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

Jamboree 2017

12:15 PM — Introduction

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

12:25 PM — Theoretical Astrophysics

Ue-Li Pen pen@cita.utoronto.ca	**Fast Radio Bursts** I'll speculate on the FRB's, and describe upcoming experiments including CHIME-FRB.
Chris Thompson thompson@cita.utoronto.ca	**High Energy Astrophysics** Recent and current research includes i) a mechanism connecting the cosmic dark matter to fast radio bursts, one which makes interesting predictions at higher (CMB) frequencies and makes direct connections with Type Ia SNe and high-energy cosmic rays; ii) the physics of magnetars; and iii) the rotation and magnetism of evolved stars.
Peter Martin pgmartin@cita.utoronto.ca	**The ISM beyond 2D** To understand the physical processes at work in the ISM we need insight into and from the structure of the ISM in 6D and a multi-frequency perspective. While daunting, there are encouraging prospects for progress over the next decade.
Norman Murray murray@cita.utoronto.ca	**Galaxy and Star Formation** I and my group work on a number of topics, including planetary dynamics, planet atmospheres, star formation, galaxy formation, and intensity mapping. I will describe two recent results, one related to star formation (the dissipation rate in GMCs) and on showing why the FIRE simulations show such bursty star formation.

Shenglin Jing jing@astro.utoronto.ca	**Magnetized Disk Wind** My work attempts to construct steady state, self-consistent ideal MHD wind models. We hope to shed light on several core issues: (i) How cold gas can be sufficiently rapidly channelled through a quasar disk at large distance from the central supermassive black hole? (ii) Can the underlying disk maintain marginal Toomre stability near the radius of influence? (iii) What is the required magnetic field configuration and the driving mechanism of the outflow?
Terrence Tricco ttricco@cita.utoronto.ca	**Star Formation and Star Destruction** I use hydrodynamical simulations to study magnetic fields and dust in molecular cloud turbulence, protostar formation and, most recently, the merging process of white dwarfs. My numerical method of choice is smoothed particle hydrodynamics (SPH), and I am broadly interested in all types of SPH simulations.
Almog Yalinewich almog.yalin@gmail.com	**The spectacular afterlife of stars** I will give a brief overview of my research on astrophysical phenomena where stars are destroyed. I will mainly focus on the methods I use to explore this field.
Sasha Kostenko kostenko@astro.utoronto.ca	**Explaining persistent x-ray emission from the Universe's most powerful magnets** I derive the cross sections of fundamental QED processes in powerful magnetic backgrounds and use them to simulate the physics in magnetar magnetospheres, with the goal of explaining/reproducing the electromagnetic spectrum of these objects in a self-consistent and intuitive way.
Laura Keating lkeating@cita.utoronto.ca	**The IGM as seen by quasar absorption lines** Quasar absorption lines are a powerful tool for studying the intergalactic medium, providing insight into the ionization state, metallicity and temperature of the gas. I will discuss my work using cosmological simulations to interpret these different probes and to learn about the high-redshift IGM.
Rachael Alexandroff rachael.alexandroff@dunlap.utoronto.ca	**Studying quasar structure & feedback physics through the use of multi-wavelength data** Quasar feedback is a necessary ingredient in galaxy evolution models and yet we have few quantitative measures of the physical parameters that govern this process. My research focuses on understanding the structure and feedback physics of luminous radio-quiet quasars using a variety of multi-wavelength data.

Cristobal Petrovich cpetrovi@cita.utoronto.ca	**Dynamics of planets, stars and black holes** I work on various aspects of gravitational dynamics from planetary systems to black holes in the galactic center. I attempt to connect the observables from collisional dynamics such as transients (gravitational and/or electromagnetic) and tidally-driven populations (e.g., hot Jupiters) with astrophysical environments and planetary/stellar populations. I will show a few recent examples.
Daniel Tamayo tamayo.daniel@gmail.com	**A million-fold speedup in the dynamical characterization of exoplanet systems** The requirement that newly discovered multiplanet systems be dynamically stable imposes important constraints on their masses and orbital configurations. However, the rate of discoveries is so high that we only have the person and computational power to characterize a small fraction of systems through direct N-body integrations. We have recently succeeded in training reliable machine learning models that can perform this task a million times faster than traditional N-body methods, and should help maximize the science extracted from current and future exoplanet missions.
Alysa Obertas obertas@astro.utoronto.ca	**Dynamics of tightly-packed systems of planets** I study the dynamics of multi-planet systems, examining their stability and the effects of resonances. I will be applying this work towards understanding the architecture of observed Kepler systems and systems that will be discovered by upcoming surveys.
Wei Zhu weizhu@cita.utoronto.ca	**Gravitational microlensing, exoplanets, and so on** I worked on gravitational microlensing and microlensing parallax for my thesis. I also did some other exoplanet-related projects. Now I'm interested in dynamics and other theoretical ideas.
Charles Zhu (presenting: Robert Main) cczhu@astro.utoronto.ca	**Computers and Compact Objects** I summarize my graduate work on magnetohydrodynamic simulations of merging white dwarf binaries, and overview my current project of developing Python packages for reducing radio baseband data from pulsars.
Robert Main main@astro.utoronto.ca	**Putting pulsars under cosmic microscopes** Radio emission from pulsars is scattered and lensed by cold plasma, and the properties of this scattering are incredibly sensitive to small scales at the pulsar. I am using this effect to try to put physical constraints, and eventually map pulsar emission regions.

Dana Simard simard@cita.utoronto.ca	**What causes pulsar scintillation?** Some pulsars show evidence of highly anisotropic scattering in the interstellar medium, but the origin of this scattering isn't yet understood. How can we learn more about this scattering and the structures in the interstellar medium that lead to it?
Dongzi Li dzli@cita.utoronto.ca	**From birefringence to small scale magnetic field** The presence of magnetic field can induce birefringence in the scattered pulsar light. I study the birefringence for evidence of magnetic domain boundaries and to constrain magnetic strength in a binary pulsar system.

1:40 PM — Cosmology

J. Richard Bond bond@cita.utoronto.ca	**CITA = Cosmic Information Theory and Analysis** We are in quest of Beyond the Standard Model of Cosmology, BSMc, with Planck, Spider, Advanced ACTpol, CCATp, the Simons Observatory, CMB Stage 4, CHIME, COMAP, EUCLID, and other experiments we are involved in analyzing and mocking, ranging from ultra-early Universe, through CMB, LSS, ultra-late Universe, even the ISM of Galaxy foregrounds aka the cosmic web theory in all its manifestations. Entropy is ubiquitous, tying the regimes together. Stacking constrained fields to estimate novel asymmetric correlation functions probing importance-sampled (super)clustering also looms large.
Philippe Berger pberger@cita.utoronto.ca	**21 cm intensity mapping with CHIME** I will discuss efforts to detect the redshifted 21 cm line with the CHIME telescope.
George Stein george.f.stein@gmail.com	**Extragalactic Mocks** Efficient extragalactic simulations are required for a large number of problems in cosmology. I will discuss our CITA led effort to develop mocks for next generation future surveys such as Euclid, COMAP, and SO.
Jason Leung leung@astro.utoronto.ca	**Inflation, Axions, and Modified Gravity** I will provide a snapshot of my research interests in cosmology.
Joel Meyers jmeyers@cita.utoronto.ca	**Particle Physics with the CMB** I will discuss the key scientific targets of the next generation of CMB experiments. The constraints provided by these experiments will be deeply interesting for cosmologists and particle physicists alike.

Alex van Engelen engelen@cita.utoronto.ca	**Imprints on the CMB from low redshift** The "last scattering surface" of the CMB is a misnomer: along their journey from this surface to our telescopes, CMB photons undergo many interactions that impart significant information about the structure and evolution of the Universe. I will discuss how we can use observed maps of the CMB to isolate these effects and thereby extract as much information as possible.
Jamil Shariff jshariff@cita.utoronto.ca	**Experimental Astrophysics from the Stratosphere: From Cosmology to the ISM** In this talk I will detail my past work developing balloon-borne and ground-based instrumentation for Antarctic CMB and submillimetre astronomy. I will also talk about my current work analyzing large CMB data sets, and probing the physics of dust polarization in the ISM.
Simon Foreman sforeman@cita.utoronto.ca	**Predictions for cosmological observables** I will briefly review my interests in developing analytical techniques for characterizing cosmological observables that will be measured by ongoing and future surveys.
Xin Wang wangxin.cita@gmail.com	**The reconstruction era of large-scale structure** I will show how reconstruction will help us to recover the linear baryonic acoustic oscillations and therefore improve the dark energy measurement, and will try to provide a glimpse of how this method could change the way we do both theory and observation.
Patrick Breysse pcbreysse@gmail.com	**High-redshift physics using every photon** In the next several years, a number of line intensity mapping experiments will enable the study of the distant universe in unprecedented depth. I will briefly overview some of the work I have done creating a theoretical foundation for these experiments with the goal of extracting the most physics from every detected photon.

2:25 PM — General 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.
Carl-Johan Haster haster@cita.utoronto.ca	**What can Black Hole observations tell us?** I will tell you what black hole observations can tell us!

I-Sheng Yang isheng.yang@gmail.com	**Gravitational Rotation of Polarization** Starting from a practical observational setup, we demonstrate a gauge-independent, observer-dependent rotation of polarization from General Relativity.
Jim Mertens mertens@yorku.ca	**Computing Cosmological Observables from General Relativistic Simulations** Accurately interpreting cosmological observations requires quantifying the impact of any approximations used by models. Simplified treatments of gravity are common, however the resulting impacts are not well-understood. To this end, I will describe recent efforts to model our Universe in a fully general relativistic setting.