2011 CfA Summer Colloquium Series

The Summer Colloquium series provides a broad introduction to the research going on at the CfA. Summer interns and other junior staff are particularly encouraged to attend but all are welcome. All talks are in Phillips Auditorium at 4 pm preceded by refreshments at 3:30 pm.

June 16: The SZ Effect and X-ray Observations of Galaxy Clusters

Esra Bulbul
Harvard-Smithsonian Center for Astrophysics

Sunyaev-Zeldovich (SZ) effect and X-ray observations of galaxy clusters provide independent methods to study cosmology, the thermodynamic properties of the intra-cluster medium (ICM), and can be used to constrain both the density and the temperature of the hot gas. The SZ effect data were obtained with the Sunyaev-Zeldovich Array (SZA), an 8-element interferometer designed both for imaging the SZ effect in galaxy clusters, and for simultaneous identification and removal of radio source contamination. Using a new model of the intra-cluster medium that applies to both SZ and X-ray observations, we find that the integrated pressure measured from X-rays and from the SZ data are consistent with each other for the sample of 25 relaxed massive galaxy clusters. This finding is in agreement with recent results from WMAP observations, and the early results from the Planck mission, and confirms that SZ and X-ray observations of massive clusters detect the same amount of thermal pressure from the intra-cluster medium. The other advantage of using X-ray and Sunyaev Zeldovich Effect observations is that it allows us to directly determine cluster masses and therefore the gas mass fraction. Allen et al. (2008) have used Chandra X-ray observations of high redshift galaxy clusters to constrain cosmological parameters. This method is based on the evolution gas mass fraction with redshift, and it requires a model of the gas mass fraction as a function of redshift, To-date, the cosmological constraints have been determined by assuming that the gas mass fraction is constant with redshift. I will present a joint Chandra and Sunyaev Zeldovich Array analysis method to determine the gas mass fraction with minimal cosmological assumptions.

June23: MEarth: The Joy of Planets Transiting Puny Stars

Zach Berta
Harvard-Smithsonian Center for Astrophysics

Finding extrasolar planets that are the right size and the right temperature for life to flourish is a difficult task; studying their atmospheres will be even more difficult. However, doing so will be easier for planets that orbit and transit (pass in front of as seen from Earth) smaller, cooler stars. To characterize the atmospheres of habitable planets elsewhere in our Galaxy, we probably need to shift our focus away from Sun-like stellar hosts to much smaller, cooler stars known as M dwarfs. The MEarth Project is an ongoing survey using eight modest robotic telescopes to search $2,000$ nearby M dwarfs for transiting, habitable, super-Earth exoplanets. I will discuss our progress so far with MEarth, as well as the enigma of the first planet we found, the steamy GJ1214b.

June 30: Exploring Astrochemistry with the Submillimeter Array

Nimesh Patel
Harvard-Smithsonian Center for Astrophysics

The Submillimeter Array (SMA) is an 8-element radio interferometer, located near the summit of Mauna Kea, Hawaii, in operation since 2004. Molecular spectroscopy with single-dish radio telescopes has long been a powerful tool for studies of astrochemistry. Radio interferometry allows direct imaging of the molecular emission at high angular resolution, providing new observational constraints to chemical models. In this talk, I will first introduce the capabilities of the SMA. Then I will review some of the astrochemistry projects carried out with the SMA, observing a wide range of sources from solar-system objects, proto-planetary disks, low and high-mass star-forming regions, evolved stars, and nearby galaxies. I will end with a brief discussion on plans to upgrade the SMA as the Atacama Large Millimeter Array starts operating, specifically on the increase of spectral bandwidth.

July 14: Hubble's Expanding Universe and the Cosmic Microwave Background

Doug Finkbeiner
Harvard-Smithsonian Center for Astrophysics

July 21: Kepler and the Mysteries of RR Lyrae Stars

Katrien Kolenberg
Harvard-Smithsonian Center for Astrophysics

The spectacular Kepler data do not only boost the discoveries of planets orbiting other stars, including those resembling Earth, but they also open a window on the inner workings of the stars themselves. In this talk I will present a brief introduction to the field of astroseismology, the science that studies the internal structure of pulsating stars b the interpretation of their frequency spectra. I will illustrate how stellar research benefits from a space mission like Kepler, focusing on the mysterious RR Lyrae stars for which Kepler data have led to some important discoveries.

July 28: Exploring the Sun and the Solar Wind Remotely and Up Close

Kelly Korreck
Harvard-Smithsonian Center for Astrophysics

The Sun, our closest star, is both a scientific laboratory for plasma physics and is the source of our space weather. In order to understand the Sun and its complex relationship with us and to other stars, we undertake research that encompasses numerical modeling, instrumentation, and novel data analysis techniques. I will discuss solar flares, Coronal Mass Ejections (CMEs), and the solar wind heating. In addition, I will overview the vast array of instruments, many of which were built at SAO.

August 4: A Holistic Study of Supernova Explosions

Alicia Soderberg
Harvard-Smithsonian Center for Astrophysics

For centuries, supernovae have been studied primarily within the visual band thanks to their strong optical emission that dominates the bolometric luminosity on timescales of weeks following the explosion. At the same time, some of the most profound advances in our understanding of supernovae have been made possible through observations at other wavelengths. I will review recent progress in this field with a focus on radio and X-ray observations.