

The speed of matter

Justin K. Taylor

Creation scientists working in astronomy have devoted much research to the problem of distant starlight, and rightly so. However, I suggest that distant starlight is only one part of a larger issue. Many active galaxies are observed to eject jets of matter over distances of millions of light-years. Colliding galaxies also must have travelled over great distances to interact with one another in the manner observed. Such motions obviously cannot occur in a timescale of a few thousand years, as this would require superluminal (faster-than-light) velocities. These observations suggest that distant parts of the universe really are very old. This, in turn, implies that the solution to the starlight-travel-time problem is to be found in some form of time-dilation, not a changing speed of light. Observations thus favour Humphreys' and Hartnett's cosmologies above Setterfield's theory.

Jets from active galaxies

Active galactic nuclei, or AGN, inhabit the centres of some galaxies and are the source of a number of strange phenomena. Most importantly for this discussion, AGN sometimes eject jets of matter at high speeds. These jets can span distances of millions of light-years.¹ This necessitates that the matter left the AGN millions of years ago, assuming the greatest possible speed, and no deceleration. (Deceleration would necessitate even more time.)

For example, there is the radio galaxy Centarus A. In visible light, Centarus A is a somewhat unusual elliptical galaxy. Radio observations reveal something even stranger. Jets of matter in the centre of Centarus A lead into huge lobes of radio-emitting material. These lobes extend to distances of over 800,000 light-years from the centre of the galaxy.² If this material had left the galaxy with an initial speed close to the speed of light, it would have taken it several hundred million years (taking deceleration into account) to reach its present position.³

The radio galaxy B2 1144+35 has jets of matter emanating from it, initially at 95% of the speed of light (0.95c). The speed is observed to decrease to only 0.02c by the time the matter reaches 78,000 light-years from the centre. These jets lead to lobes on the scale of millions of light-years, with an implied age of around 100 million years.⁴

Quasars often exhibit similar phenomena. The quasar 3C 273 has a jet 100,000 light-years long extending from its centre. As yet another example, 3C 175 has jets leading into radio lobes about 500,000 light-years from its centre.^{5,6}

In all these cases, we see matter travelling over great distances, greater than could be explained if only a few thousand years had passed since creation. Thus, we not only have a light-travel-time problem, but a *matter*-travel-time problem as well.

Colliding or interacting galaxies

It is not unusual to observe galaxies in the act of colliding with one another, a process that, like the ejection of jets and lobes, takes a great deal of time. The Milky Way Galaxy is 100,000 light-years in diameter, and this is a fairly normal size. A galaxy typically must move a distance at least equal to its own diameter (if not much more) in order to interact with another galaxy in the ways astronomers have observed. Thus, it would take hundreds of thousands of years for two galaxies to collide, even if they were created side-by-side and moved toward one another at nearly the speed of light. Of course, these are unrealistically optimistic assumptions. Real galaxy collisions take far longer than this lower limit. (It has been suggested that some of these events may be mergers rather than collisions, but in any case, the same argument would apply.)

A specific example of such interaction is the Tadpole Galaxy (UGC 10214—figure 1), a spiral that has been disrupted by a collision with a smaller galaxy. The interaction has drawn out a tail of material extending 390,000 light-years from the Tadpole, clearly requiring timescales well in excess of a few thousand years.⁷

The Antennae (NGC 4038 and NGC 4039—figure 2) are two galaxies, probably once spirals, in the act of merging with one another. Long tails have been thrown out from the galaxies as a result of the interaction. The entire system is about 300,000 light-years long. Given the observed motion of the southern tail, it must have been ejected about 500 million years ago.⁸

The Cartwheel Galaxy (figure 3) is a very unusual example of interaction. Apparently, another galaxy tore right through the centre of the Cartwheel, producing expanding rings like the ripples in water after a stone is thrown in. The outermost ring of the Cartwheel is 143,000 light-years in diameter, and the observed expansion speed implies the collision occurred about 210–720 million years ago.^{9,10}

Closer to home, the Large and Small Magellanic Clouds (LMC and SMC) are interacting with our galaxy. The Clouds are classified as dwarf irregular galaxies, and are in orbit about one another, with both orbiting the Milky Way. A long streamer of material, appropriately named the Magellanic Stream, leads backward from the Clouds,

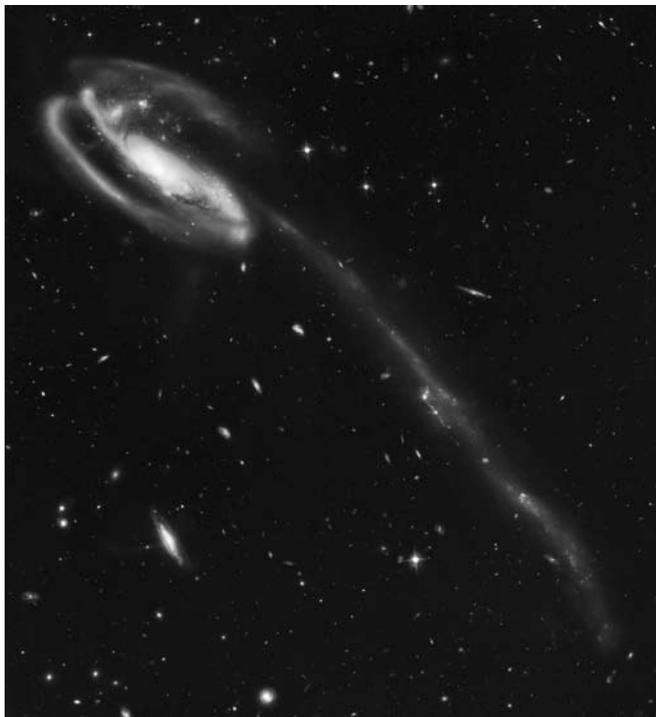


Figure 1. *The Tadpole Galaxy. The train of matter extending to the lower right is 390,000 light-years long. Courtesy NASA, H. Ford (JHU), G. Illingworth (UCSC/LO), M. Clampin (STScI), G. Hartig (STScI), the ACS Science Team, and ESA.*

bearing witness to a past encounter between the Clouds and the Milky Way.¹¹ It is believed that the stream was torn from the Magellanic Clouds by the Milky Way's tidal forces. Computer simulations suggest that this encounter occurred about 1.5 billion years ago. These simulations have accurately reproduced the observed radial velocity profile of the stream, suggesting they are on the right track.¹² However, some scientists have argued that this explanation has difficulties accounting for some data. Another model has been proposed, in which the stream was stripped from the Clouds as a result of ram pressure when they passed through an 'extended ionized disc of the [Milky Way] Galaxy'. This model gives a date of 500 million years ago for the collision.¹³ In either case, the Magellanic Stream is clearly a very 'old' structure.

Galaxies leaving wakes

Another indicator of great age involves galaxies leaving behind wakes of material stripped off by motion through the intergalactic medium. The spiral galaxy C153 is leaving behind a trail of cool gas as it plunges through the hot gas of the cluster Abell 2125 (see figure 4.) This trail is over 200,000 light-years long, which would require timescales of more than just a few thousand years, even if the galaxy were moving at nearly the speed of light. But C153 is actually moving much slower than this, with a radial (line-

of-sight) velocity of about 2,000 km/sec (0.0067c) relative to the cluster.^{14,15}

C153 is not unique. A similar example is found in the cluster Abell 160, where X-ray observations have revealed multiple wakes left behind by the galaxies of the cluster.¹⁶ At least seven other galaxies have been observed with wakes behind them.¹⁶

Mature creation?

Some readers might object, suggesting that God could have created these active and colliding galaxies much as they are today (including jets, wakes, etc.), with no need for great ages. However, this suggestion would imply that God created jets of matter leading into lobes they did not produce, giving the distinct, and false, impression of great age. It would further imply that He created galaxies with the distinct appearance of a history of interaction, which had never happened—again, giving a false impression of great age. The mature creation concept leads to the conclusion that God created man with an insatiable desire to understand the universe, then put him in a universe that could not be



Figure 2. *The Antennae. Note the tails of matter flung out to distances of well over 100,000 light-years. Courtesy Brad Whitmore (STScI) and NASA.*

understood. Proverbs 25:2 tells us that ‘It is the glory of God to conceal a matter, but the glory of kings is to search out a matter’ (NASB). It seems God created the universe with the expectation that we would try to search it out. Thus, it is only reasonable to suppose that this is possible.

Besides the theological issues, the idea of a mature creation, in the sense discussed here, is more a dismissal than an explanation. If one claimed that God created rocks with fossils already in them, he would dismiss the entire field of paleontology. But creation scientists have found it more scientifically productive to take the fossil record at face value and show that it does not support evolution. While mature creation remains possible in theory, we would do well to search for a better explanation, as has been done in paleontology.

However, there is still the vexing question of where to draw the line. Most creationists believe the sun was created more or less the way it is today. What sort of things can we conclude *would not be created* as we see them? I suggest that the key issue is whether it would be deceptive for God to create something in its present form.¹⁷ We can conclude with great certainty, for example, that God did not create fossils already in the rocks. Also, most creation scientists working in the field of astronomy would agree that the

starlight-created-in-transit concept makes God out to be somewhat of a deceiver. I submit that the same argument applies to interacting galaxies.

In some cases there are independent methods of tracing the collision back to its source, and they give reasonably consistent results for the time since collision. Tidal tails are observed, of the same type produced in even the simplest computer simulations. The observations fit with a long history of interacting galaxies.

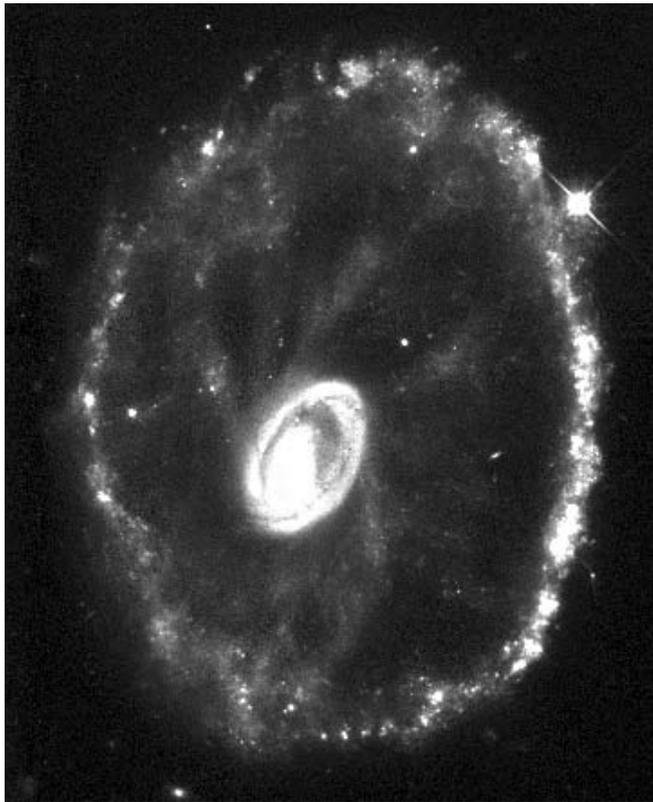
We do not know how physics and chemistry behaved under the creative word of God, but we do know that time was also created by God for his purposes. The evidence from galaxy interaction suggests that some parts of the cosmos experienced a large amount of time during the six days of creation.

What about evidences for a young universe?

Readers might also object that there are evidences for youth in the universe. There are three major arguments along these lines, which I will review briefly here. First, it has been claimed that supernova remnants (SNRs) in the Milky Way Galaxy indicate youth, as there are fewer old SNRs than evolutionary assumptions predict.¹⁸ The age of the Milky Way is beyond the scope of this paper. Our galaxy might very well be younger than the rest of the universe; some cosmologies involve a time-dilation effect that would give greater ages with greater distance from Earth.

A second argument for a young universe holds that galaxy clusters are unstable, and ought to have broken up if they were really billions of years old. However, this assumes that other explanations such as dark matter (not necessarily the non-baryonic type required by the big bang) or MOND are not valid. The conventional solution to this problem suggests that some additional dark matter could bind clusters together. In fact, much evidence exists to support dark matter theories. Gravitational lensing observations have even allowed astronomers to map what appears to be a distribution of dark matter in the Abell cluster CL0024+1654.¹⁹ Independent evidence for the existence of dark matter comes from analysis of the motions of double galaxies,²⁰ and from the rotation curves of spiral galaxies. However, some have suggested that the data could be explained equally well, or even better, in terms of Modified Newtonian Dynamics (MOND).²¹ A general relativistic version of MOND has been developed that explains both galaxy dynamics and gravitational lensing.²² In either case, the argument that galaxy clusters are unstable is without real support.

A third argument is based on the wind-up of spiral galaxies. Spiral arms, it is claimed, should wind up and merge into an indistinguishable disk after a few rotations, a process that would take only about two billion years.¹⁸ Since spiral galaxies still exist, it is argued, the universe cannot



NASA/STScI

Figure 3. The Cartwheel Galaxy apparently suffered a direct hit which produced the expanding ring observed here. The expansion speed of the ring implies an age of hundreds of millions of years. Courtesy Curt Struck and Philip Appleton (Iowa State University), Kirk Borne (Hughes STX Corporation), Ray Lucas (STScI) and NASA/ESA.

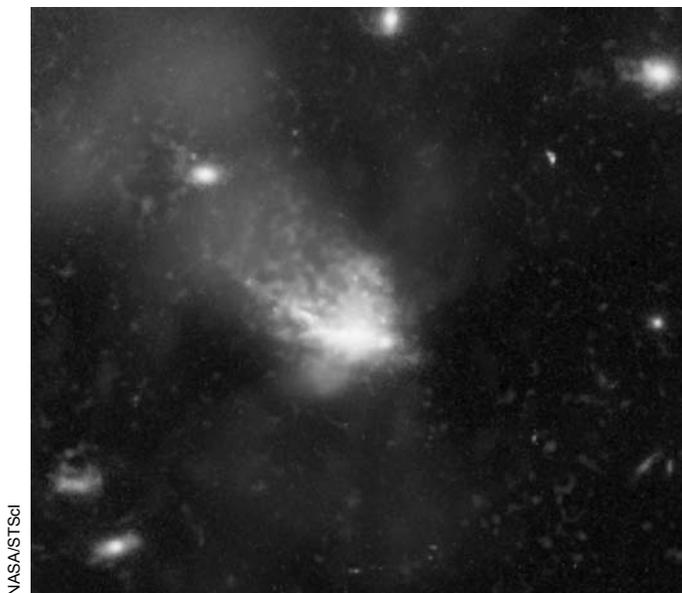


Figure 4. A composite image of the spiral galaxy C153. Note the 200,000 light-year-long wake of gas extending to the upper left. Courtesy NASA, W. Keel (U Alabama), F. Owen (NRAO), M. Ledlow (Gemini Obs.) and D. Wang (U Mass.).

be this old. However, this argument assumes that spiral arms are actually physical structures that would wind up. Alternatively, it has been suggested that the spiral arms are really density-waves travelling through the disk of the galaxy. This would eliminate the winding problem. Creationists have sometimes argued against this density-wave theory, pointing out, for example, that it cannot explain the details of the galaxy M51.²³ But given our current level of knowledge of galaxies (and given their complexity), we should expect some problems with the details. Nevertheless, the density-wave theory has been very successful in explaining the general structure of galaxies such as M81 and M74,²⁴ as well as the Milky Way.²⁵ Analysis of the motions of gas in M81 (figure 5) has also confirmed the predictions of the density-wave theory.²⁶ In fact, despite some difficulties with the details of M51, this galaxy, too, has confirmed the more general predictions of the density-wave theory.⁸

The essential point here is that spiral galaxies point to a young universe only if the spiral arms are physical structures that would wind up. This is only one theory among several, and the evidence seems to support the others.²⁷

Implications for creationist cosmologies

There are many convincing arguments for a young earth, and several good arguments for a young solar system (though creation scientists have devoted less research to the latter). However, the arguments for youth on cosmic scales turn out to be less than convincing. Furthermore, there is much evidence for maturity in the universe beyond our solar system. Interacting galaxies, jets from AGN and other phenomena provide examples of matter that has apparently



Figure 5. The spiral galaxy M81 has confirmed the predictions of the density-wave theory, implying that spiral arms do not wind up, and thus cannot be used as an argument for a young universe. Courtesy NASA/JPL/Caltech/Harvard-Smithsonian Center for Astrophysics.

moved over distances of hundreds of thousands to millions of light-years. The observed velocities often indicate ages of hundreds of millions of years or more assuming uniform conditions. (Even if we do not assume uniform conditions, the matter would have to move much faster than light to reach its present position in a few thousand years.)

These observational data indicate that distant parts of the universe really are very old. This confirms that some sort of time-dilation has occurred in our near vicinity, as proposed by Humphreys²⁸ and Hartnett.^{29,30} These data also indicate that the already-questioned³¹ CDK hypothesis, proposed by Barry Setterfield, is not sufficient to solve the entire problem.

Future studies of the age of galaxies in the local group, and, better yet, ages within the Milky Way, could put very important constraints on cosmological models. (Of special importance is the question of whether or not ages based on stellar evolution can be trusted.) If the Milky Way, including the sun's near neighbourhood, were found to be as old as the rest of the universe, this would imply that the time-dilation occurred only within a short distance of Earth, and with a sharp boundary. This would rule out Humphreys' model, but would be consistent with Hartnett's. On the other hand, if the Milky Way were found to be younger than distant parts of the universe, but still older than the solar system, this would allow either model. More importantly, however, such an observation (of gradually increasing age with increasing distance from Earth) would be a spectacular confirmation that time-dilation did indeed occur. The age of the universe, and more specifically the manner in which it changes as a function of distance from Earth, is a vital area for research in creationist cosmology. Much of the data needed for such studies is already available, and simply needs to be re-examined in light of creationist ideas.

Of course, science alone cannot provide certain

information about the distant past, and caution is always in order. But careful examination of the evidence in the light of biblical revelation should eventually lead to a consistent theory of cosmic history.

Acknowledgments

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27. It should be noted here that density-waves are not the only explanation of spiral arms. While they can neatly explain the 'grand design' spirals, the density-wave theory cannot easily explain the more disorderly, flocculent spirals. Another model has been proposed, called the stochastic theory, which can account for these. It is generally believed that both the density-wave and stochastic theories are correct, though they apply to different types of spirals. See Waller and Hodge, ref. 8, pp. 28–30.
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Justin K. Taylor is a student of mathematics and physics at a U.S. University. He is an amateur astronomer and plans to study astrophysics in graduate school. His special interests include stellar and galactic astrophysics.

Erratum TJ 19(2)

- 1) 'Mutations selection and the quest for meatier livestock', p. 18, column 2, near the bottom of second paragraph. The correct sentence should read, "... resulting in a myostatin protein with a highly conserved amino acid **cysteine** being replaced by a tyrosine in the active region."
- 2) 'The Christian foundations of the rule of law in the West: a legacy of liberty and resistance against tyranny', p. 68, column 2, figure caption. The correct caption should read, "**Barons compelled King John to sign the Magna Carta...**"