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EMERGING RESEARCH FRONTS - 2009

June 2009

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Joel R. Primack & Brandon Allgood talk with *ScienceWatch.com* and answer a few questions about this month's Emerging Research Front Paper in the field of Space Science.

Article: The shape of dark matter haloes: dependence on mass, redshift, radius and formation
Authors: Allgood, B;Flores, RA;Primack, JR;Kravtsov, AV;Wechsler, RH; Faltenbacher, A;Bullock, JS
Journal: MON NOTIC ROY ASTRON SOC, 367 (4): 1781-1796, APR 21 2006
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(addresses have been truncated.)

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

Joel R. Primack: The article, led by my former grad student Brandon Allgood, gets a lot of citations because it addresses a fundamental issue in cosmology, i.e., the shape of dark matter halos of galaxies and galaxy clusters.

Brandon Allgood: As Joel points out, the paper addressed both a fundamental question in cosmology and brought together and reexamined the major previous works on the subject. Our attempt was to create a foundation which all further works on the subject could use as a base. It not only answered theoretical questions, but also put forth predictions which we knew would be useful for upcoming surveys and, when combined with these observations, would help to constrain the cosmological model.

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

Joel R. Primack: The article also reconciled the apparent disagreements between different papers in the literature by explaining that they had used different methods of calculating the halo shapes. The article calculated halo shapes by essentially every method that had previously been used. It thus was a synthesis, as well as a major new contribution.

Brandon Allgood: Dark matter halos, as far as we can tell, surround all observable galaxies. Based on the "double dark" cosmological model (dark matter and dark energy), these halos and the galaxies within them have formed via halo-halo merging.

"My group has just finished a new simulation on a new, much more powerful supercomputer —the Pleiades machine at NASA's Ames Research Center —that has even higher

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

Joel R. Primack: In order to do this research, it was necessary to perform

supercomputer simulations that broke new ground. These were done at NASA's Ames Research Center in Mountain View, California, on the Columbia supercomputer, which was one of the fastest supercomputers in the world three years ago.

resolution in a volume 1,000 times greater!"
~Joel R. Primack

Brandon Allgood: Joel's group had, and continues to have, a large impact on cosmology. I personally saw that and was drawn to working with him on fundamental problems in cosmology. As Joel points out, the simulations used in the publication were pushing the envelope at the time. Data handling and simulation design and execution were by far the hardest problems.

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

Joel R. Primack: My group has just finished a new simulation on a new, much more powerful supercomputer—the Pleiades machine at NASA's Ames Research Center—that has even higher resolution in a volume 1,000 times greater! Pleiades is now the fastest unclassified supercomputer in the world. This "Bolshoi" simulation, led by Professor Anatoly Klypin of New Mexico State University, is the most ambitious cosmological simulation yet, and it will be the basis for a great deal of new research.

Brandon Allgood: I have left academia for an entrepreneurial career. I am currently focusing on pharmaceuticals at a company I helped found, Numerate, Inc.

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

Joel R. Primack: I don't expect any social or political implications of this fundamental astronomy research, except perhaps for public inspiration.

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KEYWORDS: SAGITTARIUS DWARF GALAXY; N-BODY SIMULATIONS; X-RAY MORPHOLOGIES; SKY SURVEY VIEW; DENSITY PROFILES; ANGULAR-MOMENTUM; DISSIPATIONLESS COLLAPSE; MILKY-WAY; CLUSTERS; ALIGNMENT.

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