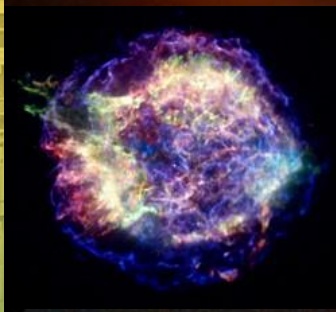
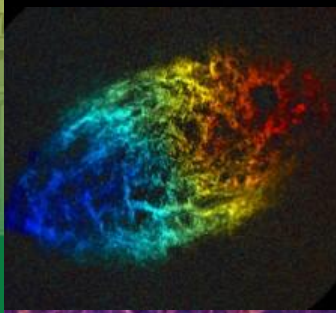
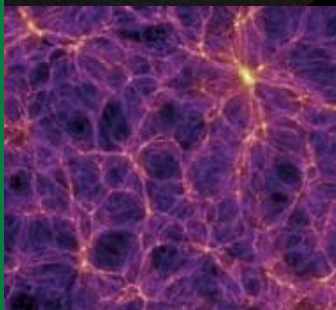
ASTROPHYSICS & GRAVITY







UALBERTA
PHYSICS

From the births of stars ...
through their deaths and beyond ...
to the edge of the Universe

The astrophysics faculty explore questions such as:

- How did the universe form?
- How did structures form in the early universe?
- How do clouds of gas form stars and planets?
- What happens when stars collide & merge?
- How do stars explode as supernovae?
- How do black holes accrete gas and create relativistic jets?
- What are neutron stars made out of?
- What happens inside of black holes?

Rodrigo Fernández, Professor
Supernovae and Neutron Star Mergers

Fernández and his group study neutron star mergers, supernovae, and other transient systems. These events are the formation sites of black holes, neutron stars, and of most elements heavier than helium. The complexity of these phenomena requires the use of numerical simulations on large supercomputers to make reliable predictions that can be tested with observations.

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Valeri Frolov, Professor
Black Holes

Classical and quantum gravity; Black hole physics; Large extra dimensions; Hidden symmetries and higher dimensional black holes; Problem of black hole entropy; Models of a black hole's interior; Quantum field theory in a curved spacetime; Quantum effects in accelerated frames; Cosmological defects; Interaction of strings and branes with a black hole; Wormholes and time machine problem.

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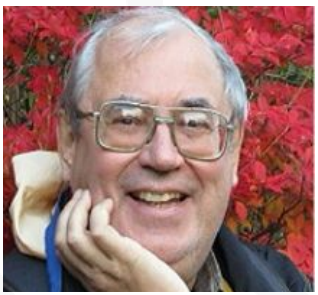

Craig Heinke, Professor
High-Energy Astrophysics

Heinke's research group uses a range of X-ray and other telescopes to study high-energy astrophysical systems, especially compact objects (the dense remnants of dead stars; white dwarfs, neutron stars, and black holes). Key questions include how compact objects accrete matter from companion stars, the composition and cooling of neutron stars, and how interactions in dense star clusters affect binary stars.

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Natalia Ivanova, Professor
Evolution of Binary Stars

Ivanova and her group are working on understanding the physics of stable and unstable stellar interactions -- from violent mergers to stable mass transfer -- and their effects on the lives of close binary stars, using supercomputers to model these interactions, and the behavior of stellar populations. Ivanova is looking for new students with interests in theoretical and computational astrophysics, high-performance computing and data analysis.

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Sharon Morsink, Professor
Neutron Stars and Relativity

Dr. Morsink and her group study neutron stars, the highest density objects in the universe, using the effects of special and general relativity. Using analytical and numerical calculations, they identify how relativistic effects change the appearance of light (especially X-rays) from fast-spinning, dense neutron stars, and how we can use this to understand the behavior of matter at extreme densities in the cores of neutron stars.

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Don Page, Professor
Black Holes and Cosmology

Page's research group works at the confluence of general relativity and quantum mechanics, applying both to understand black holes and the origin and nature of the universe. Current questions include the evaporation of black holes, whether information is destroyed when it falls into a black hole, and whether the universe is one realization of a "multiverse".

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Dmitri Pogosyan, Professor
Evolution and Structure of the Universe

Pogosyan's research interests span the range from the theory of the early Universe, to theory and analysis of initial perturbations to the Cosmic Microwave Background, to the modeling of the observed large-scale structure at low and high redshifts, to the statistical study of the galactic turbulence.

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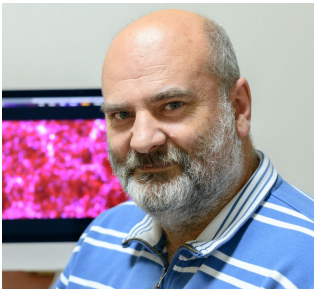
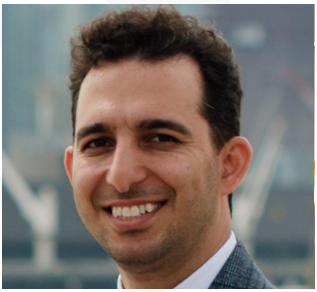


Saeed Rastgoo, Assistant Professor
Quantum Gravity, Black Holes, Gravitational Waves



Rastgoo's research group studies classical and quantum gravity, including the study of the interior and exterior of quantum black holes, the fundamental and fine structure of spacetime, and the very early and quantum cosmology. They also use phenomenological approaches to connect quantum gravity theory with modern experiments, including the use of multimessengers, particularly gravitational waves, to probe new and fundamental physics of black holes, spacetime, and cosmology.

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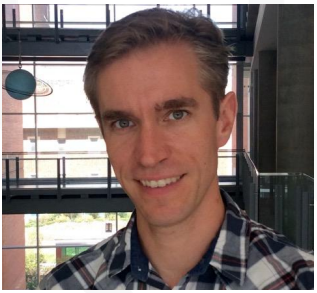

Erik Rosolowsky, Professor
Star Formation

Rosolowsky's research group uses multi-wavelength observations of star formation and the interstellar medium to study the connections between stellar generations. In this work, they use surveys of nearby galaxies from facilities like the Atacama Large Millimetre/submillimetre Array and the Hubble Space Telescope. Dr. Rosolowsky is recruiting new students with interests in observational astronomy, machine learning and big data analysis to tackle some of the pressing questions in galaxy evolution.

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Gregory Sivakoff, Professor
Relativistic Jets and Accretion

Sivakoff's research group studies the stellar undead (white dwarfs, neutron stars, and stellar-mass black holes that return to life by eating a nearby star) and supermassive black holes. Using observations across the electromagnetic spectrum, they are learning how these objects produce highly-focused very-fast outflows (relativistic jets) and how jets affect their environment

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UALBERTA PHYSICS

ASTROPHYSICS & GRAVITY

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