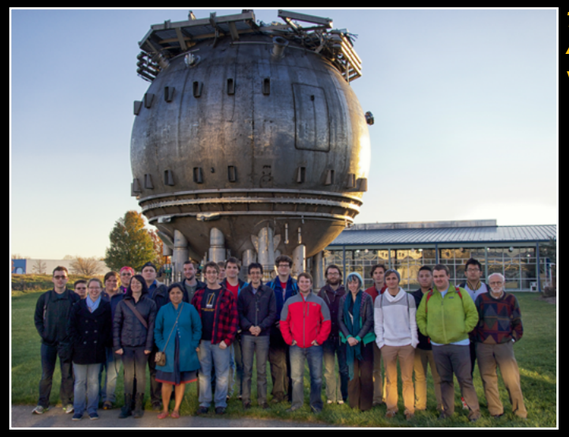
Undergraduate and Graduate Programs

The UWM Center for Gravitation, Cosmology and Astrophysics provides exceptional opportunities for students interested in the physics of the universe. Students enjoy working in a dynamic and friendly environment which promotes the growth of young scientists to become the leaders of the future. Students are integral to the life of the Center and are encouraged to begin research projects as early in their course of study as possible. While graduate students typically work with one advisor, opportunities always exist to undertake research projects with other CGCA members. By taking advantage of these opportunities, students can broaden their expertise and advance their future careers. Undergraduates also participate in research with individual faculty members and via the UWM Astronomy Club.

UWM grad student in the LIGO Livingston control room



The UWM Astronomy Club visits Fermilab

Contact Us:

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Milwaukee, WI 53211

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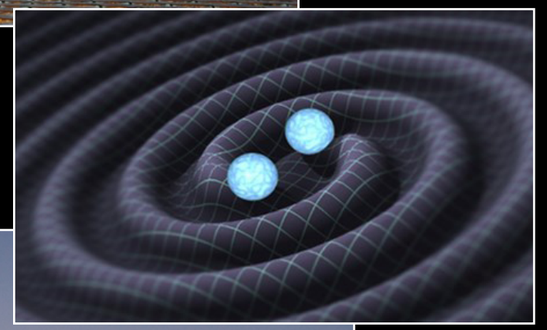
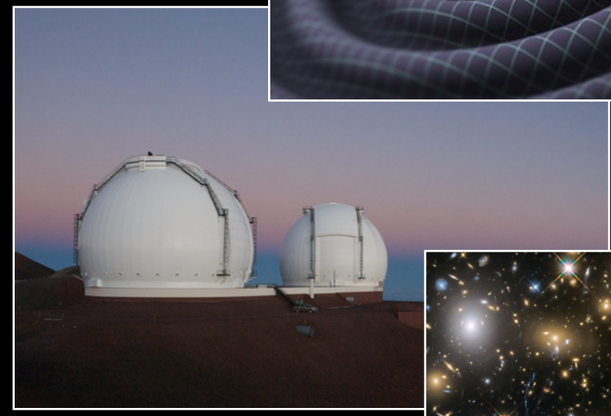
Image from a simulation of the merging binary black holes detected by the Laser Interferometer Gravitational-wave Observatory (LIGO) in September 2015. Image Credit: SXS, the Simulating eXtreme Space-times (SXS) project (http://www.black-holes.org)

CGCA faculty work on state-of-the art facilties such as the Murchison Widefield Array radio telescope in western Australia (above). UWM undergraduates (left) traveled to Australia to work on the telescope in summer 2016.

UNIVERSITY OF WISCONSIN MILWAUKEE

Center for Gravitation, Cosmology and Astrophysics





The Leonard E. Parker
Center for Gravitation, Cosmology & Astrophysics
at the University of Wisconsin-Milwaukee

UNIVERSITY of WISCONSIN
UWMILWAUKEE

http://www.cgca.uwm.edu/

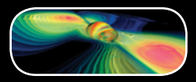
The Leonard E. Parker Center for Gravitation, Cosmology and Astrophysics

At the Center for Gravitation, Cosmology and Astrophysics, more than thirty researchers including seven faculty members, four senior scientists, and about ten postdoctoral researchers and ten students push the frontiers of astrophysics through the novel use of observation, theory, and computation. Research at the Center addresses a broad variety of problems in the physics and astrophysics of the universe, using the world's premier radio, optical, x-ray, and gravitational-wave observatories.

UWM's LIGO team

UWM astronomy students and researchers in front of the CGCA's new home in the Kenwood Interdisciplinary Research Complex (right), and presenting astrophysics to the public at a Milwaukee coffeehouse (below).

Theoretical & Computational Astrophysics



CGCA researchers use cutting-edge theoretical and computational modeling to study the physics of neutron stars, white dwarfs, black holes, supernova explosions, cosmic rays, and other exciting areas of astrophysics. CGCA scientists are interested in how these violent phenomena produce gravitational and electromagnetic radiation that may be detected by earth- and space-based observatories, and in how they may affect the larger universe around them.

Observational Astrophysics

Research in observational astrophysics at the CGCA spans the electromagnetic spectrum from radio waves to x-rays. Using sensitive x-ray, ultraviolet, optical and infrared telescopes, we measure fundamental parameters of neutron stars and white dwarfs. By constraining their masses, radii, and magnetic fields, we can understand how they formed and how they will evolve. In addition, we are involved in the development of the next generation of radio observatories, which will probe the radio sky at new wavelengths, sensitivities and timescales and connect it to observations at other wavelengths and with other particles.

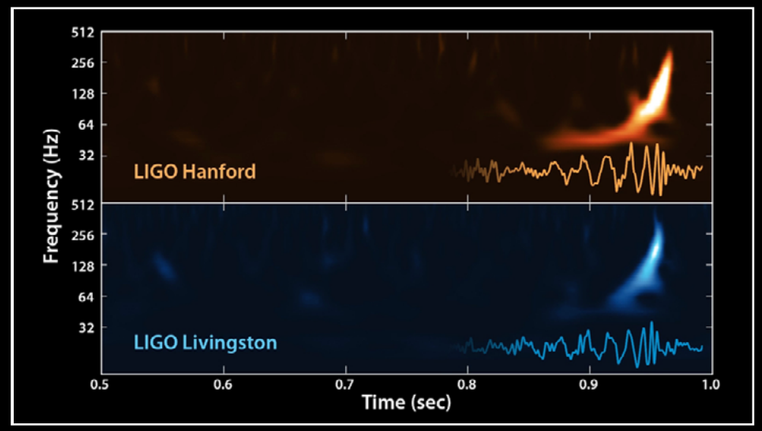
We also study the evolution of galaxies during the peak epoch of star formation in the universe. Through sensitive multiwavelength imaging and spectroscopy, CGCA scientists constrain the properties of these galaxies and their interactions with the intergalactic medium.

Pulsar Searching & NANOGrav

A team of CGCA researchers, including UWM undergraduates, is searching for new millisecond radio pulsars using the Arecibo Observatory in Puerto Rico and the Green Bank Telescope in West Virginia. Millisecond pulsars are extremely accurate astronomical clocks that can be used to detect very low frequency gravitational waves. This work is part of NANOGrav, an international effort to find pulsars and use them to detect and study gravitational waves produced by astrophysical sources such as super-massive binary black holes and cosmic strings.

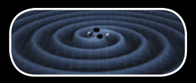
General Relativity & Cosmology

The large structures in our universe – galaxies, clusters of galaxies, filaments, and voids – formed from density fluctuations in the early universe whose imprint can be seen as small fluctuations in the cosmic microwave background. The Center's efforts in cosmology include studies of the quantum fluctuations in the early universe that ultimately led to large scale structure and the formation of galaxies themselves. Members of the Center have also worked in many areas of general relativity and relativistic astrophysics, including black-hole thermodynamics and singularities within black holes, post-Newtonian computations of binary inspiral, and instabilities and oscillations of relativistic stars.



The gravitational wave signal from two merging black holes, detected by LIGO in September 2015.

Gravitational-wave Astronomy



Members of the CGCA play leading roles in the Laser Interferometer Gravitational-wave Observatory (LIGO) Scientific Collaboration. In February 2016, LIGO announced the direct detection of gravitational waves, confirming Einstein's 100-year-old prediction. CGCA members played key parts in the discovery, and UW-Milwaukee hosts a state of the art data center specifically designed and constructed for the analysis of data from LIGO and other astronomical observatories.