

Institute for Computational Astrophysics
Annual Report
2005

The Institute for Computational Astrophysics (ICA) was formed by an act of the Saint Mary's University Faculty Senate in December 2002 on the basis of a proposal generated by Drs. David Clarke and David Guenther. In July 2005, Dr. Terry Murphy, Vice President Academic and Research submitted the amended ICA Constitution to Senate, on behalf of the ICA. Senate unanimously passed the amended ICA Constitution in July, 2005. The Institute at date of submission consists of the following members: Director, Secretary, five full-time Faculty members, two Canada Research Chairs, and two Post Doctoral Fellows.

In 2005, ICA Post Doctoral Research Associate Dr. Amanda Karakas left the ICA to begin a Post Doctoral position at McMaster University. Dr. Sasha Men'shchikov will be leaving for a position at the Service d'Astrophysique in France in January, 2006. In October, 2005, Dr. Joris Van Bever from Brussels, Belgium joined us as an ICA Post Doctoral Research Associate. The ICA will have two new post doctoral fellow arriving in 2006: Dr. Nathalie Toqué in March and Dr. Alex Razoumov in July, and will be submitting Dr. Rob Thacker for a Canada Research Chair position as Dr. Joseph Hahn will be returning to Texas as of July, 2006.

EVENTS IN 2005

Dr. Deupree continues to serve as the CASCA representative on the CITA board, attending board meetings both in October and in the first week of 2006. He has been asked to serve on the Advisory Board of the Herzberg Institute for Astrophysics and will attend his first board meeting in early 2006. He continues to serve as the ACEnet Principal Investigator, and as such serves as a member on the National Initiatives Committee (NIC), an organization made up of the Principal Investigators (or designees) of the seven regional computing consortia such as ACEnet. The task of the NIC is to develop a CFI proposal for funding computational hardware for the consortia and for developing a model for the consortia to work together to provide computational needs on

Summer Students

Faculty within the ICA employed summer students during 2005. They are as follows:

<u>Faculty</u>	<u>Student</u>
Dr. Robert G. Deupree	Patrick Rogers, Chris Geroux
Dr. David Guenther	Joel Tanner
Dr. C. Ian Short	James Sherar
Dr. Joseph Hahn	Yannick Poirier

ICA Visitors

January 31st – April 30, 2005
Birgit Fuhrmeister

Dr. Robert G. Deupree

March 31, 2005 University of New Brunswick

Modeling Stars

Dr. Robert G. Deupree

(SMUICA-05-116) Guenther, D.B.; Kallinger, T.; Reegen, P.; Weiss, W.W.; Matthews, J.M.; Kuschnig, R.; Marchenko, S.; Moffat, A.F.J.; Rucinski, S.M.; Sasselove, D.; Walker, G.A.H., "Stellar Model Analysis of the Oscillation Spectrum of ETA Bootis Obtained from MOST" 2005 ApJ, 635, 547.

(SMUICA-05-115) Straka, C.W.; Demarque, P.; Guenther, D.B.; Li, L. & Robinson, F.J. "Space and Ground Based Pulsation Data of ETA Bootis Explained with Stellar Models Including Turbulence", 2006ApJ...636..1078S.

(SMUICA-05-112) Robinson, F.J.; Demarque, P.; Guenther, D.B.; Kim, Y.C.; Chan, K.L., "Simulating the outer layers of Procyon A: a comparison with the Sun", MNRAS - 362, 1031.

(SMUICA-05-103) Walker, G.A.H.; Kushing, R.; Matthews, J.M.; Reegen, P.;

(SMUICA-05-107) Campbell, S.W.; Fenner, Y.; Karakas, A.I.; Lattanzio, J.C.; Gibson, B.K., "Abundance Anomalies in NGC 6752 - Do AGB Stars Have a Role to Play?", 2005, Nuclear Physics A, Vol 758, pg 272.

(SMUICA-05-106) Lugaro, M.A.; Pols, O.R.; Karakas, A.I.; Tout, C.A., "HR4049: Signature of Nova Nucleosynthesis?", 2005, Nuclear Physics A, Vol 758, pg. 725.

(SMUICA-05-105) Stancliffe, R.J.; Lugaro, M.A.; Tout, C.A.; Karakas, A.I., "Nucleosynthesis on the Asymptotic Giant Branch: A comparison between codes", 2005, Nuclear Physics A, Vol. 758, pg. 569.

(SMUICA-05-104) Karakas, A.I.; Lugaro, M., "The Uncertainties in the $^{22}\text{Ne} + \alpha$ -capture reactions and Mg production in intermediate-mass AGB stars", 2005, Nuclear Physics A, Vol. 758, pg. 489.

May 14 – 16, 2005, Poster Presentations at the Annual CASCA conference held in Montreal.

1. Chiaroscuro: From Pericenter Glow to Apocenter Enhancement – Illuminating the Secular Structure of Dusty Planetary Systems by C. Capobianco and J. Hahn
2. The Long Term Evolution of Saturn's Ring-satellite System by J. Hahn
3. Low-metallicity Super-AGB Stars by A. Karakas

active galactic nuclei, and Giant HII regions. They have become an extensively studied scientific topic by many research groups all over t

David Guenther is collaborating with the Yale convection group (Pierre Demarque, Yale University, P.I.) to develop an improved model of convection for stellar modeling. Their long term goal is to replace the mixing length approximation, currently

Dr. Hahn is also working with honors student Mr. Adam Chaffey to use an N body integrator to simulate the spiral density waves that a satellite can launch in a gravitating particle disk. This work is also being done on the ICA's Beowulf cluster. This is a rather challenging task since the computer must follow the motions of a very large number of interacting particles in order to resolve any wave action. This project is also quite timely, since the Cassini spacecraft has just arrived at Saturn, and is now returning many images of the spiral density waves that Saturn's satellites are launching in that planet's rings. A long-term goal of Mr. Chaffey's project is to apply our N body simulations to these spacecraft observations in order to study these ring-satellite interactions.

Dr. Hahn is also studying the disk around the star Beta Pictoris with honors student Mr. Gary Hubertise, who is analyzing optical and infrared observations of this system. These telescopic images have been provided by Dr. Sara Heap (NASA Goddard

CONCLUDING REMARKS

The ICA is progressively gaining recognition among