CITA ICAT Canadian Institute for Theoretical Astrophysics L'institut Canadien d'astrophysique théorique

Jamboree 2016

12:45 PM — Introduction

Ue-Li Pen pen@cita.utoronto.ca	**CITA** Introduction to CITA

12:50 PM — Theoretical Astrophysics

Ue-Li Pen pen@cita.utoronto.ca	**Pulsar Scintillometry** The multi path propagation of pulsar light was once considered a chaotic, turbulent process that destroys valuable timing information. Recent progress indicates that the lensing is actually orderly, and can be used as a new precision tool to study the pulsar magnetosphere, interstellar reconnection, and gravitational waves. New windows are being opened by CHIME and ARO-VLBI.
Peter Martin pgmartin@cita.utoronto.ca	**ISM, magnetic fields, diffuse foregrounds, and star formation** I am working in the structure of the ISM and its magnetic field as revealed most recently by Planck, and the implications for a variety of things from detection of primordial B modes to star formation.
Chris Thompson thompson@cita.utoronto.ca	**Excursions in Theoretical Astrophysics** TBA
Shantanu Basu basu@uwo.ca	**Accretion Processes in Star Formation** I review some of our recent models of the accretion process in star formation, highlighting episodic accretion and long-term trends in the mean accretion rate. These yield insight into the luminosity distribution of young stellar objects, the formation of protoplanetary or protostellar clumps, and the origin of the initial mass function of stellar and substellar objects.
Daniel Tamayo d.tamayo@utoronto.ca	**Understanding the Stability of Compact Planetary Systems** The chaotic dynamics of compact planetary systems is complicated. I am working with others at CITA and the CPS to both develop numerical tools to simulate these systems in detail, and to understand and predict their evolution both analytically and using machine learning tools.

Cristobal Petrovich cpetrovi@cita.utoronto.ca	**Planetary systems beyond the main sequence and the puzzle of the white dwarf pollution** A large fraction of white dwarfs show the presence of rock-forming material in their atmospheres. This result is unexpected and has been interpreted as evidence of small rocky bodies that are being disrupted and accreted by the host star. I will show that a new mechanism, which is based on secular instabilities triggered by the engulfment of planets, is capable of explaining this puzzle.
Matt Russo mrusso@cita.utoronto.ca	**Escherian Staircases in Protoplanetary Disks** A perpetual challenge in modeling protoplanetary disks is to account for various mechanisms that couple the evolution of the gas with that of the condensed components, from dust grains to giant planets. I will describe one such causal chain which may allow even low mass planets to substantially modify the disk's structure.
Dana Simard simard@cita.utoronto.ca	**What does pulsar scintillation tell us about tiny structures in the interstellar medium?** Pulsars scintillate when light from the pulsar is scattered by the interstellar medium, resulting in interference between the many paths. This scattering is from very small ionized structures aligned on the sky, but the mechanism by which these structures are produced is still debated - I'm exploring how we can use observations of pulsar scintillation to learn more about these structures and constrain their origins.
Yevgeni Kissin kissin@cita.utoronto.ca	**Properties of remnants of massive stars** We use semi-analytic models to study the angular momentum evolution and helicity accumulation within massive stars, as they evolve from the pre-Main Sequence all the way to core-collapse. Our goal is to find the origin of rotation and magnetic properties of their remnants.
Terrence Tricco ttricco@cita.utoronto.ca	**Star Formation and SPH** I perform simulations related to star formation. I study the effects of magnetic fields, such as producing protostellar outflows, and recently I've been interested in dust in the interstellar medium. My numerical method of choice is SPH, and I am broadly interested in all types of SPH simulations.
Daniel Baker dbaker@cita.utoronto.ca	**Twinkle Twinkle Little Pulsar** The scintillation of the pulsars can be used to study the properties of pulsars and their orbits. We explore how techniques from the CMB can be used applied to this problem.

Robert Main ramain@cita.utoronto.ca	**Mapping pulsar emission regions using the methods of scintillometry** Radio emission radiation is scattered in the interstellar medium, resulting in multiple interfering images. This resulting interference pattern is sensitive to incredibly small physical scales, and I am using observations of this to try to map pulsar emission regions.

1:30 PM — Cosmology

J. Richard Bond bond@cita.utoronto.ca	**TBA** TBA
Marcelo Alvarez malvarez@cita.utoronto.ca	**TBA** TBA
Philippe Berger pberger@cita.utoronto.ca	**Understanding 21 cm survey systematics with end-to-end simulations** Existing and future 21 cm surveys, such as the CHIME telescope and its Pathfinder, will produce tomographic maps of cosmic neutral hydrogen. Achieving this goal, however, will require precise knowledge of the instrument, to unprecedented accuracy. To understand whether and how these stringent requirements have been met, we are developing an accurate simulation pipeline allowing the testing of the effects of survey systematics on the observables, which we present here.
George Stein george.f.stein@gmail.com	**A Multi-Tracer View of Large Scale Structure** We use a simulation technique developed at CITA to investigate the large scale structure of our universe. Our current focuses are on detecting primordial non-Gaussianity from inflation, studying CMB secondaries and LSS probes, and forecasting for a variety of future surveys.
Joel Meyers jmeyers@cita.utoronto.ca	**Light Relics and Next Generation CMB Observations** Ongoing and future CMB observations will allow for fundamentally new insights into physics beyond the standard model and the very early universe. I will discuss theoretical targets for CMB constraints on light relics and the path toward reaching those goals.

Niels Oppermann niels@cita.utoronto.ca	**Statistics in 21 cm cosmology** The novel field of 21 cm intensity mapping aims to map out the large-scale structure of the Universe through the redshifted hyperfine emission of neutral hydrogen. To use these intensity maps for precision cosmology, a number of obscuring and distorting effects have to be overcome. I will discuss some of these effects, our attempts of understanding and/or removing them using statistics, and point out that they hold valuable information themselves in some cases.
Sandrine Codis codis@cita.utoronto.ca	**On the large-scale structure of dark matter and galaxies** I am interested in the large-scale structure of the Universe and its role in cosmology and galaxy formation. I will quickly describe some of my recent works on a) perturbation theory b) the geometry and topology of the cosmic web and c) intrinsic alignments of galaxies.
Daan Meerburg meerburg@cita.utoronto.ca	**The future of early Universe Cosmology** My research aims to utilize CMB and LSS measurements to constrain the early Universe. I will briefly explain some interesting new avenues that I am planning to pursue in the new future in the search for primordial non-Gaussinaty and primordial gravitational waves.
Derek Inman inmand@cita.utoronto.ca	**Neutrino Effects in Large Scale Structure** I study new dynamics induced by the presence of neutrinos in large scale structure. One example of this is the relative velocity effect, a bulk motion between the cold dark matter and neutrinos, that could help determine neutrino mass, hierarchy and chirality.
Haoran Yu haoran@cita.utoronto.ca	**Cosmic matter displacement fields and BAO reconstruction** In this simulation, I trace the matter motion and use the differential motion of this displacement field to reconstruct a initial stage of the matter distribution. This demonstrates the ability of a BAO reconstruction from a observation-estimated displacement field.
Simon Foreman sfore@stanford.edu	**Cosmological perturbation theory** I will provide a glimpse of how techniques from particle physics have been imported to the study of perturbations to the cosmological matter distribution, and how this has opened the door to a more precise understanding of the statistics of large-scale structure.

Xin Wang xwang@cita.utoronto.ca	**On the Statistical Equivalence of Large-scale Structure** For given kinetic equation of relevant "modes", there could exist more than one dynamical systems that produce the exact same statistics. I'll start from this concept and explore the statistical POV of the effective large-scale structure theory.
I-Sheng Yang isheng.yang@gmail.com	**Inflation on a Slippery Slope** I'll explain the recent progress and difficulty of inflation on a random-multifield landscape.
Alexander van Engelen engelen@cita.utoronto.ca	**14 Billion Years in the Life of a CMB Photon** The cosmic microwave background is encoded with a wealth of information about the evolution of the Universe through its entire history. In ths talk I will condense 13 billion years of this evolution into a three minutes, highlighting the areas where I have focussed my research.

2:15 PM — General Relativity

Harald Pfeiffer pfeiffer@cita.utoronto.ca	**Gravitational Waves** I give an overview of the activities at CITA related to gravitational waves. These activities fall into two categories: gravitational-wave astronomy via involvement in LIGO, and the modelling of gravitational-wave sources using numerical relativity.
Aaron Zimmerman azimmer@cita.utoronto.ca	**Black holes, alone and in pairs** I study the perturbations of black holes, especially their resonant modes of gravitational wave emission. I also develop new methods to compare analytic approximations and numerical simulations of binary black holes.
Darsh Kodwani dkodwani@physics.utoronto.ca	**Neutrinos, Pulsars and Black holes** The effect of neutrino shells on pulsars and interferometers. The unitary(?) evolution of Hawking quanta in the vicinity of a black hole.
Carl-Johan Haster cjhaster@star.sr.bham.ac.uk	**Looking for binaries with a ROQ** Parameter estimation studies of compact binary gravitational wave events are heavily limited in their flexibility and usefulness by computational cost. Using ROQ (Reduced Order Quadrature) methods it is however possible to bring this cost down by several orders of magnitude, while not sacrificing any accuracy, therefore enabling parameter estimation studies at a completely new level.

Prayush Kumar prkumar@cita.utoronto.ca	**Detecting gravitational waves with LIGO: role of Numerical Relativity** The recent detection of gravitational waves by Advanced LIGO has ushered us into an era where observations will lead discovery. Detecting binary black hole mergers with LIGO requires precise prior knowledge of waveforms, as predicted by General Relativity. In this talk, I will discuss how Numerical Relativity comes to our rescue!
Katerina Chatziioannou k.chatziioannou@montana.edu	**Spin-precessing gravitational wave sources** Spin-precession introduces additional structure to the gravitational waves emitted by compact binaries. I will describe this effect, our efforts to model it, as well as allude to its astrophysical significance.

2:35 PM — Others

Marcelo Ponce mponce@scinet.utoronto.ca	**SciNet: Advanced Research Computing at the University of Toronto** SciNet is the supercomputer center at the University of Toronto. We help power work from the biomedical sciences and aerospace engineering to astrophysics and climate science, by enabling research running massive parallel computing simulations, data analysis and intensive computations on our systems. In addition to that, SciNet teaches several courses and offers unique training opportunities through its certificate programs on Scientific Computing, High-Performance Computing and Data Science.