2010 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 24: Spinning Black Holes and Accretion Flows

Bob Penna
Harvard-Smithsonian Center for Astrophysics

Black hole spins are measured by comparing X-ray observations to accretion disk models. Standard disk models make various approximations for the physics of magnetic fields and turbulence. We test these approximations using state-of-the-art computer simulations of turbulent, magnetized black hole accretion in general relativity. We discuss how the disk thickness and black hole spin modify the dynamics and luminosity of the disk.

July 1: Stellar Archaeology: New Science with Old Stars

Anna Frebel
Harvard-Smithsonian Center for Astrophysics

The early chemical evolution of the Galaxy and the Universe is vital to our understanding of a host of astrophysical phenomena. Since the most metal-poor Galactic stars are relics from the high-redshift Universe, they probe the chemical and dynamical conditions as the Milky Way began to form, the origin and evolution of the elements, and the physics of nucleosynthesis. They also provide constraints on the nature of the first stars, their associated supernovae and initial mass function, and early star and galaxy formation. I will first discuss Galactic metal-poor stars with abundance patterns characteristic of neutron-capture nucleosynthesis and how they can elucidate the supernovae responsible for their unusual chemical signatures. Furthermore, stars displaying a strong overabundance of very heavy elements, in particular uranium and thorium, can be radioactively dated, giving formation times 13 Gyr ago, similar to the 13.7 Gyr age of the Universe. I then transition to a description of recent discoveries of extremely metal-poor stars in dwarf satellites of the Milky Way. Their stellar chemical signatures support the concept that small systems analogous to the surviving dwarf galaxies were the building blocks of the Milky Way's low-metallicity halo. This opens a new window for studying galaxy formation through stellar chemistry.

July 12: From Brown Dwarfs to Galaxy Clusters: Going Deep and Wide with Spitzer

Matt Ashby
Harvard-Smithsonian Center for Astrophysics

In this talk I'll describe some results coming out of the Spitzer Deep, Wide-Field Survey (SDWFS), a four-epoch infrared survey of 10 square degrees in the Bootes field of the NOAO Deep Wide-Field Survey. SDWFS is a Spitzer Cycle-4 Legacy project that used the IRAC instrument to detect nearly a million sources in the four independent shallow surveys of this field. The observations have led to new insights in a variety of disciplines, including galaxy clustering, active galaxy variability, normal galaxy populations, and brown dwarfs.

July 15: New Views of the Sun with Hinode and SDO

Kathy Reeves
Harvard-Smithsonian Center for Astrophysics

This talk will focus on results from two recent solar missions, Hinode and the Solar Dynamics Observatory. Hinode is a joint mission between NASA, Japan and ESA, and it has just reached the end of its 3 year prime mission. The three instruments on Hinode - the X-Ray Telescope (XRT), the Extreme ultraviolet Imaging Spectrometer (EIS) and the Solar Optical Telescope (SOT) have provided a unique window into the dynamics, magnetic fields and temperature structures of the Sun. Exciting results from these instruments will be shown, focussing on solar flares and coronal mass ejections (CMEs). The Solar Dynamics Observatory (SDO), which is part of NASA's Living With a Star program, was launched in February of this year. This mission also has three instruments - the Atmospheric Imaging Assembly (AIA), the Helioseismic and Magnetic Imager (HMI) and the Extreme ultraviolet Variability Experiment (EVE), and these instruments are producing an unprecedented volume of new solar data. Recent results from these instruments will be shown, again focussing on solar flares and CMEs.

July 22: Recoiling Black Holes in Merging Galaxies

Laura Blecha
Harvard-Smithsonian Center for Astrophysics

It is well-established that galaxies form hierarchically through mergers. Strong evidence also exists that supermassive black holes (SMBHs) are ubiquitous, at lesat in local galaxies, and that SMBH feedback plays an important role in galaxy formation and evolution. I will consider a possible addition to this standard paradigm: gravitational-wave (GW) recoil of SMBHs as the result of SMBH mergers. GW recoil can set a SMBH in motion during a critical phase of the galaxy merger, when the SMBH may be actively accreting and the host galaxy may be rapidly forming new stars. Using the results of galaxy merger simulations that include GW recoil of the central SMBHs, I will discuss the effects of recoils on SMBH accretion and dynamics, as well as the M-sigma relation. I'll also mention the prospects for observing signatures of GW recoil, such as offset quasars.

July 29: Searching for Planets with Kepler

Andrea Dupree
Harvard-Smithsonian Center for Astrophysics

NASA's Kepler satellite, launched in March 2009 is aimed at a 100 square degree area of the sky in Cygnus, and carries out photometry with exquisite precision on a star field of over $100,000$ stars. Kepler will stare at this field for several years in order to detect transits of terrestrial planets in the 'habitable zone' where liquid water and possibly life might exist. Verifying the planetary candidates with ground-based spectroscopy, imaging, and modeling also comprises an integral part of the Kepler program. In addition to detecting planetary transits, Kepler obtains a wealth of information on stellar variability including studies of asteroseismology and gyrochronology. I will give an overview of the Kepler mission highlighting these new results.

Aug 5 Intern Presentation: Radio Observations Reveal the Mass Loss History of Type Ibc Supernova Progenitors

Sarah Wellons
Princeton University

We present extensive radio observations and modelling of the Type Ibc supernovae 2004cc, 2004gq, and 2004dk. By probing the fastest-moving outer layers of the ejecta, we derive properties of the blastwave such as velocity, energy, and magnetic field and compare them to the properties of other ordinary SNe and GRB-SNe that have been previously observed. We model the SNe using a synchrotron self-absorbed spectrum and find that the blastwaves are non-relativistic, with velocities ranging from 0.1-0.25c and energies from 1.7×10^{47} to 1.3×10^{48} erg. All three SNe are also observed to have evidence of late-time rebrightening or fading, which we attribute to density modulations in the nearby environment caused by mass loss prior to explosion. For 2004cc and 2004dk, we find that continuum-driven eruptions are responsible for the modulations, and for 2004gq we find that they are caused by variability in the line-driven winds.

Aug 5 Colloquium: Solar and Stellar X-ray Activity and the Solar–Stellar Connection

Paola Testa
Harvard-Smithsonian Center for Astrophysics

Stellar coronae are unique laboratories for studying magnetized astrophysical plasmas, and play an important role in stellar evolution. Solar and stellar X-ray and EUV observations provide complementary information that can advance our understanding of the magnetic activity in solar-like stars. The solar corona can be studied at a high level of detail, with high spatial and temporal resolution, and it is generally used as a template for the interpretation of the X-ray emission of other late-type stars. On the other hand, the study of stellar coronae allows us to investigate the dependence of X-ray activity on a wide range of stellar parameters (spectral-type, age, rotation, multiplicity,..). I will discuss the characteristics of coronal emission on the Sun and in solar-like stars (such as spatial and thermal structuring of the X-ray emitting plasma, activity cycles, flares, coronal abundances, evolution of X-ray activity with age), in the context of the solar-stellar connection.