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Featured Guest Speaker: Dark Matter In Spiral Galaxies

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Arkansas Academy of Science

FEATURED GUEST SPEAKER
DARK MATTER IN SPIRAL GALAXIES

Presented by

Dr. Marcus S. Seigar
University of Arkansas – Little Rock

The rotation curves of spiral galaxies (i.e. the velocities of stars around galaxy centers) provide one of the strongest lines of evidence establishing the need for dark matter in the Universe. An elaborate paradigm for dark matter has subsequently developed, known as LCDM, in which the Universe consists of Cold Dark Matter, such that it is non-relativistic at the time of recombination (i.e., when neutral hydrogen atoms first formed). Simulations of LCDM structure formation can recreate the large-scale structure of the Universe extremely well.

However, an important question is whether this cosmic paradigm provides a satisfactory description on smaller scales, i.e. that of individual spiral galaxies.

A complete explanation of spiral galaxies in LCDM requires a comprehensive theory of galaxy formation. This remains lacking. Indeed, there are a number of lingering problems on small (i.e. galaxy) scales.

One of the most crucial tests for LCDM comes from the estimates of galaxy mass distributions. High-resolution N-body simulations of LCDM structure formation predict that the central density profiles of dark matter halos should rise steeply at small radii. However, observations of rotation curves of late-type disk galaxies and dwarf galaxies, have shown that quite often, mass distributions with lower than predicted densities or with constant density cores, are preferred. This is known as the cusp/core problem. Another problem for LCDM cosmology is the Tully-Fisher zero-point problem, which refers to the fact that standard models cannot reproduce the observed relation between galaxy luminosity and circular velocity without over-producing the number density of galaxies at fixed luminosity.

In this keynote talk, Dr. Seigar addresses these issues and introduces some new ideas and methods that are being developed to solve them.

Dr. Marcus S. Seigar is an Assistant Professor of Physics and Astronomy at the University of Arkansas at Little Rock. Dr. Seigar's research interests include the nature of dark matter, the processes of galactic evolution, and development of techniques used to measure the masses of black holes. Recently, Dr. Seigar has been involved with the Arkansas Galaxy Evolution Survey (AGES), a collaboration he helped set up. The current goal of AGES is to conduct a census of supermassive black holes in the Universe. The AGES team recently received a $1.4 million grant from the Arkansas NASA EPSCoR program to continue their research.

Prior to joining the faculty at UALR, Dr. Seigar was a researcher at the University of California at Irvine, where he was a recipient of the Gary McCue Fellowship. He has conducted astronomical research using some of the most powerful and sophisticated telescopes both on and off the Earth, including the Hubble Space Telescope, the Keck Observatory, and the Kitt Peak National Observatory.