Goddard Gravitational Wave Astrophysics Group (GGWAG)

Joan Centrella

Laboratory for High Energy Astrophysics

NASA/Goddard Space Flight Center

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Gravitational Wave Astrophysics at NASA/Goddard

Gravitational Wave Astrophysics is located within the

Laboratory for High Energy Astrophysics (LHEA)

(Nicholas White, Lab Chief)

http://lhea.gsfc.nasa.gov

LHEA has 2 science branches:

- ***X-Ray Astrophysics Branch*** (Rob Petre, Branch Head)
  - Relevant missions include Astro-E2, RXTE, and Constellation X
- ***Gamma Ray, Cosmic Ray and Gravitational Wave Astrophysics Branch*** (Neil Gehrels, Branch Head)
  - Relevant missions include INTEGRAL, SWIFT, GLAST, ACE, and LISA
  - Gravitational Wave Astrophysics Group recently created in support of LISA mission

Gravitational Wave Astrophysics Group

Senior Members:

- **Jordan Camp**
- **Joan Centrella**
- **Stephen Merkowitz**
- **Robin (Tuck) Stebbins** *(LISA Project Scientist)*
- **Bonnard Teegarden**

NRC Senior Associate:

- **J. David Brown**

Postdocs:

- **John Baker**
- **Dale Choi**

Graduate Students:

- **Orhan Donmez**
- **Breno Imbiriba**

Numerical Relativistic Astrophysics Group

John Baker
J. David Brown
Joan Centrella, *group leader*
Dale Choi
Orhan Donmez
Breno Imbiriba

- *Large scale numerical simulations of astrophysical gravitational wave sources such as binary neutron star and black hole coalescences, stellar collapse, rotational instabilities …*
- *Focus on sources of interest to LISA and ground-based detectors…*
- *High performance computing, adaptive mesh refinement (AMR), Lazarus project …*
- *Astrophysical source identification, data analysis…*

Current Members of GGWAG

Senior Personnel

Jordan Camp

Joan Centrella

Robin (Tuck) Stebbins

Tod Strohmayer *(X-Ray Astrophysics)*

Postdoctoral

John Baker

Plus possible contributions from students and collaborators (non-LSC members)

GGWAG contributions

Joan Centrella and John Baker

- **Catalogs of Astrophysical Gravitational Waveforms**
  Compile catalogs of computed gravitational waveforms from sources such as binary neutron star and black hole coalescence, rotational instabilities, gravitational collapse… Catalogs will be available online, and will be updated as new models become available.

- **Analysis of Model Calculations and Astrophysical Scenario Building**
  Time-frequency analysis of the source models in the catalog will be carried out; noise and other detector characteristics will be added. Given assumed signals from the detectors, scenarios for astrophysical upper limits will be constructed. This work will be done in collaboration with the Bursts Upper Limits Group.

GGWAG contributions

Tod Strohmayer

- **Astrophysics of Gravitational Wave Sources**

  Observations in the X-ray and other wavebands will be used to help model/determine/compute the strength and character of the gravitational wave signals expected from sources such as rotating neutron stars in LMXBs and black hole binaries.

- **Searches for Gravitational Radiation from Galactic Compact Objects**

  Fast chirp transform (FCT) search strategies for transient (burst) GW signals in correlation with astrophysical triggers from compact objects such as X-ray bursts and accretion outbursts will be investigated. Strohmayer will also begin studying search strategies for coherent GW signals from rotating neutron stars in LMXBs.

GGWAG contributions

Jordan Camp

- **Detector Characterization**

  Work will continue on characterization of detector noise, with emphasis on frequency noise, including prestabilized laser noise and frequency noise associated with the suspended cavities (both in and out of the LIGO signal band). Both Gaussian and non-Gaussian noise will be investigated. This work will take place in the binary inspiral and burst upper limit groups.

- **LIGO Core Optics Program**

  Camp will be involved in the LIGO core optics program, including the use of commissioning data to diagnose the optical performance of the interferometers, and participation in the advanced LIGO optics R&D.

GGWAG contributions

R. Stebbins

- **Seismic Isolation Sytems**
  - Participate in mechanical and system design and fabrication
  - Participate in prototype commissioning and testing
  - Access Goddard engineering expertise where appropriate