Metrology and the Universe', he made the clear point of saying how he felt a little out of place at the conference, because as an astrophysicist, he was happy with errors of 100% (or 1 part in 2). That is to say, if he were trying to determine some cosmological parameter, A, then he would be happy with a number somewhere between 0 and 2 times A (twice its expected value). Not exactly an exact science. It is a far cry from the precision of repeatable lab experiments. The problem with cosmology is the distance and time scales, which leave the data enormously open to interpretation.

Models are filled with many unknown parameters

Current cosmological big bang models are based on a solution of Einstein's field equation, which comes from his General Theory of Relativity. That particular solution was discovered by Friedmann and Lemaître (F–L). It suggested



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Resembling an aerial fireworks explosion, this dramatic NASA Hubble Space Telescope (HST) picture of the energetic star WR124 reveals it is surrounded by hot clumps of gas being ejected into space at speeds of over 160,000 km/h. The massive, hot central star is known as a Wolf-Rayet star. This extremely rare and short-lived class of super-hot star (in this case 50,000 K) is going through a violent, transitional phase characterized by the fierce ejection of mass.

that the universe was expanding. Earlier, Einstein himself had arrived at a different solution that suggested that the universe was static. He believed the universe to be stable and used a constant of integration in his equation to achieve this end. Hubble in 1929 announced that he believed the universe was expanding based on the observation of galaxies all over the sky racing away from the Earth. As a result, Einstein was accused of inserting a fudge factor (the cosmological constant) to keep the universe from collapsing. He is quoted as saying it was 'the biggest blunder of my life'. But the constant he inserted was a valid constant of integration, and now it has been revived to explain the apparent acceleration away from us of the distant galaxies. The point that needs to be clearly understood here is that there is a host of models that are collectively described by the many key parameters they incorporate.

Overbye writes:

> '"Cosmologists are often wrong," the Russian Nobel Prize-winning physicist Lev Landau put it, "but never in doubt".'

This is contradicted by the existence of many contrary opinions on the details of the big bang, as well as the continued survival of the opposing model, the Steady State theory of the late Sir Fred Hoyle, Bondi and Gold. It seemed to die with the discovery of the CMB radiation[2] but revived again recently by Hoyle, Burbidge and Narlikar.[3,4]

Big bangers claim that Gamow successfully predicted the CMB temperature in 1948 with a value of 5 K (later in the 1950s raised to 10 K). However, this is undermined by the fact that McKellar successfully predicted a 2.3 K temperature, in 1941, from observation of absorption lines caused by quantum mechanical features of rotating diatomic interstellar molecules. Remember it wasn't until 1965 when Penzias and Wilson discovered the radiation pouring in from the cosmos. Gold had argued in 1955 that thermalization of starlight would occur but never did the calculation which would have produced a temperature of 2.78 K.

This just demonstrates the logical fallacy of using successful prediction as 'proof' of a theory, because there may be more than one theory that predicts the same data. Rather, it is logically valid to use a failed prediction as disproof of a theory.[5]

Then in the past few decades, there has arisen a new breed of cosmologist who accepts neither of these views above. Some are creationists, like Humphreys and Gentry, whose models of origins are based on the book of Genesis, as a creation of God, the supernatural Creator of all things.[6,7] They don't pretend to know all the details of the early history, but have offered some new and innovative ideas. Others see design in nature and don't claim to be able to extrapolate what we observe today to the distant past.

Ripples in the Cosmic Microwave Background radiation

Cosmologists are hardly 'entering a "golden age" in which data are outrunning speculation' as the article suggests. If this is a reference to the volumes of data coming from measurements of the Cosmic Microwave Background (CMB) radiation from the cosmos, it is misplaced. There are many possible interpretations of the blotches seen in the CMB two-dimensional temperature maps besides the desired belief that they are some 'clumpiness' due to the quantum nature of the radiation shortly after the big bang. The believers see them as the seeds of galaxies but are they?

Gurzadyan[8] has interpreted them in a different way, as the effect of mixing of the trajectories of photons within a bundle as they propagate through space. That is, because a bundle of photons is not a point object, the individual photons follow different paths from the source to the receiver. The result at the receiving end is an enlarged and smeared image.

A 'standard' model?

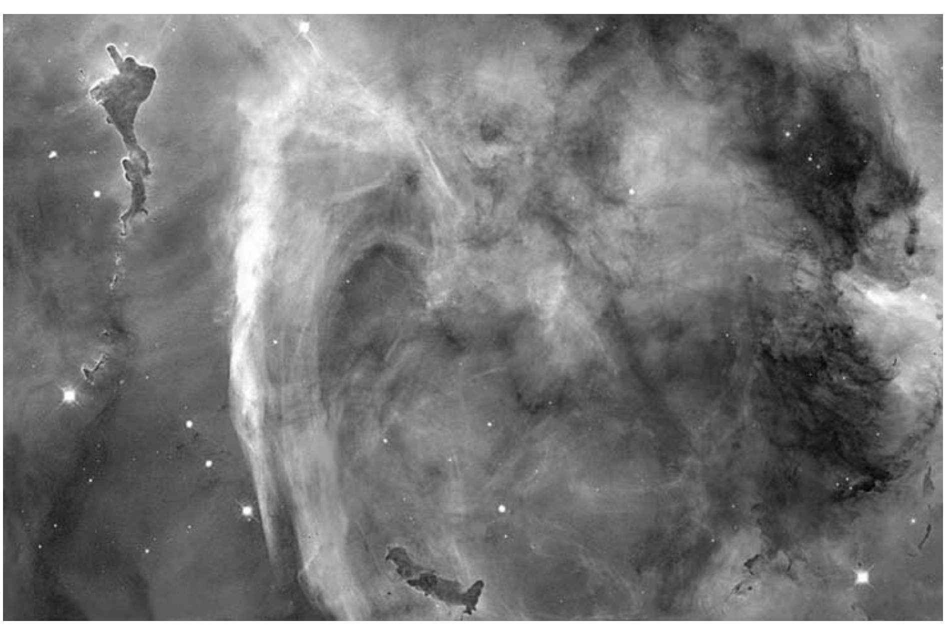
The article speaks of a 'standard model' of the universe. The so-called standard model is a construct in the minds of the big bang cosmologist where the big bang is *assumed* to be true and then the value of the parameters needed to achieve this are explored. This approach has led to many absurd conclusions. In the analysis of the cosmic microwave background data, many key parameters are inserted and then it is claimed that they are seeing the 'hand of God' in the period milliseconds after the big bang. Also this approach has been applied to the supernova data of Perlmutter[9–11] and Schmidt[12,13] which they interpret to mean the universe is accelerating. The extrapolation is critically dependent on the choice of these parameters.

The F–L big bang inflation (expanding universe) models correctly predict the CMB radiation temperatures both now and at times in the past when the universe was smaller and hotter. But so does Gentry's model[7] that utilizes the Einstein-de Sitter static spacetime solution, which sees the galaxies expanding into the *existing* space (as opposed to classic big bang which has space *itself* expanding). No spatial stretching occurs, yet many of the observational tests of a cosmological model are verified. Both classes of models are based on the same General Theory of Relativity. F–L big models assume an unbounded possibly infinite universe. Gentry's and Humphreys' models assume the universe to be finite and bounded, a view consistent with Genesis. The consequence of different boundary conditions radically alters the outcome of the model, yet the latter models explain some observations that the big bangers ignore.[14]

Dark matter and dark energy

The 'standard model' now seems to demand that the universe is about 5% ordinary matter, which is observed through telescopes; 22.5% is dark matter, which is not observed; and the remaining is a mysterious dark energy, 72.5%. The need for the dark energy has been invoked to explain the acceleration of distant galaxies. Besides the supernova data, there is no hard evidence for this additional long-range force. Usually the symbol $_M$ represents the fraction of both normal and dark matter in the universe and $_\Lambda$ represents the contribution from the cosmological constant or dark energy. The data from 42 supernovae was interpreted to mean $_M + {}_\Lambda = 1$ or the universe is flat. Hence in the 'standard model' above $_M = 0.28$ and $_\Lambda = 0.72$. But these parameters can vary between $_M = 0$–0.75 and $_\Lambda = 1$–0.25 and still fit the data reasonably well.[15]

'Quintessence' is being invoked. This is speculated to be the energy density of a slowly evolving scalar field,[16] which may constitute a dynamical form of the homogeneous dark energy in the universe. This is viewed as different from the cosmological constant, a long-range force accelerating the galaxies apart. Cosmological observations or a time variation of fundamental 'constants' are expected to distinguish quintessence from a cosmological constant. Even models including a variable speed of light, which would violate Einstein's General and Special Theories, are now in the literature.[17]



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Previously unseen details of a mysterious, complex structure within the Carina Nebula (NGC 3372) are revealed by this image of the 'Keyhole Nebula', obtained with NASA's HST. The Carina Nebula also contains several other stars that are among the hottest and most massive known, each about 10 times as hot, and 100 times as massive, as our Sun.

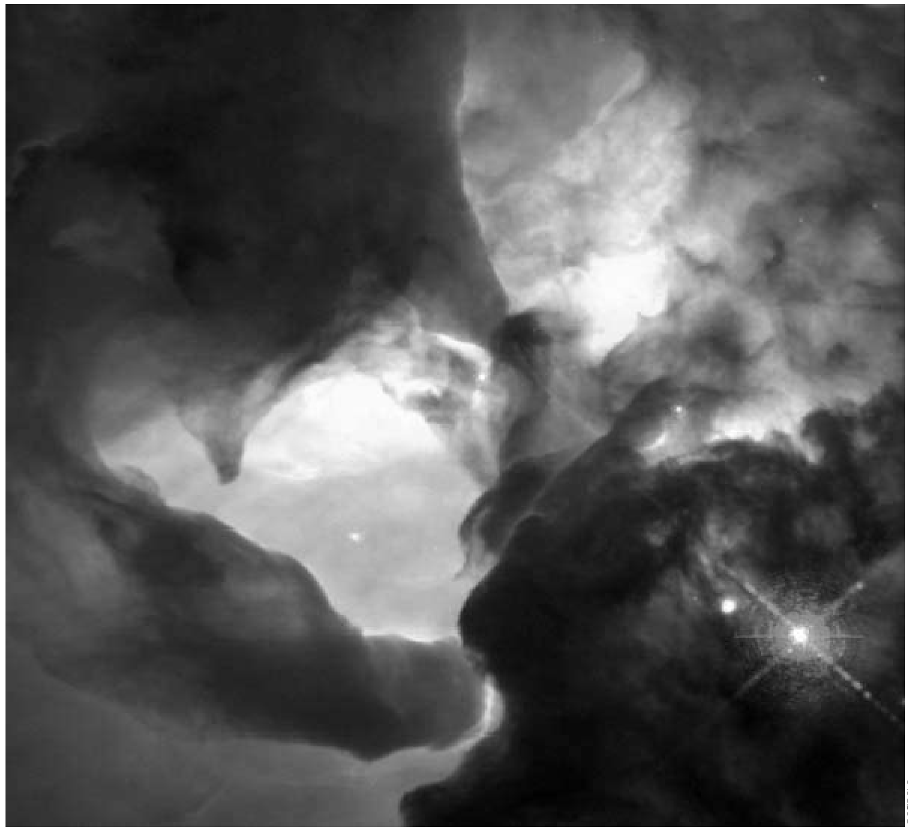
The need for dark matter comes from observations of apparently anomalous speeds of stars in the outer arms of some spiral galaxies (rotation curves). Also, the motion of some galaxies in clusters and the aesthetic desire of cosmologists to see the universe just avoid collapsing back on itself (i.e. to have a flat universe) dictates much more matter is needed than is observed.

But there may be other explanations for these observations. For example the case of the rotation curves can be explained by a modification to Newton's gravitational law, changing the inverse square of distance to just inverse distance at distances greater than about 3 million light-years. The model is based on a different view of gravitation to Einstein's

General Theory that involves a degree of gravitational shielding by massive objects. The model is not without experimental basis as a number of experiments have been repeated with the same peculiar results. The mass derived from the motion of the separation of galaxies in clusters is based on a long-range assumption, which cannot be proven. Also there is the inherent assumption about the billion years time scale of the age of the galaxies. The NYTimes article says of the model with flat space (because of critical density):

> ' ... to many theorists the simplest and most mathematically beautiful solution of all.'

But there is no reason to assume the universe has critical density. According to McGaugh, recent BOOMERANG data, which measured variations in the CMB radiation, suggest that the universe is filled with normal matter, no exotic particles, and no cold dark matter (CDM). This would leave the cosmologist very short of their needed matter, or the F–L models on which McGaugh did his calculations are wrong.



NASA

This NASA HST image reveals a pair of one-half light-year long interstellar 'twisters'—eerie funnels and twisted-rope structures—in the heart of the Lagoon Nebula (Messier 8) which lies 5,000 light-years away in the direction of the constellation Sagittarius.

The lack of CDM has caused particular concern for some Princeton astrophysicists who propose particles as big as galaxies to explain lack of dwarf galaxy formation. The particles have a density 10^{-24} times the density of an electron, and wave-functions of the order of 3,000 light-years. They interact only with gravity and are almost impossible to detect. The problem seems to be that these particles are needed to explain why dwarf galaxies are far rarer than big bang theory predicts. As theory goes, CDM was introduced to get matter to form galaxies early in the universe's history, but that created another problem in computer simulations, forming huge numbers of unobserved dwarf galaxies. Hence the proposed particles, that would form giant globs of 'fuzzy' cold dark matter.

The missing dark matter in galaxies, clusters and the whole universe, and the smoothness of the CMB radiation create unassailable problems for the formation of stars and galaxies in the 'early universe'.[18] The big bang inflation model needed the temperature variations in the CMB to be more than 10 times larger. Still, it was hailed a success? Prof. Stephen Hawking in his book said:

> 'This [big bang] picture of the universe ... is in agreement with all the observational evidence that we have today,' but he admitted, 'Nevertheless, it leaves a number of important questions unanswered ... (the origin of the stars and galaxies).'

The origin of stars and galaxies! Without an explanation of those there is no explanation of the structure of the universe. That was published 14 years ago, and Overbye's article here admits the problem is still there:

> '"It's a huge mystery exactly how stars form," Dr. Richard Bond of the Canadian Institute for Theoretical Astrophysics.'

This confirms earlier creationist statements.[19–21]

The meaning of redshifts

The very meaning of redshifts themselves is argued over by cosmologists. Only in F–L expanding universe models is the interpretation that redshifts result from the stretching of space as the photons of light are in flight through the cosmos. The unproven and unprovable Cosmological Principle is then invoked to say that what we see is not special, and any observer anywhere in the universe would see the same. The implication of empirical evidence is that the redshifts measured in the starlight of galaxies in all directions in the sky imply that the Earth is near the centre of the universe. The simplest assumption would tell us that they are Doppler shifts. But because this was philosophically unacceptable, an alternative was developed, that the centre is everywhere and that the red-shifts are cosmological in an infinite universe that is essentially homogeneous. Hubble's 1937 book *The Observational Approach to Cosmology* reveals the bias:

> 'Such a condition [these Doppler shifts] would imply that we occupy a unique position in the universe, ... But the unwelcome supposition of a favored location must be avoided at all costs ... is intolerable ... moreover, it represents a discrepancy with the theory because the theory postulates homogeneity' (pp. 50, 51, 59).

Hubble himself was driven by his own bias to avoid a conclusion he could not accept. The notion of positively curved space also gets the cosmologist out of the 'hot' water of the Earth being in a special place in the universe. In that case the universe can be finite but have no centre. The problem with that model, according to its adherents, is that the supernova data indicate flat space. Also the CMB data is interpreted by deBernardis[22] to be consistent with flat space but by Gurzadyan[23] with negative curvature. Why not accept the obvious?

Then there are the observations of Tifft. His data, from galaxies in all directions in the sky, show that redshifts are quantised, or come in discrete amounts. The big bang F–L cosmologists discount these observations as they don't fit the standard model. One interpretation of this fact would be that the universe has a shell structure and galaxies are found at distances with regular intervals between. This also would put the Earth somewhere near the centre of the universe, because if it were a long way from the point on which the shells are centred the effect of quantised redshifts would be washed out. This fact is recognised in both Humphreys' and Gentry's cosmological models.[24,25]

Then there are the observations of Arp who showed peculiar physical associations between quasars and galaxies with greatly different redshifts.[26] A survey of some 70 quasars showed that they were quantised and that they follow a predictable pattern. How are these facts explained by big bang cosmology? Instead, they are ignored or called 'bad science'.

Exotic theories

New cosmological theories are rife, more so today than ever before. In fact they are more exotic than ever. Maybe 'exotic' is the word they deliberately use to disguise the truth of how 'way out' some of their models are; yet the very word actually hints at that. There are models that start before the big bang, where the universe supposedly arose from a fluctuation that may continually occur creating multiple universes, an infinite number that makes anything possible. But there is not a shred of experimental evidence for these theories, only fairies in the bottom of the garden. The NYTimes article says:

> 'Many varieties of these particles [that would comprise dark matter left over from the big bang] are predicted by theories of high-energy physics. But their existence has not been confirmed or detected in particle accelerators. "We theorists can invent all sorts of garbage to fill the universe," Dr Sheldon Glashow, a Harvard physicist and Nobel laureate, told a gathering on dark matter in 1981.'

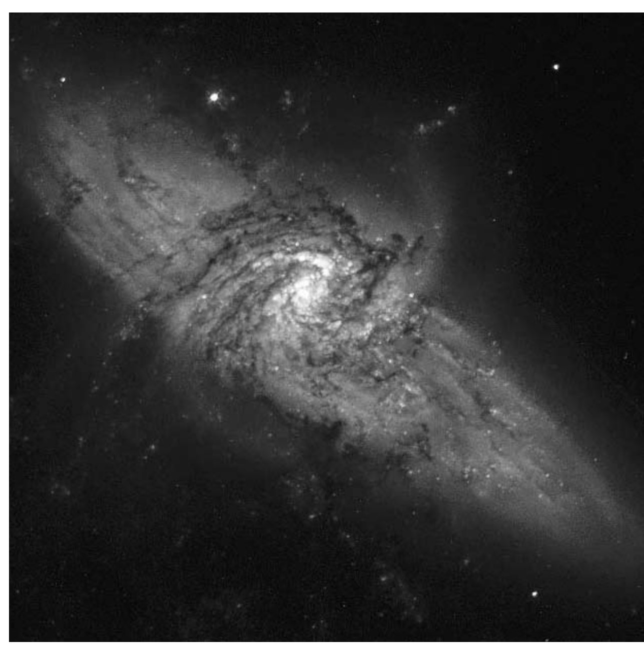
There are the string theories, with M-branes, P-branes etc. but these theories require energies greater than the Sun can deliver to test them.

Finally I quote from a paper[27] posted to the Los Alamos pre-print archive on 1 August 2002 with the abstract stating that some assumptions of the inflation model lead to deep paradoxes

> 'Present cosmological evidence points to an inflationary beginning and an accelerated de Sitter end [i.e. universe death by expansion]. Most cosmologists accept these assumptions, but there are *still major unresolved debates* concerning them. For example, there is no consensus about initial conditions. Neither string theory nor quantum gravity provide a consistent starting point for a discussion of the initial singularity or why the entropy of the initial state is so low. ... Some unknown agent initially started the inflation high up on its potential, and the rest is history' [emphasis added].[27]

What hope have we to get a resolution then? The article asks:

> 'Moreover there are some questions that scien-



This image from NASA's HST and its Wide Field Planetary Camera 2 (WFPC2) shows the unique galaxy pair called NGC 3314. Through an extraordinary 'chance' alignment, a face-on spiral galaxy lies precisely in front of another larger spiral. This line-up provides us with the rare chance to visualize dark material within the front galaxy, seen only because it is silhouetted against the object behind it. Dust lying in the spiral arms of the foreground galaxy stands out where it absorbs light from the more distant galaxy. This silhouetting shows us where the interstellar dust clouds are located, and how much light they absorb.

tists still do not know how to ask, let alone answer, scientifically. Was there anything before the Big Bang? Is there a role for life in the cosmos? Why is there something rather than nothing at all? Will we ever know?'

These questions have been asked. They are answered in the Bible. The Creation by God's hand gives meaning to the universe. Creationists, who accept the Biblical account, and also accept the validity of the laws of physics, are looking for the mechanisms of the origin of the universe, but within the framework revealed by the One who was there at the Creation. God is the first cause of all, only the details are not always clear. Some questions cannot be answered scientifically but the answer has been given.

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