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The Great American Eclipse of 2017

by H. Paul Shuch, Executive Director Emeritus

Although nature refuses to respect national boundaries, that's what the American media Chauvanistically chose to label last month's spectacular celestial event. On 21 August 2017, a partial solar eclipse was visible across practically the entire North American continent, laying a narrow swath of totality all the way from the Pacific to the Atlantic. Muriel and I traveled to an area of maximum totality, to observe the event with thirty friends gathered on a small private airport in central Tennessee. The view of the corona was awesome – but that's not what this column is about.

It is an interesting cosmic coincidence that, as viewed from Earth, both the Sun and the Moon subtend exactly one-half a degree in the sky, allowing each to totally eclipse the other when their alignments coincide properly. More significant to astrobiologists is that the mass of the Moon is sufficient to raise tides in the waters that cover two thirds of our home world. It is widely believed that these tides were at least partially responsible for creating conditions suitable for the genesis of life.

Perhaps the existence of life on other worlds will similarly depend upon the presence of a large moon, orbiting at the right distance to raise tides in the cosmic soup. But, our technology is presently unable to detect such satellites of the satellites of distant suns. All that is about to change.

To date, our most powerful tool for detecting exoplanets has been the Kepler space telescope. Since its launch in 2009, the Kepler mission has been responsible for the detection of over three thousand planets orbiting neighboring stars – all in the single, tiny speck of the sky that the spacecraft has been able to monitor. A good percentage of these other worlds appear to be orbiting in the habitable zones of their stars – the region where temperatures are right for water to exist in liquid state. How many more potential life sites might exist in the rest of space? Most estimates are in the millions; some optimists say billions. But, on which (of any) of these many worlds will life actually have swum in the oceans and crawled out onto shore? That could well depend upon the presence of moons.

The technological successor to the Kepler spacecraft will be the James Webb Space Telescope (JWST), scheduled for launch roughly a year from now. This $10 Billion US investment is poised to return scientific dividends of inestimable value. We in the SETI community are hoping it will be capable of detecting not just an abundance of other worlds in the habitable zones of their stars, but perhaps the very moons orbiting those exoplanets. After all, most of our own sun's retinue of planets are orbited by a variety of natural satellites – the Assumption of Mediocrity suggests that other planetary systems should be no different If water worlds are orbited by massive moons, might the tides raised by those moons be sufficient to stir the pot of life? Stay tuned for future discoveries sufficient to boggle the imagination!

Yours for SETI Success,
Paul

***Guest Editorials**:*

What Happens Next If We Find Proof of Space Aliens?

by Seth Shostak, Senior Astronomer, SETI Institute

From nbcnews.com, 1 August 2017, used by permission

First came the suggestion that an "alien megastructure" had been observed around KIC 8462852, a.k.a. Tabby's Star. Months later, people were talking about a signal seen by a Russian telescope that some thought was transmitted from the environs of a stellar cousin of the sun. And not long after that, the Cyclopean Arecibo antenna in Puerto Rico reported weird signals that seemed to come from the dwarf star Ross 128, a scant 11 light-years away.

This brisk cadence of celestial surprises might make it seem that we're on the cusp of proving the existence of extraterrestrials. But just because the crow's nest announces clouds on the horizon doesn't mean you're close to land.

These three claims purporting to show the existence of aliens haven't panned out. But what happens if some future claim does? What preparations are in place to deal with the discovery of a radio signal or a laser flash that would prove beyond doubt that we have cosmic compeers? Does the government have a plan? Does anyone?

A lot of people think there is a plan. A secret one. A recent survey indicated that 55 percent of the population figure that the discovery of extraterrestrials would be squelched — deep-sixed to prevent widespread panic. Only 19 percent believe the feds would fess up to E.T.'s existence.

Such a cover-up would be virtually impossible to pull off. There's no policy of secrecy, and verifying the signal would involve teams of scientists around the world. But leaving that aside, the fact that so many folks believe it's in the works attests to a discouraging lack of trust in both science and the public's ability to handle the news.

So what's the truth about what would happen if we discovered intelligent aliens? Back in 1989, when a now-defunct NASA program to search for extraterrestrial intelligence was gaining steam, protocols were drafted to spell out best practices in case the search proved successful. These were later updated and streamlined by the International Academy of Astronautics SETI Permanent Committee.

There are really only three important components to this two-page text. First, the detection of alien life should be carefully verified by repeated observations. Second, the discovery should be publicized. Third, no response should be sent without international consultation.

All that sounds both tame and sane. But there's an implicit assumption here: namely, that picking up signals from another world will be a Hollywood moment. We assume that it will play out the way it so often does in the movies: stuporous scientists, settling in for another decade or two of fruitless search, are suddenly jolted into wild-eyed excitement as a signal lights up their equipment. Then they spend about 10 minutes turning knobs and shouting at one another, after which they presumably reach into a desk drawer and pull out the protocols.

Actually, they never take this last step in the movies. And they wouldn't do it in real life either. In the many years of SETI efforts, there have been numerous false alarms in addition to the three noted at the top of this article. And what happens every time is that the media immediately start reporting the story. There is almost always a bit of sensationalism and a few garbled facts, but the news is out there long before the researchers have managed to verify the signal, as specified by the protocols. That's the truth of the matter. Really, it is. Sure, speaking of "protocols" has a certain gravitas, but these would only work for a Hollywood-style discovery.

But there's a deeper question here — one that's much harder to answer: what would be the long-term effect of learning we're not alone? Would we give up religion? Would we stop waging war? Would we cower in the face of possible interstellar aggression?

Facing such questions, social scientists tend to look for historical analogies. For example, what were the consequences when Columbus discovered the American continent (or if you prefer, when the Vikings or Ice Age Asians did)? One problem here is that the analogy isn't terribly apt. These folks weren't doing exploration for its own sake. They found something new by accident.

A better analogy might be the discovery of Antarctica or the source of the Nile. These really were exploration efforts. But even these are poor guides to how we should prepare for the discovery of intelligent aliens or anticipate its effects.

Nineteenth-century explorers had no protocols other than to write up their experiences. Furthermore, the eventual consequences of their discoveries were completely incalculable. Do you think Fabian von Bellingshausen, who first saw the Antarctic continent in 1820, could have anticipated that less than 200 years later there would be a research base at the South Pole, or that cruise ships would be taking tourists to these forlorn latitudes?

There is little certainty about what the consequences of finding aliens might be, but there is this: We'll immediately know something very important. We'll know that we are neither unique nor special. But if you ask what the legacy of such a discovery will be hundreds or thousands of years from now, there's simply no way to arrive at an answer that's either useful or accurate.

What's the Matter!

by Dan Duda
from the June/July, 2017 issue of Penn Central, the monthly newsletter of Central PA Mensa, used by permission

"*Science progresses best when observations force us to alter our preconceptions.*"
Vera Rubin, Astronomer

Particle Physics and Cosmology tend to crash into each other now and then. And that causes problems because each has its own science that works extremely well within its own sphere. However, when we try to mix them they're like oil and water—they just don't play well together. The two disciplines are currently trying to coordinate theories that could explain some very weird observations in the heavens.

Let's start with the late Vera Rubin, an American astronomer who pioneered work on galaxy rotation and contributed greatly to the hypothesis of Dark Matter.

In our Solar System, the revolution time of Mercury (closest planet to the Sun) is very fast (88 Earth days). The revolution of Earth, of course, takes one year. And it takes Pluto 248 Earth years to make its way around the Sun. Taken together with all the planets this is called the "Rotation Curve" because it accounts for the action in the entire Solar System.

The reason for this difference in speed is simple, If Mercury revolved any slower solar gravity would pull it into a fiery extinction. And, if Pluto revolved as fast as Mercury or Earth it would overcome the relatively weak solar gravity at that distance and fly right out of the Solar System.

Enter Vera Rubin. She decided to test this universal (or so we thought) rotation curve on galaxies. Like the Solar System, she expected she would find that the farther away from the core of a galaxy a star is situated the slower would be its speed. That would allow gravity to keep it in orbit. However, the world of cosmology was stunned to learn that Vera's results showed that stars have a relatively constant speed no matter where they're situated relative to the core. Why aren't most stars flying off into empty space as the theory of gravity says they should? Why indeed.

Enter Particle Physics. The mystery of the uncooperative Galactic Rotation Curve totally stumped cosmologists. There just isn't enough matter in galaxies to generate the gravity needed to account for our observations. So, a combination of physicists and cosmologists invented the term "Dark Matter." Voila! Problem solved. Or maybe not. The word "dark" really means we have no idea what is going on, but we think we need a lot more mass to generate the gravity we think ought to be there so that we can resolve what we see with what we think we know. (Whew! That's a mouthful.)

But wait, there's more! The other shock still rattling cosmologists to the core is the stunning discovery that the universe itself is not just expanding, but expanding at an ever-increasing rate of speed. Here again what we think we know about gravity says this isn't supposed to happen. Can't cosmologists ever catch a break? They think dark matter is holding galaxies together and dark energy is pushing them apart. But they have absolutely no idea what this "dark" stuff is. It's an idea that just seems to fit what we see. Greek drama had a term for this type of solution: Deus Ex Machina which means God by Machine. This technique is still used today—when our movie hero is facing the imminent detonation of a bomb a few feet away, he suddenly finds a bomb proof closet that no one knew about. It really looks like the dark substances are science's technique for saving the hero (in this case our observations).

OK, let's look at the whole picture. Baryonic matter (that's the stuff that we think we understand) makes up only 5% of the universe we see. Given our observations and what we think we understand about the universal laws of physics (especially gravity) 95% of the universe is missing. Scientist think that the 95% is dark matter and dark energy. But they (and we) don't really know.

To quote Vera Rubin:

"*In a spiral galaxy, the ratio of dark-to-light matter is about a factor of ten. That's probably a good number for the ratio of our ignorance-to-knowledge. We're out of kindergarten, but only in about third grade.*"

SETI and the Meaningless Rio Scale
by John Traphagan

An interesting question that often arises in relation to the search for extraterrestrial intelligence (SETI) is: What impact would contact actually have on humans? Several years ago, in an attempt to quantify the importance of candidate SETI signals we receive, astronomers Ivan Almar and Jill Tarter proposed a scale to measure social consequences of contact, based on the Torino Scale used to quantify the consequences of an asteroid approach to Earth by relating the likelihood of impact with potential damage the asteroid might cause.

The Rio Scale aims at quantifying social consequences of contact with extraterrestrial intelligence by relating three variables: discovery type, distance of origin, and type of phenomenon detected. Members of the IAA SETI Permanent Committee officially adopted the Rio Scale in 2002 and have continued to refine and "perfect" the scale, in order, according to the IAA website, to bring "some objectivity to the otherwise subjective interpretation of any claimed ETI detection."

Unfortunately, the Rio Scale is a good example of what happens when attempts at social science are based on naïve and poorly conceived understandings of human behavior and society. In its current version, the scale assesses issues such as whether the signal originates nearby (in our solar system) or far away (another galaxy) or if it's aimed directly at us or is a general beacon that we happen to intercept. The closer and more specific the signal, the more "important" on a scale of 0 (no importance) to 10 (extraordinary importance) the signal is in terms of social consequences.

Any social scientist looking at the Rio Scale would find numerous problems. First, the scale is meaningless because it attempts to quantify something in a universal way—the social significance of an event—that varies significantly depending on social variables such as race, gender, class, socioeconomic status, ethnicity, etc. The list of social variables is long. It's highly unlikely that all, or even most, people around the world would assign the same level of significance to the same type of contact incident.

Second, the scale isn't based on scientific research—it's little more than a nicely presented set of assumptions that have no grounding in empirical evidence. Thus, it's entirely subjective, rather than objective. A good example can be found on the IAA website claim that the scale is necessary because, "a public announcement of a discovery of extraterrestrial intelligence would have societal consequences similar to the announcement of the impending impact of a large asteroid." We have no evidence that this is true, particularly since we have never had an announcement of a large asteroid impact that was legitimate and perhaps the most significant evidence of widespread societal reactions to the announcement of extraterrestrial intelligence comes from the late 19th Century with Percival Lowell's claims that there was an advanced civilization on Mars. That was a long time ago, and the social impact, despite the assumed civilization being right next door, was minimal and brief.

There is, in fact, no evidence that the variables presented, such as distance between Earth and the signal's origin or whether we think the message was meant for us, would actually be important variables in how people react to the announcement. The variables in the scale are, themselves, highly subjective and based on assumptions instead of empirical data collected through systematic research.

Third, the scale is problematic from a data perspective, because it uses an ordinal scale to measure interval data. The problem with this is that with interval data the distances between attributes have meaning, while with ordinal data they don't. Social scientists have understood for a long time that if you create a ranking scale, it's difficult to determine what people actually mean when they rank attributes. For example, if I rank a group of ice cream flavors from 1 to 5, I might get something like this:

1. Chocolate
2. Mint chocolate chip
3. Vanilla
4. Strawberry
5. Squid Ink

The problem here is that I like 1 and 2 about the same amount, and 3 a little less. I don't like Strawberry much, and I hate squid ink flavored ice cream (yes, I've had it). So, while the scale makes it look like the distances between variables are equal, in fact for me if I were to quantify the relationships here, the scale would look more like 1, 1.1, 1.2, 10, and 5,000. That would better reflect how I think about the flavors in terms of the consequences of eating them from a quantitative perspective. But, in truth, the relationship between these variables is a qualitative one and it doesn't make much sense to try to quantify it, because the numerical values assigned to each flavor are arbitrary and would vary considerably form one person to another and even may change for me over time.

Because the authors apparently did no actual scientific research into how people might react to a contact announcement, the scale itself represents little more than their own guesses. And those guesses are based on weak understandings of human behavior and social organization. As a result, the scale is trivial and, when used as a tool for creating "Rio values" to quantify estimates of the importance of any reported detection, the only thing it's likely to accomplish is over-simplification and misrepresentation of the situation. Therefore, it will generate a misleading estimate of any social consequences related to contact with ETI.

The Rio Scale represents a fine example of what happens when people attempt to develop tools for measuring social phenomena on the basis of bad science—or in the case of the Rio Scale, no science at all. It's an amateurish and misguided attempt at addressing important policy issues related to the social consequences, across complex human groups, of contact with extraterrestrial intelligence. As a result, it trivializes the social consequences of a very complicated potential event in the future of humanity that will represent a challenge from a social policy perspective.

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Editor's Note:

You're absolutely right, John, that the value assigned to a detection by the Rio Scale does indeed change over time. Despite its possible weaknesses, this is one enduring strength of the tool. I've written articles giving examples of the values assigned to both historical and fictional detections over the weeks or months following initial discovery. In nearly all cases, the Rio Scale values started rather low, rose to higher values as further studies were conducted, and ultimately sank back to a low value as the detection was either ultimately falsified, or could be neither confirmed nor replicated.

Yours for SETI Success,

Paul ❖

Event Horizon

SearchLites readers are apprised of the following conferences and meetings at which SETI-related information will be presented. League members are invited to check our World Wide Web site (www.setileague.org) under *Event Horizon*, or email to us at info@setileague.org, to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

September 25 - 29, 2017: *68th International Astronautical Congress*, Adelaide, Australia
November 10 - 12, 2017: *Philcon*, Cherry Hill, NJ.
April 22, 2018, 1300 EDT: Twenty-Fourth SETI League Annual Membership Meeting, Little Ferry, NJ.
May 25 - 28, 2018: *Balticon 52* Baltimore Science Fiction society Annual Convention, Baltimore MD.
July 22 - 25, 2018: Society of Amateur Radio Astronomers Conference, NRAO Green Bank, WV.
August 16 - 20, 2018: *76th World Science Fiction Convention*, San Jose CA.
October 1 - 5, 2018: *69th International Astronautical Congress*, Bremen, Germany
November 9 - 11, 2018: *Philcon*, Cherry Hill, NJ.
August 15 - 19, 2019: *77th World Science Fiction Convention*, Dublin, Ireland
October 21 - 25, 2019: *70th International Astronautical Congress*, Washington DC

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