FAST BREAKING PAPERS - 2008

August 2008

PDF

W. Michael Wood-Vasey talks with *ScienceWatch.com* and answers a few questions about this month's Fast Breaking Paper in the field of Space Science.

Article Title: Observational constraints on the nature of dark energy: First cosmological results from the ESSENCE supernova survey

Authors: Wood-Vasey, WM, et al.
Journal: ASTROPHYS J
Volume: 666
Issue: 2
Page: 694-715
Year: Part 1 SEP 10 2007
* Harvard Smithsonian Ctr Astrophys, 60 Garden St, Cambridge, MA 02138 USA.
* Harvard Smithsonian Ctr Astrophys, Cambridge, MA 02138 USA.
(addresses have been truncated)

SW: Why do you think your paper is highly cited?

Explaining the accelerating expansion of our Universe has become one of the most fundamental challenges in physics today. The dynamics of the Universe are intimately connected to its composition and recent results over the past decade have concluded that 70% of the Universe consists of a mysterious dark energy that has been accelerating the expansion of our Universe for the past five billion years.

Our paper presents the latest observational results on the nature of dark energy and concludes that dark energy appears consistent with an 90-year-old idea of Einstein's, which postulated that space itself had such repulsive energy suitable for counteracting the attractive force of gravity.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Our paper presents new data on a subject of great interest to astronomers, physicists, and the public at large. Whether dark energy is a property of the vacuum of space-time, a modification of Einstein's theory of general relativity, or a hint of new fundamental physics, will have repercussions throughout the next century of scientific exploration.

SW: Would you summarize the significance of your paper in layman's terms?

The Universe has been expanding since the Big Bang. In the past five billion years, its expansion has been accelerating for entirely mysterious reasons that point to a gaping hole in our understanding of fundamental

physics. Our research uses observations of a standard type of exploding star, a supernova, which can be seen across the Universe and confirms that this accelerated expansion could be due to a surprising basic property of the repulsive effect of the vacuum.

Figure 1: +details

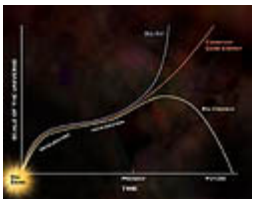

Image credit: Harvard-Smithsonian Center for Astrophysics, Chandra X-Ray Center

SW: How did you become involved in this research, and were there any problems along the way?

I have been working in this field since my first years in graduate school almost a decade ago. I have always wondered about the fundamental nature of the Universe, what it's made of, and what its future will be. Astronomy is currently one of the most exciting avenues for exploration of these fascinating questions and it has drawn in a sizeable number of particle physicists and theorists who are hoping to lend their expertise and help understand their own problems through a combined exploration of the very large to the very small.

There is currently some cultural tension between the historically independent astronomers who are used to working on their own and having great ideas in the middle of the night and the particle physicists who have been working on huge multi-billion-dollar projects for decades and have a much more organized and methodical approach to science. Our hope is to take some of the best elements from each to tackle these exciting problems during the next decade.

Figure 2:

Image credit: National Optical Astronomy Observatories

SW: Where do you see your research leading in the future?

The challenge of dark energy remains one of the most exciting and fundamental challenges in astronomy and physics today. Continued observations of supernovae, along with new techniques that measure the distribution of galaxies in the Universe and the deflection of light due to the mass of large clusters of galaxies, will provide new insights on this problem during the coming decade.

I am currently involved in two large astronomical survey projects, the Panoramic Telescope and Rapid-Response System (Pan-STARRS; currently finishing commissioning in Hawaii) and the Large Synoptic Survey Telescope (LSST; scheduled to begin operations in 2014 in Chile) that will explore all of these astronomical approaches to learning about the basic physics of the Universe.

SW: Do you foresee any social or political implications for your research?

Whenever I talk to the average person about my research they are always excited by the frontiers of our basic physical understanding of the nature of our Universe. It is a question that cuts across the boundaries of gender, age, and nationality to connect to our wonderment at ourselves, our world, and the potential for human knowledge and understanding.

Dr. Michael Wood-Vasey
Research Associate
Harvard-Smithsonian Center for Astrophysics
Harvard University

Related information:

Movie Presentation:
1. A two-dimensional illustration of galaxies receding from each other since the Big Bang with a period of decelerating expansion followed by a phase of accelerating expansion. (Movie Credit: NASA/STScI/G. Bacon). View.

Visual Webpage Presentation:

2. The explosion, rise and fall of a Type Ia supernova. (Movie credit: Peter Nugent, Alex Conley, Lawrence Berkeley National Laboratory; and N. Johnston, National Energy Research Scientific Computing Center). View.

Keywords: accelerating expansion of our universe, dynamics of the universe, mysterious dark energy, the vacuum of space-time, modification of einstein's theory of general relativity, big bang, supernova, particle physicists and

theorists, historically independent astronomers, panoramic telescope and rapid-response system, large synoptic survey telescope.

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Figures and descriptions:

Figure 1:

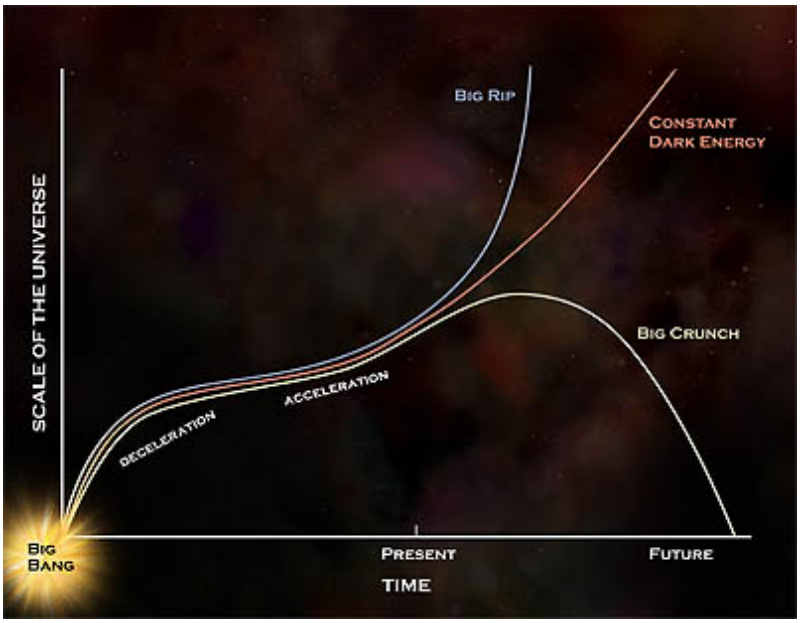

Figure 1:
The relative scale of the Universe over cosmic time. (Image credit: Harvard-Smithsonian Center for Astrophysics, Chandra X-Ray Center).

View larger image (allow time to load). Close new browser window to return to this page.

Figure 2:

Figure 2:
The Blanco 4-meter telescope at the Cerro Tolo Interamerican Observatory in Chile that we use to discover and study supernovae. (Image credit: National Optical Astronomy Observatories).

View larger image (allow time to load). Close new browser window to return to this page.

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