

DISCOVER

**PHYSICS**

GRADUATE

STUDIES

THE SCIENCE OF NATURE

# PHYSICS

**PHYSICS IS THE SCIENCE OF DISCOVERY.** Graduate students at the University of Alberta have the opportunity to work on groundbreaking research and experiments with internationally recognized professors.

**THE DEPARTMENT OF PHYSICS** is a large, comprehensive department with research programs in all major areas of physics, including computational, experimental and theoretical research.

Near the IceCube Neutrino Research Facility in Antarctica (the largest neutrino observatory in the world). Photo courtesy of Particle Physics PhD student, **TANIA WOOD/NSF**.

## KNOWLEDGE AND SKILLS

The knowledge and problem-solving skills acquired through a graduate program in physics can form the basis of a career in industry, academia, government research and defence agencies. A **POST-GRADUATE DEGREE IN PHYSICS** can prepare you for a career in these areas:

- Biosensing
- Data Science
- Design and Use of Semiconductors
- Environmental Sensing
- Financial Modelling
- Imaging Technology
- Information Technology
- Instrumentation
- Intellectual Property Law
- Medical Physics
- Microelectronics
- Microscopy
- Nanotechnology
- Non-Destructive Testing
- Oil and Gas
- Optics and Photonics
- Physics Education and Science Outreach
- Space Sciences
- Supercomputing
- Surface and Material Sciences

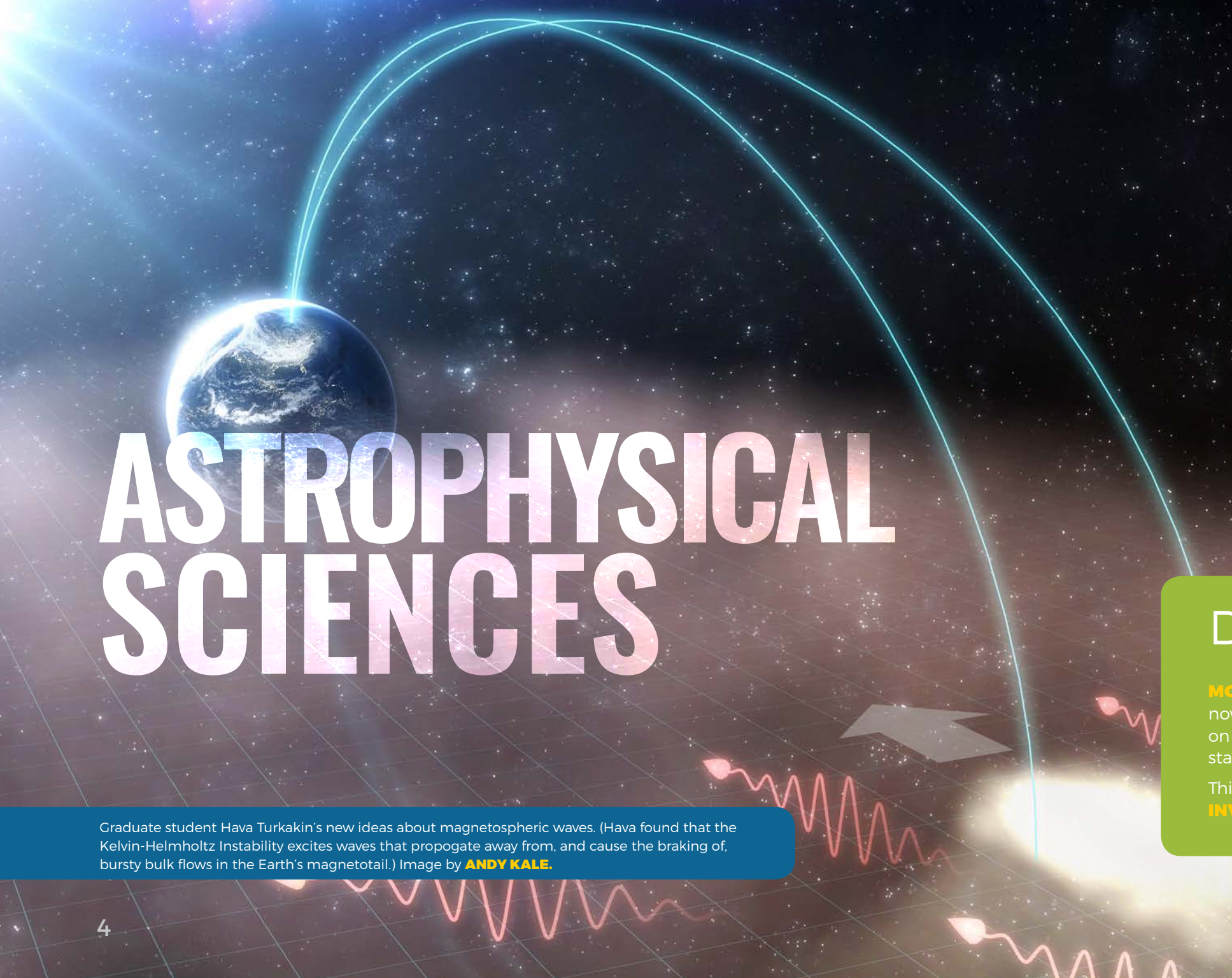
## FACILITIES

**THE DEPARTMENT OF PHYSICS** is home to labs that are well-equipped for general or specialized fields of physics research including the following:

- Nanotechnology
- Particle Physics
- Ultra Low-temperature Physics
- Rock Physics
- Biophysics
- Condensed Matter Physics
- Paleomagnetism
- Space Physics

## DID YOU KNOW?

**THE UNIVERSITY OF ALBERTA** is the first Canadian institution in the IceCube collaboration and a founding member of SNOLAB and the TRIUMF accelerator research facility.



# ASTROPHYSICAL SCIENCES

Graduate student Hava Turkakin's new ideas about magnetospheric waves. (Hava found that the Kelvin-Helmholtz Instability excites waves that propagate away from, and cause the braking of, bursty bulk flows in the Earth's magnetotail.) Image by **ANDY KALE**.

## EXPLORE THE PHYSICS AND PROPERTIES OF STARS, GALAXIES, AND THE UNIVERSE.

Astronomy and astrophysics focus on the evolution of stellar systems, the properties and physics of astrophysical objects such as neutron stars, black holes and quasars, and the structure of the universe.

Our researchers have access to the most powerful telescopes in the world and advanced computing facilities at the University of Alberta.

## RESEARCH AREAS

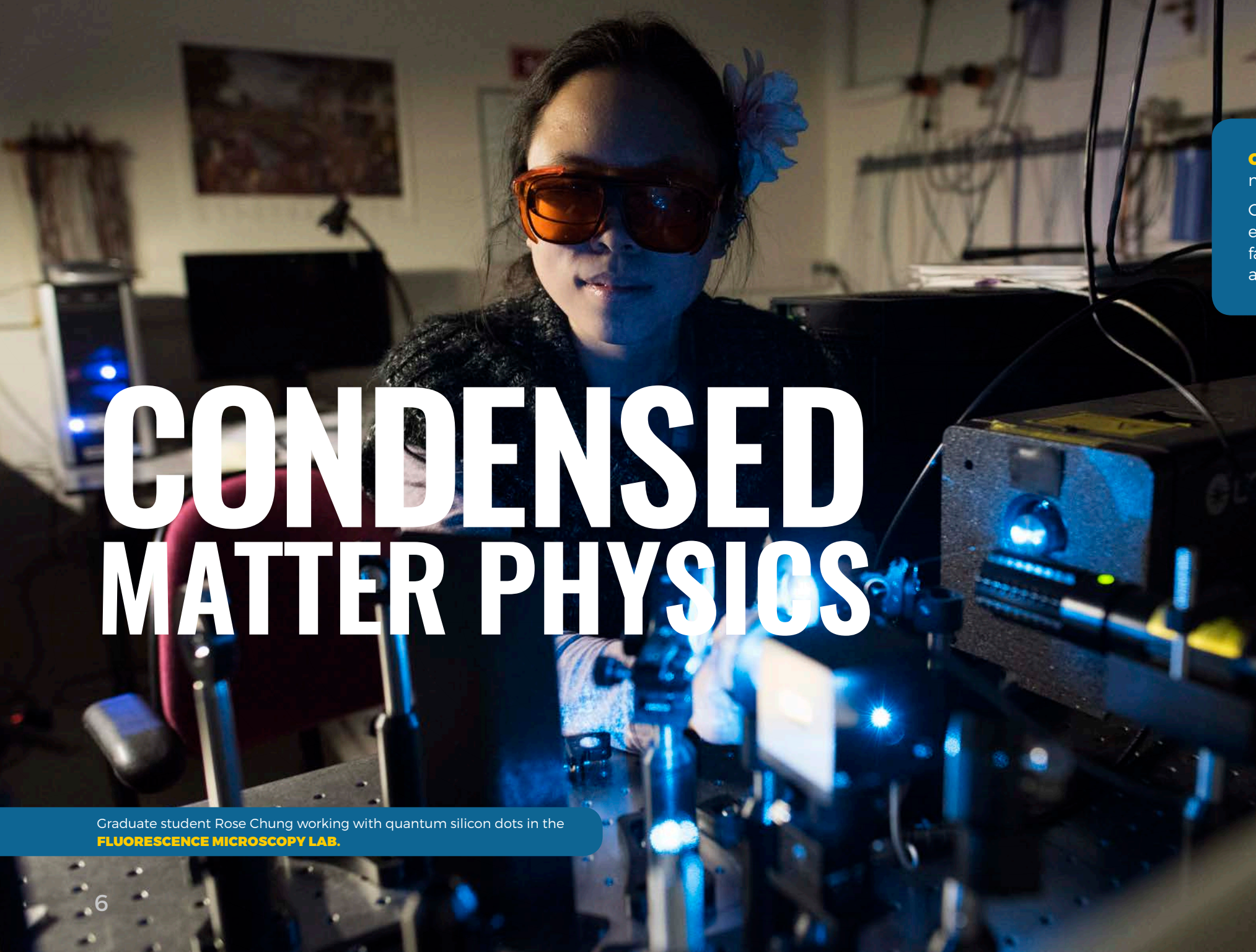
- Astronomy and Astrophysics
- Cosmology and Gravity Physics
- Plasma Physics
- Space Physics

## DID YOU KNOW?

**MOST OF THE ATOMS** that make up your body were forged inside now-dead stars. Atoms like carbon, oxygen, and nitrogen are essential to life on Earth. Every one of these atoms was built up out of lighter atoms to make starlight. How did those atoms end up here?

This is one of the questions that **OUR ASTROPHYSICS RESEARCHERS ARE INVESTIGATING.**





# CONDENSED MATTER PHYSICS

Graduate student Rose Chung working with quantum silicon dots in the **FLUORESCENCE MICROSCOPY LAB.**

**CONDENSED MATTER PHYSICS** seeks to understand the properties of matter and the physical laws that govern their behaviour.

CMP researchers at **THE UNIVERSITY OF ALBERTA** have built cutting-edge labs and have access to highly advanced tools and nanotechnology fabrication facilities at the National Institute for Nanotechnology (NINT), a federal facility that is also located on campus.

## RESEARCH AREAS

- Superconductivity
- Semiconductor Physics
- Superfluids and Supersolids
- Low-Temperature Physics
- Nanomagnetism
- Surface Science Molecular Electronics
- Quantum Information
- Nanomechanics
- Tunneling Phenomena
- Nanoscale Properties of Solids
- Terahertz Spectroscopy
- Ultrafast Phenomena
- Photonics
- Quantum Dots
- Protein Folding
- DNA Mechanics
- Prion Diseases



# GEOPHYSICAL SCIENCES

PhD student Matthew Comeau in Bolivia, part of the **PLUTONS** project using magnetotelluric data to image the magma system beneath Volcan Uturuncu. Photo courtesy of **MARTYN UNSWORTH**, Geophysics Professor.

**THE GOAL OF RESEARCH** in this area is to advance understanding of Earth's structure and evolution through the application of physical principles.

Activities include experimental, theoretical, computational, and field studies applied to fundamental research, and to the economic development and environmental protection of our planet.

## RESEARCH AREAS

- Geophysical Data Processing
- Theoretical and Applied Seismology
- Earthquake Studies
- Geodynamics
- Geomagnetism and Paleomagnetism
- Magnetotellurics
- Environmental Geophysics
- Geothermal Energy
- Climatology
- Planetary Geophysics

## AREAS OF EMPLOYMENT

- Energy and Natural Resources Industry
- Geophysical Research
- Exploration
- Environment





# PARTICLE PHYSICS

PhD candidate Tania Wood near the IceCube Neutrino Research Facility in Antarctica. Tania is a member of the IceCube Collaboration and is investigating high-energy neutrinos that originate outside of the solar system. Photo courtesy of [M. KAUER/NSF](#).

**PARTICLE PHYSICS** is the study of the fundamental constituents of matter and their interactions. Through theory and experimentation, this field studies physics at the smallest scale possible, more than 100 million times smaller than an atom.

**PARTICLE PHYSICS GRADUATE STUDENTS** have participated in national and international collaborations by co-authoring papers and travelling to CERN (Switzerland), SNOLAB (Sudbury), and IceCube (Antarctica) to conduct experiments.

## RESEARCH AREAS

### EXPERIMENTAL PARTICLE PHYSICS AND PARTICLE ASTROPHYSICS

- Dark Matter searches
- Neutrino Physics
- Higgs Physics
- Black Hole Physics at the Large Hadron Collider
- Magnetic Monopole Searches

### THEORETICAL PHYSICS

- Precision Models for the Next Generation of Experiments
- Searching for New Physics

## DID YOU KNOW?

**NOTHING, NOT EVEN LIGHT**, can escape the gravitational attraction of a black hole.

However, due to quantum mechanics, microscopic black holes will emit large amounts of radiation until they no longer exist. Such an effect is the key for searching for them in particle physics experiments.

# DISCOVER PHYSICS

We offer a wide range of financial support in the form of scholarships, awards, teaching assistantships, and other funding.

For more information, visit: [uab.ca/PGAwards](http://uab.ca/PGAwards)

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