Colloquia Abstracts – Fall 2012

Friday September 7, 10:00am to 2:00pm, AT101

Undergraduate Resarch Students

Saint Mary's University

Undegraduate Symposium

Abstract TBA

Friday September 14, 11:30am, AT305

Dr. Robert Thompson
University of Calgary
A First Peek at Antihydrogen: Project ALPHA’s Road to the Creation,Storage, and Initial Observation of Microwave Transitions in Antihydrogen

Antihydrogen, or more specifically high precision spectroscopy of antihydrogen, offers some of the most promising avenues for extremely sensitive tests of CPT symmetry. However, such precision studies would require that the antihydrogen be stored at low temperature while being probed with microwave or ultraviolet laser radiation. Project ALPHA (Antihydrogen Laser PHysics Apparatus) is one of several independent experiments currently underway at the Antiproton Decelerator (AD) at CERN, each designed to generate, trap, and study antihydrogen for tests of CPT. In 2010, the ALPHA Collaboration announced the first successful storage of neutral antimatter atoms in a magnetic bottle trap1, followed in early 2012 with the announcement of the first observations of resonant microwave transitions in atomic antimatter2. This presentation will describe the techniques employed to generate and trap antihydrogen. It will discuss the challenges of mixing antiprotons and positrons to form, detect, and analyze low temperature antihydrogen in the presence of the inhomogeneous magnetic fields that make up the neutral particle trap, and provide an overview of techniques being developed to manipulate the positron and antiproton plasmas to optimize the antihydrogen formation process. Finally, an overview of recent results and an outlook on future plans in this area will be presented.

Embry-Riddle Aeronautical University

Modeling Stellar Photospheres at High Spatial Resolution
Now is a very exciting time to be studying stellar atmospheres. These 'point sources' are being spatially resolved in record numbers by long-baseline interferometric telescopes. The star Vega, for example, subtends an angle roughly 600,000 times smaller than the full Moon. Yet, with a spatial resolution equivalent to that of a mirror more than 300 meters across, optical interferometers like the CHARA Array can resolve the variation of intensity across Vega's surface. Such measurements probe temperature gradients both across and into stellar photospheres and constrain fundamental stellar parameters. I will discuss my work modeling interferometric observations of bright stars and explain how these observations are testing a new generation of models which must be parametrized to include convective granulation, rotational distortion and tidal distortion in binary star systems.

Friday October 26, 3:00pm, AT101

Dr Robert Petre

NASA Goddard Space Flight Center

X-Ray Observations of Cosmic Ray Acceleration in Supernova Remnants.
Since the discovery of cosmic rays a century ago, many theories have been advanced regarding their origin. Evidence of cosmic ray acceleration in candidate sources has remained elusive, however.   A major breakthrough was provided by spatially resolved X-ray spectroscopy of Galactic supernova remnants (SNRs) using the recent generation of X-ray observatories (ASCA, Chandra, XMM-Newton, Suzaku). Synchrotron X-ray emission from the forward blas wave in SN 1006 and other young SNRs is most likely produced by electrons accelerated to relativistic energies. This is the first, albeit indirect, observational evidence that diffusive shock acceleration in supernova remnants produces cosmic rays to TeV energies, possibly as high as the “knee” in the cosmic ray spectrum at ~10^{15} eV. X-ray observations have provided information about the maximum energy to which these shocks accelerate electrons, as well as indirect evidence of proton acceleration. Shock morphologies measured in X-rays have indicated that a substantial fraction of the shock energy might be diverted into particle acceleration, and provided insight into the strength and the structure of magnetic field behind the SNR blast wave. Using SN 1006 as a focal point, this presentation will summarize what we have learned about c9.14 470protonh45(r) 0 1w593(al)7(f)--9(i)5

black holes puts stringent constraints on black hole formation models as it remains unclear how black holes can grow to such masses

Friday November 16, 3:00pm, AT101

Dr Linda Strubbe

Canadian Institute for Theoretical Astrophysics

"Studying Massive Black Holes Using the Tidal Disruption of Stars"

A star that wanders too close to a massive black hole gets shredded by the black hole's tidal gravity. Stellar gas soon falls back to the black hole at a rate initially exceeding the Eddington rate, releasing a flare of energy as gas accretes. How often this process occurs is uncertain at present, as is the physics of super-Eddington accretion (which is relevant for black hole growth and feedback at high redshift as well). Excitingly, optical transient surveys like the Palomar Transient Factory (PTF), Pan-STARRS and LSST should be able to shed light on these questions soon. To help these surveys find and interpret tidal disruption events, I predict their photometric and spectroscopic properties: Early on, much of the falling-back gas should blow away in a wind, producing luminous optical emission imprinted with blueshifted UV absorption lines. In just the last couple of years, PTF, Pan-STARRS, and surprisingly the Swift hard X-ray satellite are, for the first time, finding and following up tidal disruption event candidates in real time. I'll describe their recent discoveries in the context of our theoretical predictions, and also look to the future at what measured rates of tidal disruption will be able to teach us about massive black holes and their surrounding galactic nuclei.

Friday November 23, 3:00pm, AT101

Dr Philip Bennett

Saint Mary's University

Epsilon Aurigae

What do we really know about the enigmatic binary star epsilon Aurigae? Epsilon Aurigae is a bright (3rd magnitude) long-period binary that eclipses every 27.1 years, and has been continuously observed for more than 160 years. The observed spectrum is that of an apparently normal F supergiant. The system is enigmatic because the eclipsing companion is dark: no light is seen from this object in the optical spectrum. Nevertheless, the companion is large enough in physical extent to eclipse half of the (large) stellar disk of the supergiant star for more than a year and half. It is also massive: accurate spectroscopic orbital solutions have recently been obtained by two groups, showing the F star primary has a (large) radial velocity amplitude 14.3 ± 0.3 km/s, implying a comparably massive companion. The latest eclipse was in 2009— 2011, and was widely observed by interferometry (CHARA), in the infrared spectrum, the far ultraviolet (HST/COS), and from ground-based sites by a worldwide campaign of amateur astronomers led Robert Stencel (U. Denver) and Jeff Hopkins (Hopkins Phoenix Observatory). Epsilon Aur has also been widely observed photometrically and spectroscopically for the past 20+ years out of eb.gof artin the 9-10(s)]TJ0 0 4E

Saint Mary's University

Resolving the North Star's Mysteries (Finally?)

After 55 years of observing the nearby Cepheid Polaris, the speaker has gained considerable familiarity with the star and its peculiarities. Despite everything that is known about Cepheid variables in general, Polaris presents certain anomalies that have so far defied a straightforward interpretation of the star, its reddening, distance, pulsation mode, and number of companions. New spectroscopic observations of Polaris finally reveal insights into the origins of the anomalies, and may signal the beginning of a new era in understanding the star. A brief observational history of Polaris may help to understand the long fascination the star has held to astronomers.