

## 2004 CONGRESS POSTER SESSION ABSTRACTS

### RÉSUMÉS DES SESSIONS D’AFFICHES - CONGRÈS 2004

The poster session abstracts presented here will be on display in this order in the Winnipeg Convention Centre in Winnipeg, Manitoba from 19h00 - 22h00 on Monday, June 14th. *Les résumés présentés en affiches publiés ci-après seront en montre de 19h00 à 22h00, le lundi, 14 juin dans le Centre de congrès à Winnipeg, Manitoba.*

[MO-POS] CASCA

Monday  
Lundi

#### MO-POS-1

The Impact of Canadian Astronomy as Measured by Citations, **Dennis R. Crabtree** *NRC-HIA* — The impact of scientific research is often measured by citation counts. Citations do not measure the quality of the scientific research but are more a measure of the relevance of the research to other researchers. Citation counts are frequently used as one piece of information in tenure decisions and also used to measure the strength of a whole research community (as in the Astronomy Long Range Plan). In this poster I will compare the publication and citation record of Canadian astronomy groups from 1990 onward.

#### MO-POS-2

"Lets Talk Science Partnership Program" Promotes Science in Canadian Schools, **Vesna Milosevic-Zdjelar**, *University of Winnipeg* — Canadian universities participate in initiative developed to promote science in schools and community. At seventeen universities, graduate students (as well as undergraduate students at the University of Winnipeg), volunteer to share their knowledge, expertise and enthusiasm with elementary and high school students, teachers and wide community. Through partnerships with schools, science and children museums and scout organizations, our program successfully reaches 25 000 children every year. We will describe here our program at the University of Winnipeg and its place in the national picture

#### MO-POS-3

Doing Science with the Spitzer Space Telescope, **P. Barmby**, S. Laine, M. Lacy, Spitzer/IRAC Team, *Harvard-Smithsonian Center for Astrophysics, Spitzer Science Center* — The Spitzer Space Telescope, launch in August 2003, is well into normal science operations. Here we give an overview of the capabilities of the three science instruments, science operations, and the long-term schedule. Science projects from the Early Release Observations, First Look Survey, and IRAC instrument team's Guaranteed Time will be used to illustrate the power of Spitzer observations for the study of Galactic and extragalactic star formation, high-redshift galaxies, and stellar populations.

#### MO-POS-4

HIFI: The High Resolution Spectrometer for Herschel\*, **Michel Fich**, *University of Waterloo* (on behalf of the HIFI Team) — The Herschel Space Observatory will be a facility-class space observatory operating at wavelengths between 60 and 670 microns. It will be launched, with the Planck satellite, in 2007 to the second Lagrangian point with a minimum lifetime of three years. The Herschel telescope will be 3.5 m in diameter and passively cooled to 80K. HIFI (the Heterodyne Instrument for the Far-Infrared) is a high resolution spectrometer and one of three focal plane science instruments for Herschel. One of the primary purposes of Herschel is to study astrochemistry and HIFI is the main instrument for studying atomic and molecular spectral lines. Together with the Canadian Space Agency, a consortium of approximately 25 Canadian astronomers are contributing a central part of the HIFI instrument (the Local Oscillator Source Unit, or LSU) and, in return, are full partners in the HIFI Science Team. This poster outlines the current status of the instrument development and presents an overview of the science to be carried out with HIFI. It will also describe how interested Canadian scientists can join the Canadian Herschel/HIFI Consortium and become involved in the mission.

\* This work is being supported by CSA.

#### MO-POS-5

Recent Results from the Odin Satellite\*, **Michel Fich**<sup>1</sup> and K.A. Woodley<sup>2</sup>, <sup>1</sup>*University of Waterloo* and <sup>2</sup>*McMaster University* — Odin is a mm and submm heterodyne 1.1m radiotelescope mounted on a spacecraft launched on 20 February 2001. It has been developed in a partnership between Sweden, Canada, Finland and France. In this poster we report on recent results from Odin, including a sensitive search for molecular oxygen in interstellar clouds, a survey of the Galactic Plane, and a detailed study of molecular processes in several star forming regions.

\* This work is being supported by NSERC and CSA.

#### MO-POS-6

SPIRE: Herschel's Submillimetre Camera and Spectrometer\*, **David Naylor**<sup>1</sup>, P. Davis<sup>1</sup>, J. DiFrancesco<sup>2</sup>, M. Halpern<sup>3</sup>, P. Martin<sup>4</sup>, D. Scott<sup>3</sup> and C. Wilson<sup>5</sup>, <sup>1</sup>*University of Lethbridge*, <sup>2</sup>*HIA*, <sup>3</sup>*University of British Columbia*, <sup>4</sup>*University of Toronto* and <sup>5</sup>*McMaster University* — The Herschel Space Observatory is an ESA cornerstone mission due for launch in 2007, which will conduct astronomical observations across the far-infrared and submillimetre waveband. It will carry a passively cooled, low-emissivity, 3.5-m telescope and will operate at the Sun-Earth L2 point for three years, providing a large amount of observing time at wavelengths unrestricted by the terrestrial atmosphere. The instrument payload will be cooled with an on-board supply of liquid helium, which determines the lifetime of the mission. Canada is involved in both the SPIRE and HIFI instruments on Herschel. The main scientific goals of SPIRE are deep extragalactic and galactic imaging surveys and spectroscopy of star-forming regions in our own and nearby galaxies. The SPIRE instrument comprises a 3 and imaging photometer at spectral channels at 250, 350, and 500  $\mu\text{m}$ , and an imaging Fourier transform spectrometer (FTS) covering the range 200-670  $\mu\text{m}$ . The FTS employs a dual-beam configuration with broad-band intensity beam dividers. The SPIRE detectors are feedhorn-coupled neutron transmutation doped (NTD) Germanium spider-web bolometers. The Canadian contributions to the SPIRE instrument are (a) a mid-resolution ( $R \gg 1000$ ) broadband FTS to test and qualify instrument models, (b) software packages to deglitch the signal stream, correct for the spectral response of the instrument, and process the spectrometer data, and (c) staff effort for the Instrument Test Team and Control Centre. Five Canadian researchers participate in the SPIRE Specialist Astronomy Groups as Associate Scientists. The Canadian involvement in the SPIRE project will be described.

\* This work is being supported by CSA, NSERC.

#### MO-POS-7

Protoplanetary Dust Disk Dynamics\*, **Robin Humble**<sup>1</sup>, S.T. Maddison<sup>2</sup> and J.R. Murray<sup>2</sup>, <sup>1</sup>*Canadian Institute for Theoretical Astrophysics* and <sup>2</sup>*Swinburne Centre for Astro and Supercomputing* — With a view to investigating planet formation processes we have developed a code for simulating astrophysical dusty-gas flows in protoplanetary disks. Our parallel three dimensional code incorporates gas hydrodynamics, self-gravity and several gas drag prescriptions to follow the dynamical evolution of a two-phase dusty-gas medium. We present results of some calculations with submillimetre, centimetre and metre sized dust. Dust disk lifetimes and possible gas giant and terrestrial planet formation scenarios are discussed.

#### MO-POS-8

Neptune's Migration into a Dynamically Hot Kuiper Belt\*, **Joseph Hahn**<sup>1</sup> and R. Malhotra<sup>2</sup>, <sup>1</sup>*Saint Mary's University* and <sup>2</sup>*University of Arizona* — The effects of Neptune's orbital expansion into a dynamically hot Kuiper Belt is examined numerically. In the model, a torque is applied to Neptune's orbit causing it to expand 9 AU outwards and into a stirred up Kuiper Belt composed of  $10^4$  massless particles having initial eccentricities  $e \sim 0.1$ . This system is integrated over the age of the Solar System, and our results confirm Chiang *et al.*'s (2003) finding that migration into hot Kuiper Belt allows particles to get trapped at weak mean motion resonances like the 5:2. Indeed, our higher-resolution study of this scenario shows particles getting trapped at many of Neptune's weak resonances, including the 13:6, 9:4, 7:3, 12:5, 8:3, 11:4, 3:1, 7:2, 4:1, all of which reside in the  $50 < a < 80$  AU zone. Many of these trapped particles have such high eccentricities that they also inhabit the domain usually identified as the Scattered Disk. Of course, gravitational scattering by Neptune also produces a Scattered Disk of particles, but most of these particles are removed over the age of the Solar System during subsequent encounters with the planets. Indeed, inspection of all particles with semimajor axes  $50 < a < 80$  AU and  $e > 0.25$  shows that about 90% were trapped at Neptune's migrating resonances, with only 10% actually being scattered by Neptune. These results may also provide an explanation for the 'extended' scattered disk of Gladman *et al.* (2002), namely, that some of these KBOs were trapped at an exotic resonance with Neptune rather than scattered.

\* This work is being supported by CFI.

**M0-POS-9**

**Evolutionary Models of the roAp star HR 1217: Magnetic Fields and Pulsation Frequencies**, Christopher Cameron<sup>1</sup>, J.M. Matthews<sup>1</sup>, M.S. Cunha<sup>2</sup>, D.B. Guenther<sup>3</sup> and W. Weiss<sup>4</sup>, <sup>1</sup>University of British Columbia, <sup>2</sup>Centre for Astrophysics of the University of Port, <sup>3</sup>Saint Mary's University and <sup>4</sup>University of Vienna — Strong magnetic fields measured in the chemically peculiar A stars of the upper main sequence are believed to be intricately linked to observed abundance anomalies. In addition, a small subset of these stars are unstable to high-overtone pulsations. These stars, known as rapidly oscillating Ap (roAp) stars, show evidence that the magnetic field also has a strong influence on the observed oscillation frequencies. We present evolutionary models for the particular case of the roAp star HR 1217 and estimate the effect of the magnetic field on the calculated oscillation frequencies. We also show how the observed abundances influence calculations of the temperature-optical depth relation for this star.

**MO-POS-10**

**Testing Stellar Evolution Theory: Theoretical Luminosity Functions and M92**, Brian Chaboyer, S.R. Bjork, N.E.Q. Paust, Dartmouth College — A Monte Carlo simulation exploring uncertainties in standard stellar evolution theory on the red giant branch of metal-poor globular clusters has been conducted. The analysis takes into account uncertainties in the primordial helium abundance, abundance of alpha-capture elements, radiative and conductive opacities, nuclear reaction rates, neutrino energy losses, the treatments of diffusion and convection, the surface boundary conditions, and color transformations. These theoretical luminosity functions are compared the observed luminosity function of M92. The M92 luminosity function was obtained from observations which combine wide field (32 x 32 arc-minute) data from the 2.4m telescope at MDM Observatory with HST ACS images of the central 3 arc-minute core of M92. Accurate photometry of over 25,000 stars are used in the construction of the M92 luminosity function.

**MO-POS-11**

**In Pursuit of the Rotation Rates of Wolf-Rayet Stars**, Andre-Nicolas Chene and N.S. St-Louis, Université de Montreal — Les étoiles chaudes et massives ont un taux de perte de masse très important (jusqu'à 10<sup>-5</sup> MSolaire an<sup>-1</sup>), sous la forme d'un vent stellaire engendré par la pression de radiation (force exercée par la lumière sur la matière). Les étoiles Wolf-Rayet (WR), qui sont les descendantes des étoiles O (les étoiles les plus massives de la Séquence Principale de brûlage d'hydrogène), possèdent les vents stables les plus intenses (voir fig.1). Cette épaisse couche de matière nous empêche de voir l'étoile elle-même, dont il est, par ce fait, difficile d'en déterminer les paramètres. En particulier, le taux de rotation des étoiles WR est pratiquement inconnu. Comme des modèles récents d'évolution stellaire montrent que le taux de rotation est un paramètre crucial dans la vie de ces étoiles (Maeder & Meynet 1996), il est important de le déterminer par des observations. Or, pour certaines étoiles, il est maintenant bien connu que des perturbations à la surface, tel des pulsations stellaires ou des taches magnétiques, se propagent dans le vent en engendrant des structures à grande échelle qui ont une densité inférieure ou supérieure à la moyenne (voir fig.2). La rotation entraîne ces structures, appelées Régions d'Interaction en Co-rotation (CIR en anglais), en générant des spirales dans le vent. Cela se traduit par des variations périodiques dans les raies spectrales d'étoiles apparemment isolées (voir fig.3 tirée de la thèse de T.Morel, 1999). En étudiant ces variations, il est donc possible de déduire le taux de rotation des étoiles WR, tant attendu par les modèles.

**MO-POS-12**

**Defining the Orbit and Distance to WR140**, Sean Dougherty<sup>1</sup>, N.J. Bolingbroke<sup>1</sup>, A.J. Beasley<sup>2</sup> and M.J. Claussen<sup>3</sup>, <sup>1</sup>National Research Council; <sup>2</sup>OVRO and <sup>3</sup>NRAO — Milli-arcsecond resolution VLBA observations of the archetype colliding-wind WR+O star binary system WR140 reveal the wind-collision region as a bow-shaped arc of emission that rotates as the highly eccentric orbit progresses from phase 0.74 to 0.95 (Beasley *et al.*, in prep). Assuming that the arc is symmetric about the line-of-centres of the two stars and "points" at the WR star, this rotation shows the O star moving from SE to approximately E of the WR star between these orbital phases. In conjunction with orbital parameters derived from radial velocity variations (Marchenko *et al.* 2003, *ApJ* 596, 1295) and the recent IOTA observation of both stellar components (Monnier *et al.* 2004, *ApJL* 602, L57), the VLBA observations allow us to constrain, for the first time, the inclination of the orbit plane as 122° ± 5°, the longitude of the ascending node as 353° ± 3°, and the orbit semi-major axis as 9.0 ± 0.3 mas. This leads to a robust distance estimate to WR 140 of 1.8 ± 0.1 kpc and mass estimates for the components of 20 ± 4 M<sub>⊙</sub> for the WR star and 54 ± 10 M<sub>⊙</sub> for the O star.

**MO-POS-13**

**Seeking the Progenitors of Magnetic Ap/Bp stars: Detection of a Magnetic Field in Two HAEBE Stars\***, Dominic Drouin<sup>1</sup>, S. Bagnulo<sup>2</sup>, J.D. Landstreet<sup>3</sup>, E. Mason<sup>2</sup>, D.N. Monin<sup>3</sup> and G.A. Wade<sup>1</sup>, <sup>1</sup>Royal Military College of Canada, <sup>2</sup>ESO Chile and <sup>3</sup>University of Western Ontario — The Herbig Ae/Be (HAEBe) stars are widely thought to be the pre-main sequence progenitors of the magnetic Ap/Bp stars. During a very recent observing run at the ESO VLT, we carried out observations to search for direct evidence of magnetic fields in the envelopes and photospheres of a selected sample of HAEBe stars. The analysis of our data showed a 4σ detection for 2 of the 14 targets observed. These results represent a breakthrough in our understanding of the nature, origin and evolution of magnetic activity in A and B type stars by providing a crucial link between the main sequence magnetic stars and their pre-main sequence counterparts.

\* This work is being supported by NSERC.

**MO-POS-14**

**New Insights into Polaris the Cepheid**, David G. Turner, Saint Mary's University — The North Star, Polaris, and the anonymous, poorly populated star cluster in which it lies, have been target objects in a newly initiated campaign of photometric observation using the Burke-Gaffney Observatory at Saint Mary's University. Polaris is one of the most curious, overlooked, and misinterpreted objects in the nighttime sky. Even its presently recognized status as the brightest known classical Cepheid variable is of fairly recent origin. Yet for the last twenty years Polaris has presented an enigma of major concern to variable star specialists: its light amplitude has been decreasing at such an alarming rate that concern was expressed that it might cease to pulsate entirely some time in the mid-1990s. As usual, Polaris stubbornly defies all expectations. Recent photometry indicates that it continues to pulsate at its standard rate of once every 4 days, but at an extremely low, perhaps still decreasing, level. The star also exhibits a rapid rate of period change that raises questions about its evolutionary status and pulsation mode: is it in the first crossing of the instability strip or perhaps the fifth crossing, does it pulsate in the fundamental mode or in an excited harmonic? Such questions are not easy to answer with certainty, and the fact that the star's distance inferred from its Hipparcos parallax is probably inaccurate does not help the situation. Main sequence fitting from its cluster membership and new studies of its period changes provide alternate estimates for its basic parameters that appear to resolve many of the questions posed above. And the North Star is also an exciting object of study for avid variable star enthusiasts with proper equipment. Where else can you see stellar evolution occurring right before your eyes?

**PO-MOS-15**

**Synthetic Flux Spectra of Rotationally Deformed Stars**, C. Ian Short and Catherine Lovekin, Institute for Computational Astrophysics and Department of Astronomy and Physics, Saint Mary's University — Due to geometrical effects and variation of stellar parameters over the surface, the flux spectrum of a star that is deformed by rapid rotation may differ significantly from that of a spherical star of stellar parameters that are fit to the observed flux spectrum. We have used the shape and variation of stellar parameters computed with a fully 2D stellar evolution code and synthetic intensities computed as a function of emergent angle with a NLTE stellar atmosphere and spectrum synthesis code (PHOENIX) to synthesize the flux spectrum of the rapidly rotating star alpha Eridani. We compare the flux spectrum of the rotationally deformed model to that of a spherical model fit to the observed spectrum and investigate the effect on derived stellar parameters of the more realistic modeling.

**PO-MOS-16**

**Rapid Photometry of Variables in the Globular Cluster M55**, Jason Rowe, C. Cameron, J.M. Matthews and M. Huber, University of British Columbia — We present results from photometry obtained with the 8 metre Gemini-South telescope for the core of the globular cluster M55. Over a 6 hour observing run, 2200 images were obtained to measure the light curve shapes of SX Phe type variables. The shape parameters are used to help identify pulsation modes for application to field variables.

**MO-POS-17**

**Spectral Modelisation and Analysis of NGC2363-V1, An Errupting LBV\***, Véronique Petit<sup>1</sup>, L.D. Drissen<sup>1</sup> and P.C. Crowther<sup>2</sup>, <sup>1</sup>Université Laval and <sup>2</sup>University of Sheffield — I will present the results of a follow up study of the LBV star NGC2363-V1 between the years 1997 and 2003. V1, discovered in 1994 by Drissen *et al.*, is presently undergoing a major outburst, associated with an increase in its mass loss rate. Spectra obtained by the Hubble Space Telescope were modeled by the non-LTE line-blanketed model CMFGEN (Hillier and Miller 1998) to obtain the evolution in the physical parameters of this incredible star.

\* This work is being supported by Laurent Drissen.

**MO-POS-18**

**Self-Correlation: A Useful New Tool for Analyzing the Photometric Variability of T Tauri Stars\***, John Percy<sup>1</sup>, W.K. Gryc<sup>1</sup>, W. Herbst<sup>2</sup> and J.C.Y. Wong<sup>1</sup>, <sup>1</sup>University of Toronto and <sup>2</sup>Wesleyan University, Middletown CT — T Tauri stars are irregular variable stars in an early phase of evolution where gravitational contraction to the main sequence is still taking place. The (photometric) variability is complex, and takes place on a variety of timescales, due to a variety of physical processes. There is low-level periodic photometric variability, due to the rotation of the star with active regions on its surface. The periodicity is usually investigated by Fourier analysis, but, especially if the active regions are non-permanent, this method may fail. In this paper, we use self-correlation analysis as an adjunct to Fourier analysis. Self-correlation analysis determines the cycle-to-cycle behaviour of the star, averaged over all the data. The data come from an on-line archive of T Tauri photometry, maintained by W. Herbst. Using self-correlation, we have reanalyzed T Tauri stars with known periods, to verify the periods and the applicability of the technique. We have then applied self-correlation to T Tauri stars whose periods (if any) are uncertain or unknown. The results will be described.

\* This work is being supported by NSERC Canada.

## MO-POS-19

**Atomic Data for Resonance Lines, Donald C. Morton, Herzberg Institute of Astrophysics, National Research Council of Canada** — Resonance lines, *i.e.* those transitions involving the ground state or excited levels of the ground term, have a special role in astrophysics because they will dominate the spectra of regions of low particle and radiation densities such as interstellar and intergalactic gas as well as stellar and QSO winds. Thus having reliable data on the wavelengths and transition probabilities of resonance lines is central to many astrophysical investigations. This paper summarizes the present status of the author's efforts to provide critical compilations of these data. Under the general title of "Atomic data for Resonance Absorption Lines" there are three papers:

II. Wavelengths Longward of the Lyman Limit for Heavy Elements (Ge to U), 2000 ApJS 130, 403;

III. Wavelengths Longward of the Lyman Limit for the Elements Hydrogen to Gallium, 2003 ApJS 149, 205 – an update of Paper I published in 1991; and

IV. Wavelengths between the Lyman Limit and 100 Å for the Elements Helium to Gallium, in preparation.

Experimental transition probabilities ( $A_{ul}$ ) for the extreme ultraviolet region covered in Paper IV are scarce, but fortunately *ab initio* theoretical multiconfiguration calculations now can accurately predict the laboratory energies and give  $A$ -values consistent with laboratory measurements where checks are possible at longer wavelengths. The data in Paper IV are particularly relevant to the study of absorption lines in high-redshift QSOs.

## MO-POS-20

**The Degree of Contact and Other Properties of Binary Stars with Common Envelopes\***, Stefan Mochnacki, University of Toronto — A compilation of models fitted using both photometric and spectroscopic data is analysed using the concepts of mean density, minimum period and transfer-corrected primary temperature. The tendency of W UMa systems to have common envelopes close to their inner Roche surfaces is shown to be a closeness in radius rather than a function of fill-out factor. This allows the use for evolutionary studies of systems for which only spectroscopic mass ratios are available without photometric solutions; the new DDO sample of spectroscopically observed systems is analysed. An analysis of the recent Pribulla-Kreiner-Tremko catalogue is also presented.

\* This work is being supported by NSERC.

## MO-POS-21

**2D-Modelling of the Rotation of a Rapidly Rotating Be star, C. Lovekin and R.G. Deupree, Institute for Computational Astrophysics, St Mary's University** — Recent interferometric observations of the Be star Achernar (HD10144) have found it to be extremely oblate, with an axis ratio of  $2a/2b = 1.56 \pm 0.05$ , where  $a$  and  $b$  are the best fit to the semimajor and semiminor axes for the surface shape. This ratio is very close to the limit of 1.5 for a solid body at critical rotation. Based on stellar models, Achernar is a late main sequence star and probably should not be expected to be rotating as a solid body. We have modelled rapidly rotating stars to attempt to reproduce the observed properties of Achernar using a 2D stellar evolution code. The surface of the model is assumed to be an equipotential. Calculated models rotating at critical velocity on the ZAMS have appreciably lower surface velocities than the observed  $T_{\text{eff}}$  and  $L$  of Achernar are reached. These models fail to match the observed oblateness, with ratios of  $2a/2b$  of 1.27 to 1.36, depending on the inclination. We have also calculated models whose rotation rate increases towards the rotation axis and is constant on cylinders. These laws do make the stellar surface more oblate, although the increase in oblateness is insufficient to match the observations.

## MO-POS-22

**The Structure of Close Binaries in 2D, A.I. Karakas, and R.G. Deupree, ICA, Saint Mary's University** — Previous studies of the evolution of close binary systems have assumed that each component is spherically symmetric, even if it fills its Roche lobe. Rotation and tidal interactions will cause the structure to deviate from spherical symmetry but it was not known in detail how large this distortion will be. Using a state-of-the-art 2D stellar structure code, we study the departure from spherical symmetry on the structure of an zero-age main sequence model of solar composition ( $Z = 0.02$ ). We assume that the companion is a gravitational point source and in a circular orbit. We present preliminary results of the structure of an  $8M_{\odot}$  primary with a  $5M_{\odot}$  point-source secondary companion. We have also begun to study the effect of the primary on the secondary, by calculating the case with  $5M_{\odot}$  with an  $8M_{\odot}$  companion. In each case we assume that the separation is  $20R_{\odot}$ . We plan to perform evolutionary calculations on these models, evolving to the point where the primary fills its Roche lobe. At this point this model may serve as a starting point for a study of mass loss from the primary. Future work will be to study the effect each binary star has on the structure of the other by assuming that neither star is a gravitational point source and calculating the structure of both components simultaneously.

## MO-POS-23

**The Faint End Of The Luminosity Function In The Core Of The Coma Cluster: A Data Mining Case Study, Margaret L. Milne and C.J. Pritchett, University of Victoria** — We present optical measurements of the faint end of the luminosity function (LF) in the core of the Coma cluster. The archives of the Hubble Space Telescope were mined for images of the Coma cluster and of the field; number counts were determined from these and used with the method of statistical background subtraction to determine the luminosity function to  $m_p = 25.75$ . This is the faintest determination of Coma's LF to date, and also marks the first time that HST images have been used to construct Coma's LF. Evidence is found for a steep faint end slope with  $\alpha$  approximately equal to  $-2$ . The process of creating the LF and the implications of the result will be discussed, with an emphasis on the role data mining can play in this field of study.

## MO-POS-24

**Stellar Atmospheres with Abundance Stratifications, Dmitry Monin and F. LeBlanc, Université de Moncton** — Strong non-uniform distributions of chemical elements as a function of optical depth (*i.e.* chemical stratification) are observed in some chemically peculiar stars. Diffusion processes acting in their atmosphere is most likely responsible for the stratification. Model atmospheres including self-consistent vertical element abundance gradients produced by diffusion are presented here. These models are based on a modified version of the multi-purpose atmospheric code PHOENIX. The changes to the atmospheric structure due to the abundance gradients are shown. Possible applications to different stars are also discussed.

## MO-POS-25

**Probing Sunspot Magnetic Fields with Solar Oscillations, Ashley Crouch<sup>1</sup> and P.S. Cally<sup>2, 1</sup> Université de Montréal and <sup>2</sup> Monash University** — Sunspots absorb and scatter incident  $f$ - and  $p$ -modes. Until recently, the responsible absorption mechanism was uncertain. The most promising explanation appears to be conversion to slow magnetoacoustic-gravity waves and Alfvén waves, which carry energy down the magnetic field lines into the interior. Assuming uniform vertical magnetic field, this mechanism easily explains  $f$ -mode absorption, but cannot fully account for observations of (higher order)  $p$ -modes. Recent calculations show that  $p$ -mode absorption produced by simple sunspot models with non-vertical magnetic fields is ample to explain the observations. In fact, the resultant  $p$ -mode scattering by such models is in remarkable agreement with observations. This excellent agreement allows some degree of probing of subsurface magnetic field strengths (*i.e.*, visualizing the invisible). Here, we present results from the best sunspot models currently available and discuss their implications for subsurface magnetic field structure.

## MO-POS-26

**Models of Rotating Delta Scuti Stars, R. Deupree, Institute for Computational Astrophysics and Department of Astronomy and Physics, Saint Mary's University** — Delta Scuti stars are viewed as prime candidates for probing the internal structure of stars by matching multiple pulsation modes. The task is formidable because mode identification is not trivial when there are only a comparatively small number of modes observed and because a number of delta Scuti stars rotate sufficiently rapidly that their structure cannot be modeled with the same degree of confidence as can the structure of nonrotating stars. This work presents a first step with the full 2D calculation of rotating models of delta Scuti stars. It is expected that these models will form the basis of calculating rigorous linear, adiabatic, nonradial pulsation periods using the approach of Clement (ApJS, 116, 57). Pulsation mode results for ZAMS models for presented for several rotation rates.

## MO-POS-27

**Causality and the Collimation of Astrophysical Jets\*, Heather Cameron and C.D. Matzner, University of Toronto** — Collimated jet-like outflows are associated with many astrophysical objects, ranging from protostellar objects to active galactic nuclei. Although magnetic fields are implicated in launching and shaping these flows, and many theoretical models have been offered for them, fundamental questions remain to be resolved. What, for instance, is necessary for collimation — would the Solar wind collimate if there were no heliopause? In both Newtonian and relativistic winds, collimation requires causality: information must cross streamlines. At the same time, information flow is restricted by the acceleration that accompanies collimation. We use the method of characteristics to derive preliminary results on the links between collimation, acceleration, and the causal structure of magnetized winds.

\* This work is being supported by University of Toronto.

## MO-POS-28

**The Relation Between Supermassive Black Holes and their Environments\*, X.Y. Dong and M.M. De Robertis, York University** — In order to study the origin and maintenance of activity in galactic nuclei, we consider a sample of 118 spiral galaxies from a variety of morphological stages from Ho *et al.* (1997) to search for correlations among active parameters such as emission-line properties, and parameters associated with the host galaxy. After first calibrating a  $K$ -band relation between the bulge and central black hole masses:  $\log_{10} [M_{\text{BH}} / M_{\text{SUN}}] = (-0.413 \pm 0.061) M_K + (-1.704 \pm 1.442)$ , we determine the central black hole masses for these galaxies from  $K$ -band bulge magnitudes  $M_K$  measured from 2MASS data, and using the two-dimensional decomposition routine GALFIT. The parameters that correlate extremely well with black-hole mass include: narrow emission-line width, various emission-line ratios, and the inclination-corrected 21 cm line width for the galactic disk. A list of other pairs of parameters that show good correlations also described. The IRAS 25, 60 and 100  $\mu\text{m}$  luminosities correlate well with the  $H\alpha$  (narrow-line) luminosity. There are also interesting correlations between the IR flux ratios and the

$H\alpha$  luminosity. We also present the distributions of active and non-active parameters as a function of morphological type,  $T$ . Bulge luminosities (and black hole masses) are larger in early type spiral galaxies, but with a significant scatter. The absolute  $K$ -band bulge magnitude is  $M_K = (0.3528 \pm 0.1413) T + (-22.7378 \pm 0.4277)$ . As we discuss, this is undoubtedly a major reason why Seyfert galaxies are discovered primarily in early type spirals. The distributions for Sc galaxies are often markedly different from the distributions in earlier types.

\* This work is being supported by NSERC.

**MO-POS-29**

**The Optical And Infrared Emission Of The Magnetar 1E 1048\***, Martin Durant and M.H. van Kerkwijk, *University of Toronto* — In the magnetar model for anomalous X-ray pulsars (AXPs), the superstrong magnetic field of the neutron star causes currents to traverse the magnetosphere. Optical and infrared emission is produced when ions absorb X-rays from the stellar surface and are promoted into high Landau excitation states, energy which is then released as the ion de-excites. Since the energy of the Landau levels and the radiative timescale both depend on the local magnetic flux density, the magnetic mirroring effect causes a sharp cutoff in the spectrum; and since the current causes the toroidal component of the exterior magnetic field, a relationship between the infrared/optical flux and the X-ray flux and timing torque are expected. I will present photometric data taken with Magellan and the VLT of 1E 1048, and compare these to other AXPs and specifically to the questions raised above.

\* This work is being supported by Martin Durant.

**MO-POS-30**

**XMM-Newton Observation of the High Magnetic Field Radio Pulsar B0154+61**, Marjorie Gonzalez<sup>1</sup>, V.M. Kaspi<sup>1</sup>, A.G. Lyne<sup>2</sup> and M.J. Pivovarov<sup>3</sup>, <sup>1</sup>McGill University, <sup>2</sup>University of Manchester and <sup>3</sup>Space Sciences Laboratory, UC Berkeley — We present results from a deep X-ray observation of the radio pulsar B0154+61 performed with the XMM-Newton satellite. The pulsar has a characteristic age of 20.5 kyr, a rotation period of 2.3 seconds and an inferred dipole surface magnetic field strength of  $2.1 \times 10^{13}$  G, some of the highest values in the radio pulsar population. Our analysis shows that no X-ray emission is detected from the position of B0154+61 with XMM-Newton. Using a blackbody model, the derived upper limits on the pulsar's temperature and luminosity are  $<73$  eV and  $<1.4 \times 10^{32}$  ergs s<sup>-1</sup>, respectively (assuming a distance of 1.7-kpc and a column density  $N_H < 3 \times 10^{21}$  cm<sup>-2</sup>). When compared to the values predicted by neutron star cooling models, the above limits are found to favor those requiring rapid cooling, especially when corrections for the presence of a light-element atmosphere and relatively high magnetic field on the neutron star are made. However, the uncertainties in distance, column density and atmospheric composition prevent a definite conclusion. In addition, the limits on the temperature and luminosity of B0154+61 are found to be much lower than those exhibited by the "anomalous X-ray pulsars" (AXPs), although their spin characteristics are comparable, thus leaving unanswered the question of a radio pulsar/AXP connection.

**MO-POS-31**

**A Gemini Observation of the Anomalous X-Ray Pulsar 1RXSJ170849-400910\***, Jennifer West and S. Safi-Harb, *University of Manitoba* — The anomalous X-ray pulsars (AXPs) represent a growing class of neutron stars discovered at X-ray energies. Unlike the Crab-like pulsars, they are radio-quiet, slow X-ray rotators, and have an X-ray luminosity higher than their rotational spin-down power. The two competing models proposed to explain their anomalous nature invoke either accretion from a low-mass companion on a disk, or an ultra-magnetized neutron star (magnetar). In the past few years, evidence has been accumulating in favor of the magnetar model, making AXPs and the Soft Gamma-Ray Repeaters among the strongest magnets in the Universe. Infrared observations offer a tool to test these models and study the variability of these objects. 1RXSJ170849-400910 is a relatively bright AXP which was discovered with the ROSAT X-ray satellite, and later found to be an 11 s X-ray pulsar by the ASCA X-ray satellite. Recently, Israel *et al.* (2003) reported the detection of the likely IR counterpart to 1RXSJ170849-400910 using a deep observation the ESO and CFHT telescopes. We will here present a Gemini observation of 1RXSJ170849-400910 obtained with Flamingos, the Gemini-South near-IR imager, in J (1.25  $\mu$ m), H (1.65  $\mu$ m), and K (short) (2.15  $\mu$ m), and compare our result with that of Israel *et al.*

\* This work is being supported by NSERC and URGF.

**MO-POS-32**

**Near InfraRed Detection of the Anomalous X-Ray Pulsar 1E 2259+586**, Cindy Tam<sup>1</sup>, V.M. Kaspi<sup>1</sup>, M.H. van Kerkwijk<sup>2</sup> and M. Durant<sup>2</sup>, <sup>1</sup>McGill University and <sup>2</sup>University of Toronto — On June 18 2002, the Anomalous X-ray Pulsar AXP 1E 2259+586 underwent a major X-ray outburst that lasted several hours and consequently linked AXP's to another class of high-energy bursting objects, called Soft Gamma-ray Repeaters (SGR). This was predicted uniquely by the "magnetar" model, in which these two classes are ultrahigh magnetic field, isolated young neutron stars. A few days after this outburst, Target of Opportunity observations were obtained with the Gemini North Near-Infrared Imager (NIRI), followed by a longer term monitoring program of the IR variability that spanned nearly one and a half years. It was observed that shortly after the burst, the pulsar's Ks band flux dramatically increased relative to its pre-burst flux level, prompting the question "does the IR luminosity of 1E 2259+586 constantly undergo fluctuations, or can this brightening be undeniably associated with the X-ray outburst?" We present the results of our IR analysis, and relate them to the results of previous X-ray studies. There was no evidence for variability apart from that seen immediately after the outburst, implying the IR fluctuation was definitely associated with the outburst. Also, we discuss the effect that our findings might have on current AXP theoretical models.

**MO-POS-33**

**The Study of a Puzzling Galactic Supernova Remnant and The Discovery of an Active Galactic Nucleus in its background yard\***, Samar Safi-Harb<sup>1</sup>, U. Hwang<sup>2</sup>, R. Petre<sup>2</sup>, S.S. Holt<sup>3</sup> and P. Durouchoux<sup>4</sup>, <sup>1</sup>University of Manitoba, <sup>2</sup>NASA/GSFC, <sup>3</sup>Olin College and <sup>4</sup>Saclay, France — G41.1-0.3 is an intriguing supernova remnant with an unusual morphology and properties. In our previous X-ray study of this remnant, we suggested that it is the result of a type II supernova explosion; however no pulsar has been yet found to be associated with it. We report on our Chandra spatially resolved spectroscopic study of the remnant, and correlate its X-ray emission with the radio and millimeter observations. We then address its unusual morphology and discuss its properties in the light of a shock wave interacting with an inhomogeneous medium. The burning question about G41.1-0.3 remains: where is its compact stellar remnant? While searching for a compact object, we discovered an X-ray pointsource just outside the remnant. We discuss the nature of this new source and argue that it is a nearby Seyfert II Active Galactic Nucleus.

\* This work is being supported by NSERC, NASA.

**MO-POS-34**

**Long Term Timing Observations of the Young, Energetic Pulsar PSR B1509-58**, Margaret Livingstone<sup>1</sup>, V.M. Kaspi<sup>1</sup> and R.N. Manchester<sup>2</sup>, <sup>1</sup>McGill University and <sup>2</sup>ATNF - We present results from the long-term timing observations of the young, energetic pulsar PSR B1509-58. We present a phase-coherent analysis of 21 years of timing data from the Molonglo and Parkes Radio Observatories and the Rossi X-Ray Timing Explorer. We have measured the frequency derivative as well as higher order frequency derivatives to test the conventional model of pulsar spin-down given by  $\dot{\nu} = K\nu^n$ , where  $\nu$  is the frequency of the pulsar,  $\dot{\nu}$  is the frequency derivative,  $K$  is a constant related to the magnetic field of the pulsar and  $n$  is the 'braking index'. Using a partially phase-coherent timing analysis, we have measured a braking index consistent with previous measurements. We also measure the value of the third frequency derivative to be inconsistent with the simple spin-down law for pulsars, possibly indicating a time-dependent magnetic field.

**MO-POS-35**

**PSR J1740-5340 Promises and Surprises\***, Fernando Pena and M.H. van Kerkwijk, *University of Toronto* — Bright stars which are binary systems where the other component is a neutron star are very useful as a tool to constraint pulsar's masses. Different equations of state (EOS) will give different values slightly greater than the current  $1.35 M_{\odot}$  depending in the type of interactions between particles at the core and depending in the mass accreted. In the particular case of the binary system PSR J1740-5340 the companion is a bright ( $V \sim 17$ ) non-MS star (we called it "red straggler") which partially fills its Roche lobe ( $R/R_{\text{Roche lobe}} \leq 1$ ), the orbital period is 1.35 days. The system is in the globular cluster NGC 6397 (mean velocity  $\sim 18$  km/s) and the pulsar has a period of 3.5 ms (MSP). I will present high resolution VLT/UVES spectra ( $\sim 24$  nights covering different orbital phases). From these I will show the radial and rotational velocities of the companion star, and assuming some models I will present the mass ratio (already done,  $M_{\text{PULSAR}}/M_{\text{COMP}} \sim 5.7$ ), the inclination angle of the orbit (in progress but will be finished by the time of the congress), and finally the mass of the binary components (MSP and companion). Together with the mass measurement I will discuss some interesting puzzles of this system, most of them related to the lack of heating showed by companion's light curve (which is purely sinusoidal, because of its tidal deformation), strange because we expect some influence of the pulsar's irradiation on the very close-companion's atmosphere.

\* This work is being supported by University of Toronto.

**MO-POS-36**

**A Chandra Observation of the W50 Nebula Associated with SS433**, A. Moldovan and S. Safi-Harb, *University of Manitoba* — The X-ray binary system SS433/W50 has baffled astrophysicists since its discovery in 1979. W50 has been classified as a Galactic supernova remnant that harbors SS433, an X-ray binary consisting of a compact object accreting matter from a companion star at a super-Eddington rate. The nature of the compact object is still unknown, but it is expelling relativistic jets that interact with W50, causing it to elongate along the jets axis and forming the X-ray lobes. We have studied this system with ROSAT, ASCA, RXTE and, most recently, Chandra. A 75 ksec Chandra observation will be presented for the western lobe of W50. This observation and the corresponding analysis will be compared to the observations made by ASCA and ROSAT of the western lobe, as well as the eastern lobe of W50. The Chandra data will also allow a spatial resolution of thermal and non-thermal emission from the shock-excited regions in the remnant.

**MO-POS-37**

**The Plerionic Supernova Remnant G21.5-0.9: In and Out\***, H. Matheson and S. Safi-Harb, *University of Manitoba* — The Crab nebula has been viewed as the prototype for a pulsar-wind nebula or a plerion. Today, we know of about a dozen Galactic plerions. The absence of a supernova remnant (SNR) shell surrounding the Crab and other plerions is still a mystery. G21.5-0.9 is an intriguing plerionic SNR. Early Chandra observations revealed a faint extended X-ray halo, which was suggested to be the missing shell of the

SNR. Safi-Harb *et al.* (2001) show however that the X-ray emission from this extended halo is non-thermal, unlike what would be expected from an SNR shell. They suggested that the extension could be indicative of a larger than previously thought plerion and/or due to a dust scattering X-ray halo. In the former scenario, G21.5-0.9 would be the only plerion which has a larger size in X-rays than in the radio. Since G21.5-0.9 is a calibration target for Chandra, there is a large amount of data available. We will present our analysis of 207 ksec of data obtained with the High-Resolution Camera and 450 ksec of data acquired with the Advanced CCD Imaging Spectrometer. We will show the results of our deep search for thermal emission and discuss the nature of the X-ray halo in the light of the proposed models. We will also put further constraints on the parameters of the putative pulsar powering G21.5-0.9.

\* This work is being supported by NSERC.

#### MO-POS-38

*X-Ray Aurora in Magnetosphere of Accreting Neutron Stars\**, Vahid Rezanian, John C. Samson and Peter Dobias, *Theoretical Physics Institute* — In this study we propose a new generic model for quasi-periodic oscillations (QPOs) based on oscillation modes of neutron star magnetospheres. We argue that the interaction of the accretion disk with the magnetosphere can excite resonant shear Alfvén waves in a region of enhanced density gradients. We demonstrate that depending on the distance of this enhanced density region from the star and the magnetic field strength, the frequency of the field line resonance can range from several Hz (weaker field, farther from star), to approximately kHz frequencies (stronger field, ~ 6-10 star radii from the star). We show that such oscillations are able to significantly modulate inflow of matter from the high density region toward the star surface, and possibly produce the observed X-ray spectrum. In addition, we show that the observed 2:3 frequency ratio of QPOs is a natural result of our model.

\* This work is being supported by NSERC.

#### MO-POS-39

*The Search for Supernova Remnants Using the International Galactic Plane Survey Data\**, Ashish Asgekar<sup>1</sup>, Samar Safi-Harb<sup>2</sup> and Roland Kothes<sup>2, 1</sup> *University of Manitoba* and <sup>2</sup> Dominion Radio Astrophysical Observatory, NRC — The International Galactic Plane Survey (IGPS) has in the past few years demonstrated its remarkable sensitivity towards low-surface brightness, extended structures, like supernova remnants (SNRs). We are searching for new SNRs targeting the positions of already-known pulsars in the IGPS data. Two candidates were identified by comparing the IGPS 20-cm images with the archival images from other surveys, such as the NVSS and IRAS. We will present their polarized intensity and spectral index maps obtained with the archival VLA data, and search for their X-ray counterparts.

\* This work is being supported by IGPS.

#### MO-POS-40

*Correlating Dust Properties with Star Formation and the ISM in the BIMA SONG Survey*, Scott Brooks and C. Wilson, *McMaster University* — We present preliminary results from the analysis of 450 and 850 micron SCUBA jiggle maps of a selection of galaxies from the BIMA SONG catalog. Our observations are sensitive to the continuum emission due to cool dust, which can be correlated with the gas emission to determine empirically what the relative importance is to the continuum emission of changes in the dust mass versus changes in the dust heating due to nearby star formation.

#### MO-POS-41

*The Spatial Distribution and Extraordinary Extinction Law in Optical Nebulae of the 2nd Quadrant*, Tyler Foster<sup>1</sup> and R. Kothes<sup>2, 1</sup> *Herzberg Institute of Astrophysics, National Research Council*, <sup>2</sup> *University of Calgary, HIA/NRC* — We have constructed a new map of the Galactic Plane Region  $90^\circ \leq l \leq 180^\circ$ ,  $-3.5^\circ \leq b \leq 5.5^\circ$  using new non-photometric distances to ~70 HII regions, from the technique of Foster & Routledge (2003). We present new radial velocity measurements for each region using Canadian Galactic Plane Survey HI and <sup>12</sup>CO data, as well as published H $\alpha$  line surveys. The most noticeable result is that the clear majority of these optically catalogued nebulae (c.f. Sharpless 1959) are residents are the Perseus Arm, the nearest major spiral arm to the Sun. Many of these regions form a striking "chain" that follows the Arm's inner edge. Some others are Local Arm inhabitants, while Sh-127 ( $d = 6.2$  kpc) is likely an Outer Spiral Arm member. Published photometric distances to many HII regions (particularly those near the Galactic anticentre,  $150^\circ \leq l \leq 180^\circ$ ) suggest that they are scattered irregularly throughout the disk, a picture inconsistent with the accepted model of their formation in "chains" along Spiral Arms. We show that most of these HII regions are surrounded by layers of dust, and that the value of total-to-selective extinction  $R_V = A_V / E(B - V)$  in the involved dust is greater than the canonical ISM value of  $R_V = 3.1$ . The anomalous photometric distances of these HII regions are likely the result of observing their exciting star(s) through these dense shells of dust, where we measure  $R_V$  to range from 3.2 to more than 7. This abnormal extinction law particularly affects the distance moduli of those regions toward the anticentre, where extinction due to associated dust equals or exceeds that due to foreground material.

#### MO-POS-42

*Pulsar-Based Galactic Magnetic Field Mapping: A Small Annulus With An Anti-Clockwise Magnetic Field, In A Large Disk With A Clockwise Magnetic Field*, Jacques P. Vallee, *National Research Council Canada - Herzberg Institute of Astrophysics* — A new pulsar-based model for the structure of the Milky Way's magnetic field is obtained, by using both the rotation measure and the dispersion measure of over 350 pulsars in the Milky Way. The model holds true separately for pulsars above the galactic plane, and for pulsars below the plane. In this pulsar-based model, an overall clockwise-going magnetic field (as seen from the North Galactic Pole) extends radially at least from 1 to 12 kpc from the Galactic Center, except for a 2-kpc wide anti-clockwise magnetic field located in a radial annulus between 4 and 6 kpc from the Galactic Centre. Here the magnetic field is not attached to any specific spiral arm. The origin of this unique anti-clockwise annulus could be due to a number of factors (internal or external) or could be primordial (regular or chaotic). The new model has a very special feature in the form of a string of HII regions located in the anti-clockwise annulus, and it may be a new class of "axisymmetric (ASS) magnetic field" models. The new model disagrees with recent pulsar studies that employed several magnetic reversals in the inner Galaxy, and some more in the outer Galaxy [the "bisymmetric (BSS) field" model].

#### MO-POS-43

*Fourier Transform Spectroscopy of Orion Molecular Cloud*, D.A. Naylor<sup>1</sup>, M.K. Tahic<sup>1</sup>, B.G. Gom<sup>1</sup>, G.R. Davis<sup>2</sup> and D. Johnstone<sup>3, 1</sup> *University of Lethbridge*, <sup>2</sup> JAC and <sup>3</sup> *Herzberg Institute of Astrophysics* — The Orion molecular cloud is the most studied region of star formation in our galaxy. Recent SCUBA images at 450 & 850 mm reveal a variety of structures including candidate pre-stellar cores, cores containing Class 0 protostars, shocks and PDR fronts. In the last few years, we have been using a Fourier transform spectrometer (FTS) at the James Clerk Maxwell Telescope (JCMT) to separate the line and continuum components of emission in the two brightest sources of the Orion Molecular Cloud: KL and S. In December 2000 we obtained complete spectral scans of the 850 mm band of Orion KL and S with the JCMT heterodyne receiver B3. In October 2002 and April 2003 we obtained spectral scans of the 850 mm band of Orion KL with the University of Lethbridge Fourier Transform Spectrometer. These spectra will be compared to determine the potential for measuring, simultaneously, both the line and continuum emission components of galactic sources using the FTS currently under development for use with the SCUBA-2 detector.

#### MO-POS-44

*A Galactic Chimney Over the W47 HII Region Complex*, Jeroen Stil, R. Ouyed and A.R. Taylor, *University of Calgary* — We present new 21-cm line and 21-cm continuum from the VLA Galactic Plane Survey (VGPS; Taylor *et al.* 2002) of the Galactic star formation region W47 and the associated worm GW 38.0+1.6. The edge of this region is a 200 pc long vertical filament observed in the 21-cm line and 21-cm continuum. The location of this filament and the radio recombination line velocity of the ionized gas associate the filament with the W47 complex at  $V_{LSR} = 50$  km/s. The shape of the filament can be represented by a Kompaneets model with W47 as the source that encloses the GW 38.0+1.6 area. However, the HI filament is detected at  $V_{LSR} = 0$  km/s. The location and velocity of the HI suggest a velocity component of 50 km/s perpendicular to the expansion velocity of the super bubble. We have initiated 3-dimensional magnetohydrodynamic simulations of a superbubble bursting out of the Galactic disk to obtain insight into the physics of this surprising result.

#### MO-POS-45

*Imaging Cold Dust in the Galactic Plane*, Henry Matthews<sup>1</sup>, B. Weferling<sup>2</sup>, A. Evans<sup>3</sup>, M. Cohen<sup>4</sup>, J. Jackson<sup>5</sup>, R. Simon<sup>5</sup>, D. Johnstone<sup>6</sup>, G. Davis<sup>2</sup>, T. Jenness<sup>2</sup>, D. Pierce-Price<sup>2</sup>, W. Dent<sup>7</sup>, J. Richer<sup>8</sup> and G. Fuller<sup>9</sup>, <sup>1</sup> *National Research Council of Canada*, <sup>2</sup> JAC Hawaii, <sup>3</sup> Keele University, UK, <sup>4</sup> Berkeley University, <sup>5</sup> Boston University, <sup>6</sup> HIA/NRC, <sup>7</sup> UKATC, UK, <sup>8</sup> MRAO, UK, <sup>9</sup> UMIST, UK — We present images of continuum emission at 850 and 1200 microns wavelength from a section of the Galactic Plane centered near longitude 44 degrees. These data were obtained from complementary observations made with the JCMT and SEST bolometer array receivers, with beamwidths of about 14 and 22 arcsec respectively. The features seen arise principally from cold dust in two spiral arms at about 1.5 and 8kpc distant from Earth; dust is optically thin at mm/submm wavelengths. These data are compared with existing spectral line data having similar angular resolution, which allow kinematic distances to be assigned to individual features. Comparison with images at mid-infrared wavelengths is also revealing. These data presage the potential of large-scale survey observations with forthcoming instrumentation such as SCUBA2 and HARPC/ACSIS at the JCMT.

#### MO-POS-46

*HI Shells Surrounding The Cygnus Loop\**, Denis Leahy, *University of Calgary* — The Cygnus Loop supernova remnant has been observed in the 21 cm neutral hydrogen (HI) line with the Dominion Radio Astrophysical Observatory's (DRAO) Synthesis Telescope and 26 m Telescope. A search through the dataset reveals large structures associated with the Cygnus Loop in position and velocity. A large ring feature extends from the southeast rim into the center of the Cygnus Loop. Another large structure is found which wraps around the southern and western limb of the southern extension of the Cygnus Loop. Both structures have been identified in the IRAS all-sky survey maps of the region, allowing both HI and dust column densities to be determined as a function of position. The velocity structure of the HI is studied and used to constrain the origin of the HI.

\* This work is being supported by NSERC.

**MO-POS-47**

**A Huge Magnetic Bubble In The Anti-Centre Region Of The Milky Way**, **Roland Kothes**, and T.L. Landecker, *Dominion Radio Astrophysical Observatory, University of Calgary* — We present the discovery of a large magnetic bubble in the data of the Canadian Galactic Plane Survey. This structure is revealed by rotating the polarization angle of the smooth Galactic background polarization. The magnetic bubble is surrounded by an HI bubble with a systemic velocity of about -20 km/s implying a Perseus arm location. At this distance the bubble has a diameter of about 300 pc. At the northern edge of the bubble is the SNR VRO 42.05.01, which is the remnant of a supernova that happened just outside the edge of the bubble. This is not only the first time a Faraday screen can be related to an HI structure, but also gives us the opportunity to directly study the interaction of the supernova shock wave with the HI bubble and the embedded magnetic field.

**MO-POS-48**

**Propagating Star Formation Around Single O-star HII Regions**, **Charles Kerton**<sup>1</sup>, Lewis Knee<sup>2</sup> and Christopher Brunt<sup>3, 1</sup> *Iowa State University*,<sup>2</sup> *HIA* and<sup>3</sup> *UMass/FCRAO* — The vast majority of stars of all masses form in regions in which rare but prominent high mass O stars are born. It is thus important to understand the processes and modes of star formation in the harsh environment of HII regions and PDRs around O stars. We present the initial results of our sub-mm (JCMT SCUBA) observations of small angular size HII regions designed to examine how star formation propagates through a molecular cloud surrounding an HII region. Our targets are a carefully chosen sample of eight small (~10 arcmin in diameter) HII regions each excited by a single O star. The SCUBA observations are being combined with near-IR (2MASS), mid-IR (MSX), mm (FCRAO) and cm (DRAO) observations to determine the spatial distribution of the embedded stellar population throughout the surrounding molecular cloud. The small size of the HII regions permits easier acquisition of the multiwavelength data needed to trace all of the relevant physical components (HI, HII, molecular gas, and stars) which enables the entire physical chain from triggering source to emerging stellar population to be investigated.

**MO-POS-49**

**The Kinematics of Massive Star-Forming Region NGC 7538\***, **Michael Reid**<sup>1</sup>, C. Wilson<sup>1</sup> and B. Matthews<sup>2, 1</sup> *McMaster University* and<sup>2</sup> *University of California at Berkeley* — Progress in understanding star formation increasingly comes through an understanding of the kinematics of star-forming regions and cores. Much is known about the kinematics of low-mass regions and cores, but less about their higher mass counterparts. One such region in our galaxy, NGC 7538, is the home of a spectacular class 0 core candidate, NGC 7538, which has a young outflow and disk of several hundred solar masses (Sandell, Wright, & Forster 2003, ApJ, 590L, 45). We are studying the massive young cores of NGC 7538, with an eye toward their kinematic properties. We have acquired SCUBA continuum maps at 850 and 450 microns of the entire region, as well as high-resolution BIMA and VLA line maps of select cores in up to seven different molecular kinematic probes. Analysis of this data is proving complex, but we present some preliminary results here.

\* This work is being supported by NSERC.

**MO-POS-50**

**Characterizing the Outflow of W28A2**, **Pamela Klaassen**<sup>1</sup>, R. Plume<sup>1</sup>, R. Ouedy<sup>1</sup> and J. DiFrancesco<sup>2, 1</sup> *University of Calgary* and<sup>2</sup> *Herzberg Institute of Astrophysics* — The formation of high mass stars is less well understood than that of lower mass stars due to the shorter time scales and larger distances involved. One of the earliest stages of high mass star formation consists of a period of outflow which can be studied through its impact on its environment. We present observations of W28A2, a shell like Ultracompact HII region associated with one of the youngest and most energetic outflows in the Galaxy (O6 star). Using the James Clerk Maxwell Telescope, we have observed the outflow in a number of transitions and have derived the age, mass, extent, and velocity of the outflow. In order to better constrain the driving mechanism of the outflow, we have conducted magneto-hydrodynamic simulations (using Zeus-MP and Jetget) of a high-velocity jet impacting on a surrounding molecular envelope.

**MO-POS-51**

**Mapping the Sprial Structure of the Milky Way Galaxy\***, **Saul Davis**<sup>1</sup>, H.B. Richer<sup>1</sup>, J.S. Kalirai<sup>1</sup>, G. Fahlan<sup>1</sup>, G. Bono<sup>2</sup> and M. Cignoni<sup>3, 1</sup> *Univeristy of British Columbia*,<sup>2</sup> *Osservatorio di Roma* and<sup>3</sup> *Universita degli Studi di Pisa* — The details of the spiral structure of the Milky Way remain poorly understood. This project attempts to provide us with a more complete picture of our own Galaxy - We have obtained images of 19 open clusters in the disk of the Milky Way. These clusters are predominantly in the quadrant of the Galaxy opposite to the Galactic center ( $135^\circ < l < 225^\circ$ ), and over half are at low latitude ( $b < 5^\circ$ ). The images were obtained with CFHT12k, for the CFHT Open Star Cluster Survey, and represent a unique data set in terms of area (0.22 square degrees per image) and depth ( $V \sim 23$ ) in this region of the sky. The colour-magnitude diagrams (CMDs) of the various lines of sight look markedly different. Most obvious, is the difference between the lines of sight with  $b > 5^\circ$  and those with  $b < 5^\circ$ , yet more subtle distinctions appear between the low-latitude lines of sight with are presumably attributable to the presence of spiral arms. By simulating CMDs we hope to be able to constrain various parameters that describe the Galaxy, such as scale-length and scale height of the disk, star formation history of the disk, initial-mass function of the halo, and finally, the precise location and extent of the spiral arms. Early results will be presented.

\* This work is being supported by UBC.

**MO-POS-52**

**Infrared Imaging of Protoclusters in the Orion B Molecular Cloud**, **Ashley J. Ruiter** and George F. Mitchell, *Saint Mary's University* — Sub-millimetre mapping of Orion B using SCUBA (Mitchell *et al.* 2001, ApJ, 556, 215) has revealed a large population of compact cores, most of which are clustered in well-separated regions. In three nights in January 2003, we obtained near-infrared images of two of these regions. Using the CFHT-IR camera on the Canada-France-Hawaii telescope, we imaged NGC 2068 and NGC 2071 in a narrow band K-continuum filter, and in a narrow band filter centred on the 2.122  $\mu$ m line of H<sub>2</sub>. This vibrational H<sub>2</sub> line is a well-known diagnostic for shocked gas and radiatively excited gas. When it is observed in regions of active star formation, the exciting mechanism is often shock excitation by an outflow. The IR images show continuum point sources (stars), and regions of extended molecular hydrogen emission. Some cores show a coincident infrared source, while others show no sign of an associated IR source. The latter situation is an indication that the core in question, if containing a forming star, is deeply embedded. Since deeply embedded pre-stellar cores will have no obvious associated K narrow band emission, the H<sub>2</sub> map and a CO map of high-velocity gas are useful probes of the physical processes which are taking place in the vicinity of each core. We will present the H<sub>2</sub> and K continuum images, comparing the emission with the SCUBA map and with a previously obtained map of CO. In particular, we will discuss the implications of these new observations for the evolutionary state of the SCUBA cores.

**MO-POS-53**

**Starlight Excitation Of Permitted Lines In The Orion Nebula\***, **Kevin Blagrove** and P.G. Martin, *CITA, University of Toronto* — Robust abundance calculations for gaseous nebulae require knowledge of line formation mechanisms for a multitude of lines, encompassing both permitted and forbidden. Permitted lines are usually associated with cascades after recombination. However, there is often a sizeable (or even overwhelming) contribution from fluorescence processes (*e.g.*, excitation by starlight). Here, using data from deep optical echelle spectroscopy, we confirm (and extend the analysis of) the line formation mechanisms which had been predicted for permitted lines of several ions. We develop a completely independent method based on the ionization and velocity structure of the Orion Nebula as determined from forbidden lines in the context of photoionization models.

\* This work is being supported by NSERC.

**MO-POS-54**

**Molecular Hydrogen in a Sample of Cooling Flow Clusters** **Louise Edwards**<sup>1</sup>, C. Robert<sup>1</sup> and F. Marleau<sup>2, 1</sup> *Université Laval* and<sup>2</sup> *SIRT Science Centre* — We present imaging data of the cooling flow clusters Abell 644, Abell 400 and Abell 1795 taken with CFHT-IR in the infrared. These clusters are all cooling flows of moderate mass deposition rates (200, 100 and 10 solar masses per year, respectively). With proper data reduction, the use of narrow band filters can provide the 1-0 S(1) emission line of molecular hydrogen. For Abell 1795, we report the molecular hydrogen flux of the central dominant galaxy, as well as discuss the first detections of molecular hydrogen emission found in cooling flow cluster galaxy other than the CDG. We describe the emission morphology of the CDG emission found for Abell 1795 and relate it to possible emission mechanisms. We compare our measurements with Donahue *et al.* (2000) who have published similar work for three other cooling flow clusters. For Abell 400 and Abell 644 we present the preliminary results of our data analysis.

**MO-POS-55**

**Studies of an Intergalactic Neutral Hydrogen Cloud**, **Jayanne English**<sup>1</sup>, B. Koribalski<sup>2</sup> and K.C. Freeman<sup>3, 1</sup> *University of Manitoba*,<sup>2</sup> *Australia Telescope National Facility* and<sup>3</sup> *RSAA, Australian National University* — An intergalactic HI cloud of a few billion solar masses, previously detected using the Parkes Radio Telescope and the Australia Telescope Compact Array (ATCA) (English 1994; Freeman *et al.* 1996), has been confirmed in further ATCA observations of the NGC 3256 galaxy group. The group contains the prominent merging galaxy NGC 3256, which is surrounded by a number of HI fragments (English *et al.* 2003), the tidally disturbed galaxy NGC 3263 (Koribalski *et al.*, in prep.), and several other galaxies. Using ATCA HI data we examine the nature of this massive gas cloud and its relationship to the neighbouring galaxies. This could be a primordial "galaxy building block". However the cloud's properties, in conjunction with the spatial extents and velocity behaviours of the group's major galaxies, may indicate that it originated out of tidal debris.

**MO-POS-56**

**A Gallery of Galaxies in the Hubble Deep Field South**, **Theresa Wiegert**<sup>1,2</sup>, D.F. de Mello<sup>3</sup> and C. Horellou<sup>2, 1</sup> *University of Manitoba*,<sup>2</sup> *Onsala Space Observatory*; and<sup>3</sup> *Goddard Space Flight Center* — We have applied a photometric redshift technique using spectral energy distribution templates to the WFC2 images of the Hubble Deep Field South. As a result, a catalogue of 1142 objects with photometric redshifts and spectral types was produced, showing the redshift distribution of galaxy spectral types. There is a

decrease in early-type galaxies for higher redshifts ( $z > 1$ ), while the amount of irregular and starburst galaxies increases. A subsample of the galaxies is displayed in a gallery, showing the reliability of using spectral energy distributions for calculating photometric redshifts. The work was done as part of a master's thesis project at Onsala Space Observatory.

#### MO-POS-57

The NOAO Fundamental Plane Survey, **Russell Smith**<sup>1</sup>, M.J. Hudson<sup>1</sup>, R.L. Davies<sup>2</sup>, J.R. Lucey<sup>3</sup>, J.E. Nelan<sup>4</sup>, D. Schade<sup>5</sup>, N.B. Suntzeff<sup>6</sup> and G.A. Wegner<sup>4, 1</sup> *University of Waterloo*, <sup>2</sup> Oxford University, <sup>3</sup> University of Durham, <sup>4</sup> Dartmouth College, <sup>5</sup> HIA/CADC and <sup>6</sup> CTIO/NOAO — The NOAO Fundamental Plane Survey (NFPS) is a wide field imaging and spectroscopic survey of the ~100 nearest X-ray luminous galaxy clusters, with two principal science goals: (1) to measure distances and peculiar velocities through the Fundamental Plane relation, to probe large-scale flows to  $\sim 200h^{-1}$  Mpc; and (2) to study the structural, morphological and star-formation properties of the cluster galaxy population. Here, I present some preliminary results in each of these categories, and discuss some multi-wavelength follow-up studies based upon the NFPS sample.

#### MO-POS-58

Changes in the Radio Image of Quasar 3C454.3 and their Possible Effect on the VLBI Astrometry for the Guide Star of the Gravity Probe B Mission\*, **Ryan Ransom**<sup>1</sup>, J.I. Lederman<sup>1</sup>, N. Bartel<sup>1</sup>, M.F. Bietenholz<sup>1</sup>, D.E. Lebach<sup>2</sup>, M.I. Ratner<sup>2</sup>, I.I. Shapiro<sup>2</sup> and J.-F. Lestrade<sup>3, 1</sup> *York University*, <sup>2</sup> Harvard-Smithsonian Center for Astrophysics and <sup>3</sup> Observatoire de Paris-DEMIRM — Since 1997 we have observed the quasar 3C454.3 at 3.6 cm with a VLBI array of 12 or more stations about four times per year in support of the NASA-Stanford relativity gyroscope experiment, Gravity Probe B (GP-B). This quasar is a phase reference source for the imaging and astrometry of the mission guide star, HR 8703, which we observed during the same sessions. We present a selection of VLBI images of 3C454.3 produced from observations between January 1997 and December 2003. The images show changes in the region within 1.5 mas of the radio core of the quasar. We also examine the effect of these changes on our astrometric results for HR 8703.

\* This work is being supported by NASA, NSERC.

#### MO-POS-59

A Step Closer to the Detection of the Reionization Epoch, **Sasa Nedeljkovic**, C.B. Netterfield and U. Pen, *University of Toronto* — Approximately a billion years after the Big Bang, the first stars reionized the universe and ended the so-called Dark Ages. In many models, the reionization occurs rapidly making a sharp step in the spectra from the quenching of the redshifted 21cm line. The step is expected to be visible between 70-240MHz for  $Z_{\text{reion}} = 5$  to 20. The step is expected to be around 15mK, which is easily detectable from a signal to noise point of view. However, the signal is 5 orders of magnitude smaller than the foregrounds, complicating the task of detection. With large radio instruments such as PAST, CLAR, LOFAR and ultimately SKA on the way, we give the update of the small instrument built primary for the detection of the reionization step: TREX (21cm Reionization EXperiment). This poster will give an overview of the latest instrument specification.

#### MO-POS-60

Visualizing the CMB through the Dust: A New Generation of IRAS Maps\*, **Marc-Antoine Miville-Deschenes**<sup>1</sup> and G. Lagache<sup>2, 1</sup> *Canadian Institute for Theoretical Astrophysics* and <sup>2</sup> Institut d'Astrophysique Spatiale — Twenty years ago the IRAS satellite made an all-sky survey in the mid/far-infrared that had a tremendous impact on modern astrophysics. In this contribution I will show that IRAS will still be a crucial element for cosmological missions to come like Planck, an European satellite (with Canadian contribution) that will be launched in 2007 and that will map the whole sky in the submm/mm range. The main scientific goal of Planck is to study the cosmic microwave background but one of the biggest challenge of Planck is to be able to separate the numerous emission components in that frequency range (dust emission, synchrotron, free-free). To tackle this problem, external data sets, which probe specific components, are needed. With its full-sky coverage and arcminute resolution, the IRAS data, that probe the dust emission of the interstellar medium, will be a key player in the analysis of the Planck data. Unfortunately, the available IRAS product suffers from several instrumental effects that prevent its use for detailed CMB analysis. In this context we have performed a totally new reprocessing of the IRAS data, based on the knowledge acquired recently on the behavior of photoconductors and using modern data analysis techniques. In this contribution I will present the image processing techniques we used to improve significantly the quality and reliability of the IRAS data. This new generation of IRAS data opens very exciting new perspectives on the study of the interstellar medium but it will also be essential for the analysis of CMB data.

\* This work is being supported by Canadian Space Agency.

#### MO-POS-61

Distribution of the Submillimetre Population of Galaxies, **Vjera Miovic** and C.B. Netterfield, *University of Toronto* — The sources detected by the ground-based sub-mm surveys are understood to be dusty galaxies experiencing massive bursts of star-formation. The lack of the precise redshift determination of these sources and of the counterpart identification in radio and other wavebands, prevents a reliable estimate of the evolutionary history of these galaxies. Previous studies have investigated finding the photometric redshifts of identified point sources above the confusion limit<sup>[1]</sup>. We investigate the possibility of constraining the luminosity and density evolution of sub-mm galaxies using a different approach – extracting information from the statistics of the unresolved sources detected beyond the "confusion limit". The results from our simulations can be used to analyse the data from sub-mm surveys, such as Spitzer, BLAST or Herschel.

1. Hughes et al, 2002

#### MO-POS-62

A Deep Near-IR Look At Dusty Submillimetre Galaxies\*, **Alexandra Pope**<sup>1</sup>, D. Scott<sup>1</sup> and C. Borys<sup>2, 1</sup> *University of British Columbia* and <sup>2</sup> Caltech — The study of sub-mm galaxies at optical wavelengths is difficult given that the optical images are highly obscured by dust and there are often several possible counterparts. We have been forced to characterize the entire population of sub-mm galaxies by the sub-sample of sources that have radio counterparts. There is a need for deep near-IR images of these dusty galaxies in order to study the radio-undetected sub-sample and thus understand the entire sub-mm population. We have been compiling a sub-mm map of the Great Observatories Origins Deep Survey (GOODS) North field. GOODS is a huge multi-wavelength campaign to unite the deepest observations from NASA's big three space observatories: HST, Chandra and Spitzer, to study galaxy formation and evolution. We have used the ACS HST images from GOODS to study a large sample of 850 micron sources. With the depth achieved by this survey, near-IR counterparts have been found for the majority of the radio-detected sub-mm sources. The colours, morphologies and photometric redshifts of these secure identifications can be used to characterize the optical properties of dusty sub-mm galaxies to help identify counterparts to the blank-field sources. Certain combinations of near-IR properties can be used to successfully identify the counterpart to a sub-mm source.

\* This work is being supported by NSERC/NRC.

#### MO-POS-63

Results from the BOOMERANG 2003 Antarctic LDB Flight, **Carrie MacTavish**, *University of Toronto / BOOMERANG collaboration* — BOOMERANG is a balloon-borne, microwave telescope with polarisation sensitive bolometric detectors. It is designed to measure the polarization, as well as the small scale temperature anisotropies of the cosmic microwave background. In January of 2003 the experiment mapped over 2000 square degrees of the sky at an angular resolution of approximately 10 arcminutes. The most recent results from the analysis of the data obtained from this flight will be presented.

#### MO-POS-64

Metallicity Distribution Function of Galaxies Through Infrared Colors, **Waldemar Okon**<sup>1</sup>, W.E. Harris<sup>1</sup> and D. Crabtree<sup>2, 1</sup> *McMaster University* and <sup>2</sup> HIA/NRC — Globular clusters around galaxies provide unique tracers of their merger and formation history as well as the cluster formation itself. The key quantity which is related to the galaxy enrichment history is the metallicity distribution function (MDF). The MDF is of much interest and debate in current literature, and its fine structure, which contains the sequential starburst history of a galaxy, is sketchily known. This is because most of the current MDF work is based on the fundamentally insensitive (V-I) color index. We have undertaken a project which uses the (V-K) color index, which is more than four times more sensitive to metallicity than (V-I), to considerably improve on the current state of the quality of MDFs. This new data will allow us to study the MDFs of galaxies in much greater detail than previously possible, and hence will increase the understanding of galaxy formation. We have been using the CFHT-IR camera on the Canada-France-Hawaii Telescope to obtain deep K-band photometry of globular clusters in the interesting S0 galaxy NGC 1023 (which may have an unusually wide mixture of cluster ages), the giant elliptical M87, NGC 3377, 3379, 3608, M60, M86, M89 and NGC 2768 during three observing runs. Results from data analysis completed to date are presented here. These include the color distribution (which clearly shows bimodality for M87), color-magnitude and color-color diagrams.

#### MO-POS-65

Dynamical Masses of Galaxy Clusters, **Kris Blindert**<sup>1</sup>, H.K.C. Yee<sup>1</sup>, M.D. Gladders<sup>2</sup> and E. Ellingson<sup>3, 1</sup> *University of Toronto*, <sup>2</sup> Carnegie Observatories and <sup>3</sup> University of Colorado — Cosmological simulations predict a universal density profile for galaxy clusters. In order to test this prediction one requires a large sample of galaxy clusters in a wide range of masses. To this end, we are completing a follow-up survey of about forty galaxy clusters selected from the Red-Sequence Cluster Survey (RCS), with redshifts from 0.15 to 0.6, in a wide range of cluster richness. I will present some preliminary results for a subset of the clusters, including the correlation of optical richness with mass, and the mass-to-light ratio as a function of cluster mass.

#### MO-POS-66

A Peculiar Probe of the Dark Matter Distribution of Large Scale Structure\*, **Robbi Pike**, *University of Waterloo* — Quantifying peculiar motions of galaxies and clusters provides a fundamental tool for probing the mass distribution of large scale structure. It is believed that light traces mass (at least within some biasing scheme), permitting the use galaxies as tracers for the underlying dark matter distribution. Within the confines of linear theory, peculiar motions, due to coherent gravitational pulls from overdense regions can lead to

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valuable information pertaining to the cosmological density parameter,  $\Omega_m$ . The primary goal of this research was to place constraints on  $\Omega_m$  by modelling the galactic density and velocity fields in the local universe ( $cz \sim 8000$  km/s). When comparing observed peculiar velocities to that which is predicted for a given density model (v-v comparisons), the aim is actually to measure the parameter  $\beta = \Omega^{0.6} / b$ , which depending on how well mass traces light is a degenerate combination of  $\Omega_m$  and the biasing parameter,  $b$ . We have computed the density field from galaxy distributions for both the 2MASS and NOG all sky redshift surveys (magnitude and volume limited samples). These are transformed into real space density fields through an iterative procedure outlined by Yahil *et al.* (1991). We use the VELMOD maximum likelihood technique (Willick *et al.* 1997b), making v-v comparisons with several peculiar velocity datasets (SFI, SBF and SNIa) to constrain  $\beta$ . I will report on our findings and discuss how they fit in the current literature, as well as shed some insight into the morphological dependences for both elliptical and spiral galaxies.

\* This work has been supported by Hudson for the completion of a Masters program at the University of Waterloo.

### MO-POS-67

SCUBA-2: A Submillimeter Bolometer Array Camera for the JCMT\*, **Michel Fich**, (on behalf of the SCUBA-2 Team), *University of Waterloo* — Canadian astronomers have played a large role in the success of SCUBA on the JCMT. SCUBA has had a major impact in many areas of astronomy from solar system research out to large scale cosmology studies. SCUBA has been declared to be the “most successful ground-based instrument” in a recent study. Now Canadian astronomers have an opportunity to participate in the construction of a replacement for SCUBA. SCUBA-2 will be many hundred of times faster than SCUBA. This will generate a new explosion in submillimeter research and discoveries as revolutionary as those found with SCUBA. This poster will discuss the current state of the development of SCUBA-2 and describe a few of the exciting science programs that various groups have proposed for the new instrument.

\* This work is being supported by CFA.

### MO-POS-68

Initial Observations with the Arecibo Signal Processor, **Robert D. Ferdman**<sup>1</sup>, I.H. Stairs<sup>1</sup>, D.J. Nice<sup>2</sup>, D.C. Backer<sup>3</sup>, R. Ramachandran<sup>3</sup> and P. Demorest<sup>3</sup>, <sup>1</sup>*University of British Columbia*, <sup>2</sup>*Princeton University* and <sup>3</sup>*U.C. Berkeley* — The Arecibo Signal Processor (ASP) is a flexible, state-of-the-art wide-bandwidth observing system, for the acquisition and analysis of radio telescope signals. The primary application driving the development of this instrument is high-precision long-term timing of predominantly millisecond pulsars. This is attained through coherent removal of dispersion introduced into pulsar signals as they traverse the interstellar medium. The system will be able to process the incoming data stream in near-real time, through a network of personal computers, over a bandwidth of 64 MHz, in each of two polarisations. This initial implementation of ASP is at the 300-m Arecibo telescope in Puerto Rico, in order to take advantage of its enormous sensitivity. We present preliminary results of timing and flux calibrations with ASP for several pulsars. Comparisons have been made, and are shown, between ASP results and those of several existing pulsar instruments ranging from narrow to wide bandwidths, and which use coherent as well as incoherent de-dispersion. In particular, we show results of parallel timing observations with the Princeton Mark IV instrument, a narrow-bandwidth coherent de-dispersion instrument, and the precursor timing system to ASP. We briefly discuss several upcoming observations with ASP, as well as plans for installation of a twin instrument at the 100-m Green Bank Telescope.