Astrobiology News March 2014: Cosmos: An Unexpected Journey

Over the next few months, I hope to provide some commentary on the new *Cosmos* television series. Based on the 13-part series, *Cosmos: A Personal Voyage*, which was broadcast by PBS in 1980 and hosted by the late science popularizer, Carl Sagan, the new series is hosted by the American Museum of Natural History's Neil deGrasse Tyson. It airs Sunday nights on Fox, and is rebroadcast Mondays on the National Geographic Channel. I encourage you to watch it! The Adler Planetarium is hosting a "Cosmos Café" for 2 hours each Monday, from 11:30 am-1:30 pm, where visitors can join two Adler scientists in conversation about each episode¹. The series' new title is *Cosmos: A Spacetime Odyssey*, but I've chosen the subtitle of the 2012 film based on J.R.R. Tolkien's epic fantasy, *The Hobbit*, for this month's article, because the scientific odyssey really has been an unexpected journey, and it's nothing short of amazing where that journey has taken us.

The first episode of *Cosmos* sets the stage for our journey, with a brief tour through our Universe in both space and time. Compressing the 13.8 billion year history of the Universe onto the scale of one calendar year on Earth (where the Universe is born at the start of January 1st), the beginning of human civilization, marked by the invention of writing, occurs roughly 15 seconds before the end of the year. On the scale of this "Cosmic Calendar", the voyage of Christopher Columbus, the life of Renaissance Scholar Leonardo da Vinci, and the birth of modern science itself, occur within the last second before midnight. During the last tenth of that second, humanity has used science, and the technologies science has enabled to extend our senses, to write the history of our Universe. The exponential increase in human knowledge along this journey makes it increasingly difficult to project where science and technology will take us a few years from now, let alone 100 or 1,000 years in the future!

Of course, one consequence of this explosion in knowledge is the fact that the days of the Renaissance Scholar (or polymath) like da Vinci are long since gone, even for the brightest among us. It is impossible for an expert in one field to keep abreast of all the significant discoveries in other fields. Science has become a community effort, often leveraging the expertise of many different individuals in large collaborations. If this is critical across different scientific disciplines, it is absolutely essential when assimilating information across diverse disciplines. Unfortunately, expertise outside one's own background and training is often under-utilized and under-respected, especially when it comes to challenging pre-conceived notions or long-held views. For example, the premiere *Cosmos* episode assumes the so-called "conflict thesis" that science and religion have been historically at war with each other. This view, popularized by two 19th century writers, Andrew Dickson White and John William Draper², is not the prevailing view

¹ http://www.adlerplanetarium.org/events/cosmos-cafe

² Andrew Dickson White, *A History of the Warfare of Science with Theology in Christendom* (New York: D. Appleton and Company, 1896); John William Draper,

among contemporary historians³. Almost one-quarter of the 1st episode of *Cosmos* is devoted to Giordano Bruno's tragic clash with the Church, but Bruno was hardly the first theologian in Christendom to hold the view that there are multiple inhabited worlds beyond Earth, nor would this view have been grounds for execution.⁴

In any event, Bruno was not a scientist as we would understand the term 'scientist' today. There is a vast difference between having an idea, and being able to test that idea, which is an essential aspect of modern science. One of the first discoveries announced by the *Kepler* mission after its launch in 2009 was the detection of phases exhibited by a very large, hot exoplanet as it orbited its star, HAT-P-1, located 1,000 light years⁵ from Earth. What I found particularly striking about this incredible observation was that it occurred just 400 years after Galileo's telescopic observations of 1609 showed that the phases of Venus provided conclusive evidence that our closest planetary neighbor orbits the Sun. Whereas it takes a few minutes for light to travel from Venus to the Earth, the light we currently observe from HAT-P-1 began its journey to us 600 years before Galileo's observations - a mere two seconds ago on the scale of the Cosmic Calendar. Just a few weeks ago, the *Kepler* mission team announced the verification of 715 new exoplanets, more than tripling the number of previously confirmed exoplanets discovered by the *Kepler* mission, and bringing the staggering current tally to over 1,771⁶! What discoveries might be in store for humanity in the next second on the Cosmic Calendar?

Until next month,

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History of the Conflict between Religion and Science (New York: D. Appleton and Company, 1875)

³ Ronald L. Numbers, *Galileo Goes to Jail and Other Myths about Science and Religion (ed.)* (Cambridge, MA: Harvard University Press, 2009)

⁴ For example, see Thomas F. O'Meara, *Vast Universe: Extraterrestrials and Christian Revelation* (Collegeville, MN: Liturgical Press, 2012)

⁵ Roughly 6,000,000,000,000,000 - six quadrillion - miles

⁶ See kepler.nasa.gov and exoplanet.eu