2012 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. Talks are in Phillips Auditorium at 4 pm preceded by refreshments at 3:30 pm, unless otherwise indicated.

June 14: Why General Relativity is Still Really Cool

Dr. Chanda Prescod-Weinstein
MIT Department of Physics & Kavli Institute for Astrophysics

Black holes? Expanding universe? Old hand? General Relativity (GR) will be celebrating 100 years in not too long, and in that time, very little has changed for the theory. Although we've come to understand it more deeply, we haven't really made any changes to it. But, that doesn't mean it's a dead subject! With the discovery of cosmic acceleration, GR is being challenged. Will it stand up to the test? I will discuss the state of research on cosmic acceleration, modified gravity and maybe even a little quantum gravity.

June 21: Exploring the Energetic Transient Universe

Ashley Zauderer
Harvard-Smithsonian Center for Astrophysics

How do we detect supernovae, gamma ray bursts, and other exotic transients? And what can we learn from observations of these objects, including the most distant in the universe? I will present a summary of current optical surveys and multi-wavelength (radio, X-ray, gamma-ray) followup efforts to discover and identify the most energetic explosions in space. My research focuses on radio observations of these energetic events, and I will discuss a few interesting cases observed in the past year: a supernova in M51, a tidal disruption of a star by a quiescent supermassive black hole, and dark gamma ray bursts.

July 5:The Mysteries of the Inner Galactic Clouds
* Talk begins 3 pm

Volker Tolls
Harvard-Smithsonian Center for Astrophysics

The inner few hundred parsecs of the galaxy are dominated by the Central Molecular Zone (CMZ) containing the densest concentration of gas and dust in the Galaxy and the massive black hole at its center. Farther out from the center, to about 400 parsecs, is the region called Inner Galaxy (IG) whose dynamics are dominated by the gravitational potential of the Galactic Bar. Material that slowly falls from the outer parts of the Galaxy towards the plane encounters extreme physical conditions. Dust and molecular material form dense massive clouds, the so-called Inner Galactic Gas Clouds (IGGC). In this talk I will review existing work performed to disentangle the physical processes going on in these clouds and present first results from on-going analysis of Herschel HIFI and PACS [CII], [NII], [OI], [OIII], and high-J CO emission line observations in focused regions in Clumps 1 and 2, which have been supplemented by Herschel and Spitzer photometric data and MOPRA and JCMT molecular line observations.

July 12: Three Predictions in Exoplanets Worth $10,000 or More

Sarah Ballard
Harvard-Smithsonian Center for Astrophysics

Three years ago, the exoplanet blog Oklo.org proposed an equation for assigning a dollar value to exoplanets, normalized so that a "million-dollar-world" is a potentially habitable one. In March 2009, the most valuable exoplanet was worth a mere $158 (for comparison, hot Jupiters clock in at only a fraction of a penny). In light of this habitability formula, I'll give an overview of some of the most valuable contributions to exoplanets in the past year. I'll focus on three separate ideas in exoplanet characterization that contribute heavily to a planet's dollar amount: mass estimations for very low-mass planets, the M dwarf advantage, and the pricelessness of nearby exoplanets in particular.

July 19: Star Formation in Nearby Galaxies

Linda Watson
Harvard-Smithsonian Center for Astrophysics

I will summarize a couple of the exciting recent results from studies of star formation in nearby galaxies, including work on the Kennicutt-Schmidt law, extended UV (XUV) disks, star formation in dwarf galaxies, and the CO-to-H2 conversion factor. These studies were made possible by excellent multi-wavelength datasets from ultraviolet, Halpha, and infrared to millimeter and radio. I will also present results from our study of star formation in twenty nearby bulgeless spiral galaxies, with a focus on potential relationships between circular velocity, scale height of the cold ISM, and star formation efficiency.

July 26: Accretion, Winds & Jets: High Energy Emission from Young Stars

Moritz Guenther
Harvard-Smithsonian Center for Astrophysics

Young stars and planetary systems form in molecular clouds. After the initial radial infall an accretion disk develops. The circumstellar envelope depletes and thus the absorption of the central star decreases. The high energy emission of these objects, the so-called classical T Tauri stars (CTTS) differs markedly from their main-sequence counterparts.

I will describe three different emission mechanisms that contribute to the observed X-ray and UV emission:

1. A corona not unlike that observed on main-sequence stars.

2. The accretion spot: The accretion disk does not reach down to the central star, but it is truncated near the co-rotation radius by the stellar magnetic field. The inner edge of the disk is ionized by the stellar radiation, so that the accretion has to be funneled along the magnetic field lines. On the stellar surface an accretion shock develops, which is observable in a wide wavelength range including X-rays and UV excess.

3. Furthermore, many (if not all) accreting systems also drive strong outflows which are ultimately powered by accretion. However, the exact driving mechanism is still unclear. Several components could contribute to the outflows: Slow, wide-angle disk winds, X-winds launched close to the inner disk rim, and thermally driven stellar winds. In any case, the outflows contain material of very different temperatures and speeds.

Accretion and outflows in the CTTS phase do not only determine stellar parameters like the rotation rate on the main-sequence, they also could have a profound impact on the environment of young stars.

August 2: Dark Energy and Cosmic Sound

Dan Eisenstein
Harvard University

I will discuss how sound waves racing through the cosmos during the first million years of the Universe provide a robust method for measuring the cosmological distance scale and thereby the properties of dark energy. The distance that the sound can travel can be computed to high precision and creates a signature in the late-time clustering of matter that serves as a standard ruler. Galaxy clustering results from the Sloan Digital Sky Survey and SDSS-III reveal this feature and allow us to measure distances to $z = 0.35$ and $z = 0.57$ to better than 2%.