DARK ENERGY AS THE KEY TO THE COSMOS
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The February 2007 issue of *Scientific American* has an article entitled "The Universe's Invisible Hand" by Christopher I. Conselice which suggests "Dark Energy may be the key link among several aspects of galaxy formation that used to appear unrelated."

As an overview it is suggested:

> "Dark energy is best known as the putative agent of cosmic acceleration. An unidentified substance that exerts a kind of antigravity force on the universe as a whole."

This antigravity suggestion is directly inconsistent with Newtonian physics (in which actions at a distance have their origin in matter) based upon "an unidentified substance" which is to act in a manner inconsistent with the action of any force known to man. This is an outrageous basis for scientific speculation, particularly where what passes for science today appears to have accepted it, at least to the point where the most widely read scientific magazine considers it worthy of publication. This damns the modern physics community as well as the magazine which permitted publication.

It is further suggested:

> "Less well known is that dark energy also has secondary effects on material within the universe. It helped to imprint the characteristic filigree pattern of matter on large scales. On a smaller scale it appears to have choked off the growth of galaxy clusters some six billion years ago."

If dark energy plausibly explains problems relating to the formation and evolution of galaxies it might have some merit, but if it does not this is a further reason for discarding it. Let us briefly consider the two quoted assertions for neither assertion is adequately explained. From the perspective of reality, the filagree pattern exists, but there is no direct evidence that growth of galaxy clusters was choked off six billion years ago, as discussed below.

The Hubble Space telescope has taken two sets of pictures of clusters of galaxies in two regions in extremely remote space. In one set of pictures large numbers of very young and bright small round objects is present. In the other set of pictures of the other region there is a cluster of a large number of mature galaxies. This cluster of remote galaxies must have been formed in the last two billion years, so clusters of galaxies have formed more recently than six billion years ago. This evidence is ignored.

Astronomers have found a curious instance in which the clustering of galaxies was actually choked off, but that choking occurred about 10 billion years ago, not in the most recent 6 billion years. More particularly, a review of galaxy clusters in intermediately remote space (1) shows old galaxies which are tightly clustered as well as young galaxies which are loosely clustered. Citation (1) also shows, to the astonishment of modern astrophysics, that there are few clusters having an in-between status. So the clustering process in intermediately remote space (about 6 to 8 billion light-years away) has not only continued the clustering of old galaxies and started the clustering of young galaxies, but has proceeded in a confusing manner because clusters of intermediate age and intermediate clustering are strangely absent. So something did choke off the formation of clusters of galaxies, and then, a few billion years later,

re-started the formation of clusters. This, quite obviously, has nothing whatever to do with dark energy. Conselice's 2007 Scientific American article discussed herein also ignores these peculiar galaxy clustering findings.

Moreover, and to the surprise of modern astrophysics (and as conceded in the article) few dwarf and normal-sized galaxies are present at a distance beyond six billion light-years so few of the more massive galaxies were formed in remote space which is where galaxies were formed in the most recent six billion years of this universe. Of course many of the more massive galaxies were formed closer to us during that time period so many galaxies younger than six billion years were formed within six billion light-years of us. Most of these have been incorporated into existing clusters. The suggestion dark energy has choked off the growth of clusters six billion years ago is made without confronting the available observations which, as noted above, are manifestly peculiar and at least partially inconsistent with the asserted fact.

Considering more fully the choking off of cluster formation noted above, if dark energy formed the clusters, why did it not in intermediately remote space form the peculiarly absent clusters of intermediate age and intermediate extent of clustering? The reported sequence of events would require dark energy to provide an action which was on to form the older clusters, then off so as not to form the clusters of intermediate age, and then on again to form the younger clusters. It jars the mind to think any form of energy in space would produce this on and off action. Also, if dark energy choked off the clusters, why did it not do so equally well everywhere in the cosmos for clusters containing young galaxies are present close to us? The failure to resolve these obvious questions undermines the suggestion that dark energy exists so as to choke off galaxy formation in the early universe in some unexplained manner.

The suggestion that dark energy has "choked off the growth of galaxy clusters some six billion years ago." requires additional discussion because the article suggests, on the one hand, that dark energy is involved in forming the clusters and, on the other hand, it also suggests it is involved in causing them to stop forming. When the same agent has opposite functions at different times or in different portions of the visible universe at the same time, this is manifestly illogical and strongly suggestive of error, especially when no detailed effort is made to confront the troublesome facts or to explain how the choking action takes place.

Two additional aspects of the formation of galactic clusters are of interest to the possible existence of dark energy. First, modern astrophysics now concludes the clustering of galaxies takes place progressively over a period of time as gravity draws the galaxies together. But it is now well documented that larger clusters and larger voids than are present near us exist a few billion light-years away from our central position in the visible universe even though, in big bang thinking, these relatively remote clusters had billions of years less time in which to gather together. As should now be evident the subject article relies upon clustering to bolster its argument while it ignores well-recognized clustering problems.

Second, the evidence referred to in the article suggests few dwarf or normal size galaxies have formed in the remote universe where they had to be formed in the most recent six billion light-years. Since full-sized galaxies are the stuff of which clusters of galaxies are made, their substantial absence directly explains the small number of such clusters at greater distance. The article never considers the fact that the small number of clusters beyond six billion light-

years might simply result from the absence of the galaxies which would be contained in the clusters. It seems it is not the clustering process which was choked off in remote space, as the article states, but the formation of larger size galaxies, and this undermines the article's analysis.

So the article reaches conclusions without considering the problems which those conclusions either raise or encounter. Indeed, the article ignores existing observations when it reaches its conclusions. This type of incompleteness destroys those conclusions.

The article also suggests:

> "On a still smaller scale, dark energy has reduced the rate at which galaxies yank on, bang into and merge with one another. Such interactions shape galaxies. Had dark energy been weaker or stronger, the Milky Way might have had a lower star formation rate, so the heavy elements that constitute our planet might never have been synthesized."

The first thought is that the rate of mergers has been reduced, but this is not supported. The more peculiar suggestion is that our Milky Way galaxy would have a lower star formation rate regardless of whether the dark energy supposedly near us was "weaker or stronger". It is obviously strange to conclude that opposite variations in the strength of something which forces some action would yield the same result (here a lower star formation rate). Despite the obvious peculiarity of this conclusion, these opposite actions are not justified. The article and the magazine which published it do not appear to have considered the lack of logic in this suggestion. Where is the editorial review which editors of distinguished magazines are supposed to apply?

Considering the assertion more specifically, our own Milky Way galaxy does not reveal any significant disruption even though it is surrounded by about 150 globular clusters and two dwarf galaxies (the Clouds of Magellan). Accordingly, the suggested conclusion that galactic interactions are the cause of the vigorous star-forming activity which characterizes our own galaxy is poorly founded.

After suggesting different laws of gravity might apply on a supergalactic scale, the article recognizes the inadequacy of this suggestion and states:

> ". . . the more generally accepted hypothesis is that the laws of gravity are universal and that some form of energy, previously unknown to science, opposes and overwhelms galaxies' mutual attraction pushing them apart faster."

This provides a force having no discernible action near us, but which "adds up to the most powerful force in the cosmos." Of course no explanation is provided as to how some invisible something in space remote from any galaxy might overwhelm gravity and push those galaxies around. This essential consideration is avoided even though we know of no force which does not have its origin in matter, but which, nonetheless, functions at a distance to influence matter. Speculations inconsistent with all existing knowledge are properly ignored and it is wrong to foist them upon the public without at least labeling them for what they are.

The most striking problem flowing out of the presence of some mysterious energy filling space which pushes the galaxies apart is the direction of the push. Gravity is directional, everything being attracted toward greater mass. We need not ask which way gravity will act because it always acts in the same direction.

In contrast, if energy in space were to exert a pushing force, which way should it push?

If dark energy were to help form galactic clusters, then it would have to empty the voids by pushing galaxies toward the gravitational center where the galaxies are concentrated and where they are far more numerous than in the filigrees. On the other hand, if dark energy were to expand the universe, it would have to push the galaxies outwardly away from where the galaxies are concentrated near the gravitational center of the universe. So astrophysics has conjured up a force which matches the cosmological actions we see only because that is what astrophysics glibly asserts. This is ludicrous.

One problem in having dark energy determine the disposition of matter in space is the size of the clusters. These are too large for gravity to form because gravity is too weak to produce such a large structure in the limited time available in the Big Bang theory. Judging from the weakness of dark energy near us (as described in the article it is suggested to be much weaker than gravity) it could not significantly control the concentration of the galaxies into the clusters. So the problem of forming clusters was a mystery in prevailing thinking previously, and dark energy does not resolve the mystery.

Suppose dark energy is more effective when the galaxies are far apart. This means that something in space millions or billions of light-years away from a galaxy will function to push it away. This action relies upon the concept of action at a distance, something astrophysics has always (quite properly) opposed. If one is to move a ponderable object in space, one must establish some form of spatial structure adapted to force the intended motion in the immediate vicinity of the object to be moved.

Moreover, a repellent force cannot determine the motion of galaxies (other than to push them apart). Rotary motion is an aspect of an attractive force, not a repellent force. Enormously large walls of galaxies all moving together have been found. Something other than a repellent force in space must exist to provoke such coordinated motions. Indeed, gravity is far too weak to establish such an enormous structure in the available time. The galaxies in the filigrees also possess a coordinated motion in the direction of filigree extension, and a repellent force could not supply that coordinated motion.

Still further, globular clusters exist with densities a thousand times greater than characterizes our own and other ordinary galaxies. If dark matter and dark energy control the cosmos, how could such small galaxies possess such an enormous density?

An important suggestion advanced in the article is that dark energy "is spread smoothly everywhere". In our experience with anything filling space, as illustrated by air, in order for that which fills space to accelerate an object in any direction one must have a pressure difference. If dark energy is spread smoothly, as is asserted, it cannot move any ponderable object because the push provided by the dark energy on one side of a galaxy would be opposed by an equal and opposite push by the dark energy on the other side. When we follow the reasoning set forth in the article we get nowhere.

The article insists the universe is expanding, which is true, but it further asserts the "galaxies are not moving through space . . . but are being carried along as the fabric of space itself stretches". This is a wild and unsupported speculation contrived to sustain preconceived notions even if it does represent the prevailing wisdom. If space gripped the ponderable bodies within it, as is necessary to allow it to carry a galaxy, then our Earth would also be gripped by space so it could not move effortlessly through space in an endless stable orbit around the Sun,

as it has done for billions of years.

The article bases its conclusions on the now established fact that the universe expansion in intermediately remote space today is accelerating in a peculiar fashion. More particularly, the article asserts "it had been slowing down but at some point underwent a transition and began speeding up." The thought the universe had been slowing down and then reversed what it had been doing is unacceptable because a reversal in action is self-evidently implausible and is unexplained. Even if we concede a speeding action exists at the present time, this does not establish a prior slowing action, and the only support for such prior slowing is unsupported speculation. Even if we go along with prevailing big bang thinking, this transition from slowing to speeding destroys the Big Bang theory which demands continued slowing. The 2005 publication referred to herein (2) contains an explanation for the outward acceleration which does not include a prior slowing, bu Conselice seems unaware of it. The failure to be aware of the relevant literature establishes incompetence.

How do we explain the obviously contrived and glib presentation which the article presents? What has happened is that the observed speeding destroys the Big Bang theory, so to preserve that theory one must bring in the black magic of dark energy, because any sensible explanation of the observed speeding in intermediately remote space is ruled out by the sacred theory which cannot be challenged.

The article in describing galaxy formation uses language in a strange manner. In our galaxy the outer suns move too rapidly but remain in the galaxy nonetheless. To explain this astrophysics now relies upon dark matter in a halo to hold these outer suns in the galaxy. This extra mass has to be in a "halo" because, if it filled the entire galaxy the inner suns would be affected by it, and they are not. A halo is, as is well known, a toroidal structure which is circular with a hole in the middle. But the article uses the term "blob" instead of the term "halo". The suggestion is the galaxy formed around a blob so as to be spherical, as the observations of new galaxies suggest. But in existing theory the dark matter in our galaxy must have a hole in the middle of it. How could dark matter have had a different shape when the galaxy was formed? There is an obvious inconsistency here.

A major focus of the article is the merger of galaxies. It is suggested:

"The earliest galaxies we can see existed when the universe was about a billion years old, and many of these indeed appear to be merging."

We seem to be discussing what has been seen, but what is available is a mosaic of the pictures taken by the Hubble Space Telescope. Most of the objects pictured there are round, small and those which are not round might be distorted by some gravitational lens effect. The thought that "many" of these objects "appear to be merging" is not substantiated in the article and appears to be an overstatement. Indeed, when that mosaic was published it was noted that the pictures showed little of the expected mergers taking place between us and the pictured extremely distant region of space. Since the existence of mergers was under consideration, extensive merging of the small remote objects pictured would have been discussed.

Then there is the conclusion the universe has "run out of steam" because "Most of the stars that exist today were born in the first half of cosmic history,". This assertion twists the fact. We get some idea of what was actually known when we note the article later states:

"Since the universe was half its current age, only lightweight systems have

continued to create stars at a significant rate."

But the object density found by the Hubble Space Telescope was stated to be 90 times greater than exists near us. So there was plenty of matter available in remote space, and one must ask why most of the objects formed in that space are small and light. So it is not that the universe ran out of steam, but only that in remote space primarily lightweight galactic systems were formed. Dark energy does not explain how lightweight systems formed first while it took many additional billions of years before large numbers of the more massive systems could form.

In summary, the subject article which accepts the existence of dark energy does not begin to recognize the relevant observations, to provide sensible answers to the obvious problems which it raises or to recognize the relevant literature. Instead, it represents the usual inadequate treatment of cosmology which characterizes *Scientific American* magazine.

References

1- See the report by R. Cowen in *Science News*, May 31, 2003 (Vol. 163 #22 page 341)
2- See this writer's paper in *Infinite Energy* magazine, issue # 62 (2004)