

# ASTRONOMY AND ASTROPHYSICS

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## Astronomy and Astrophysics Facilities

Astronomy is conducted as a research program in the Department of Physics, Engineering Physics and Astronomy. Staff and student offices together with laboratory space are located on the third floor of Stirling Hall. Most of the radio observational data continues to be obtained with the Very Large Array (VLA) operated by the National Radio Astronomy Observatory near to Socorro, New Mexico, the James Clerk Maxwell Telescope in Hawaii, the Five Colleges Radio Astronomy Observatory at Amherst Massachusetts, the MERLIN array at Jodrell Bank, University of Manchester UK, and the Parkes Radio Facility in Australia. The Nobeyama facilities in Japan have also been used. Optical observations are carried out at the Canada-France-Hawaii Telescope (CFHT) in Hawaii, at the Cerro Tololo Interamerican Observatory (Chile), and at various other multi-national facilities including the Hubble Space Telescope. Infra-Red observations to date have been carried out at the CFHT. Numerous programs for reducing data are available, including the Astronomical Image Processing System (AIPS), and the Image Reduction Astronomical Facility (IRAF). Members of the Group can readily access data from the Canadian Astronomical Data Centre (CADC), the NASA National Space Science Data Center, and from other world-wide data centres, using INTERNET.

A large fraction of the activity of the Group lies in the domain of Theoretical Astrophysics, Physical Cosmology, and General Relativity. Theoretical simulations and analysis are well supported by a locally and internationally networked system of Sun, HP, Silicon Graphics, MIPS, and DEC workstations, together with the necessary peripheral equipment. There is also an extensive algebraic computation facility.

The headquarters of the Sudbury Neutrino Observatory (SNO) is located in the Queen's Physics Department, which encourages collaborative theoretical and observational work with this new world-class facility. The Group also has substantial links with the Canadian Institute of Theoretical Astrophysics (CITA) in Toronto. In addition, various arrangements allow access to both Canadian and American super-computing facilities.

## Fields of Research

- Formation and dynamical evolution of the Solar System.
- Non-linear dynamical systems, chaos and astrophysics, self-similarity and hierarchical structures.
- The interstellar medium and star formation.

- Observation studies and dynamical simulations of star clusters; star clusters in external galaxies separate class.
- High energy astrophysics, stellar structure and evolution.
- Theoretical and observational studies of pulsars, galactic x-ray sources, neutron stars and black-holes.
- The interstellar medium in external galaxies, and active galactic nuclei.
- Radio Astronomy: theoretical and observational studies of radio galaxies and extragalactic x-ray sources.
- Galaxy formation, structure, and evolution; galaxy mergers.
- Physical Cosmology: theoretical simulations and observations of large scale structures in the Universe; Extragalactic distance scale.
- The early Universe: formation of large structure, dark matter.
- Mathematical General Relativity: gravitational collapse, singularity structure, cosmic censorship, exact solutions, quantum theory on curved spacetime.

## Courses and Programs of Study

Details of course offerings are given under the Department of Physics, Engineering Physics and Astronomy (<https://www.queensu.ca/sgs/graduate-calendar/courses-instruction/physics-engineering-physics-and-astronomy-courses/>). In particular the following course offerings should be noted: PHYS 811, PHYS 813, PHYS 814, PHYS 815, PHYS 816, PHYS 823, PHYS 832, PHYS 840 to PHYS 848, PHYS 861, PHYS 913, PHYS 914, and PHYS 926.