



UMass Amherst Proposal to Join the LSC

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Proposal Summary



- I will join the Physics Department at UMass Amherst in the fall, after 5 years at MIT-LIGO
- I propose to start an LSC data analysis group consisting of:
 - 1 postdoc
 - ~2 graduate students (and ~2 undergraduates)
- Focus will be the search and validation of transient GW events in LIGO data:
 1. Active role in the Burst Analysis Group
 2. Work with Inspiral Analysis Group on vetoes and Inspiral-Burst-Ringdown followup
 3. interface between Data Analysis and Detector through the Glitch Group
- I will continue my current services to the LSC:
 - Member of the Inspiral Review Committee since 2005
 - Publication and Presentation Committee
 - Other?

Where is Amherst, anyway?



- Western Massachusetts, Pioneer Valley – Five Colleges Area (UMass, Amherst College, Mt Holyoke, Smith College, Hampshire College)
- 90 miles west of Boston (2 hour drive from MIT), 175 miles from NYC

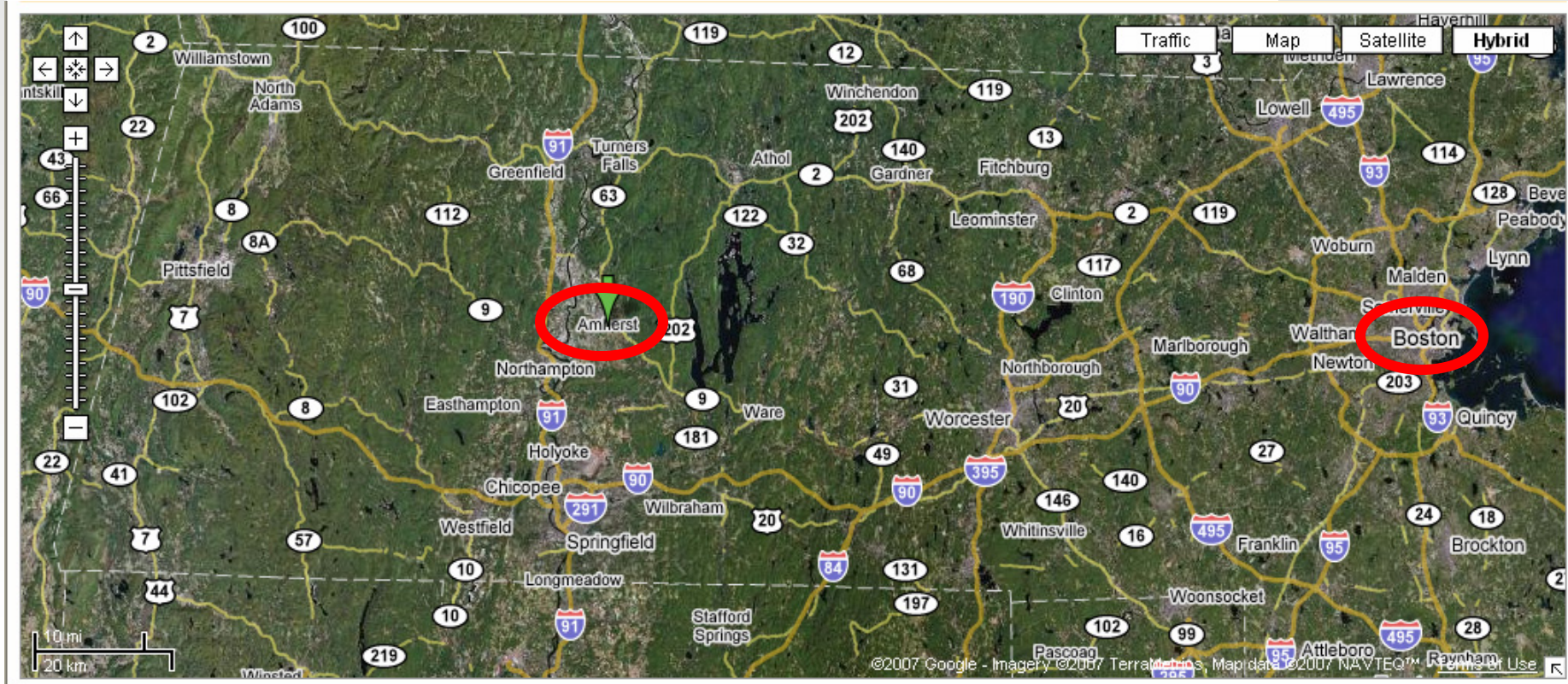


Image: Google Maps

UMass Amherst

The flagship campus of the University of Massachusetts system.



From the UMass web page:

- **Enrollment (Fall 2006)**
 - Students: 25,593
 - 19,823 undergraduates
 - 5,770 graduate students
 - Faculty : 1,169
- **Research**
 - Supported research activities total > \$134M/year
- **Academics**
 - 87 bachelor's degree programs, 6 associate's, 73 master's and 51 doctoral programs in 10 schools and colleges.
- **Library**
 - The library system is the largest at a state-supported institution in New England with more than 5.8 million items.
- **Athletics**
 - 23 teams compete at the NCAA Division I level.
- **Arts**
 - The Fine Arts Center, six galleries for visual arts.



A Very Important Bit of History



Discovery of the Pulsar System PSR 1913 + 16 (1975)

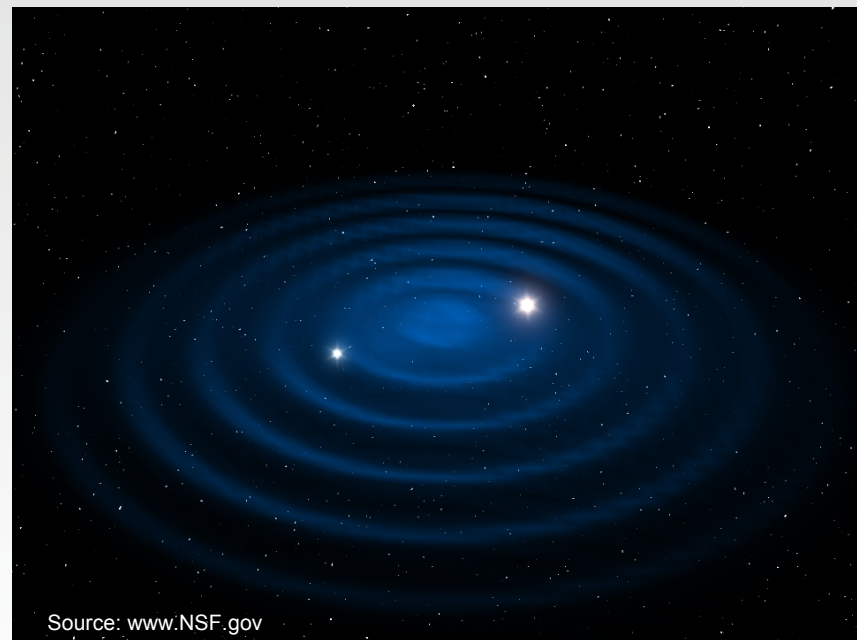
http://nobelprize.org/nobel_prizes/physics/laureates/1993



Hulse



Taylor



Joe Taylor and his graduate student Russel Hulse did all the work at UMass

The Physics Department



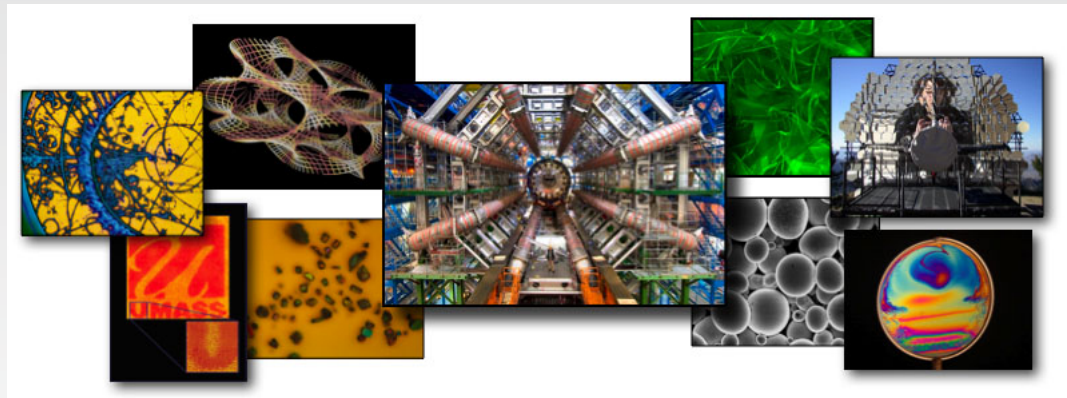
- 37 faculty, 75 graduate students, 90 undergraduate students
- Diversified research

I will be part of the HEP group:
Atlas, BaBar, Veritas

Theory group:
Particle, cosmology, string theory
Classical and quantum gravity

Medium Energy Nuclear Physics

Condensed Matter (theory and experiment), Nanotechnology, Biophysics



There is also an astronomy department, part of the greater Five College Astronomy Department, 26 teaching and research faculty (20 at the University and 6 at the Colleges), 7 research fellows and postdoctoral associates, 20 graduate students, and approximately 60 undergraduate astronomy majors.

Proposed Activity: The Burst Search



Participation in the LSC Burst Group and its “eyes-wide-open” search for short transient GW events. The search is designed to be open to serendipity and independent of uncertainties in source models. As such, it heavily relies on coincident evidence in multiple detector, consistency tests and, more generally, the validation of candidate events.

The current burst strategy is a coherent follow-up of candidate events identified as coincident excess power in more than one interferometer. New, fully-coherent search methods are becoming available within the LSC and VIRGO, to reconstruct the waveform and triangulate the source location in a network of detectors. We will contribute to the:

- implementation of these algorithms ***in an end-to-end analysis***, comparison of how different methods perform on large volumes of data and selection of the best performing strategy for certain classes of signals
- tuning of consistency criteria, analysis cuts and vetoes for burst candidates in the LIGO-VIRGO network

... within the scopes and needs of the Burst group.

The Burst Search

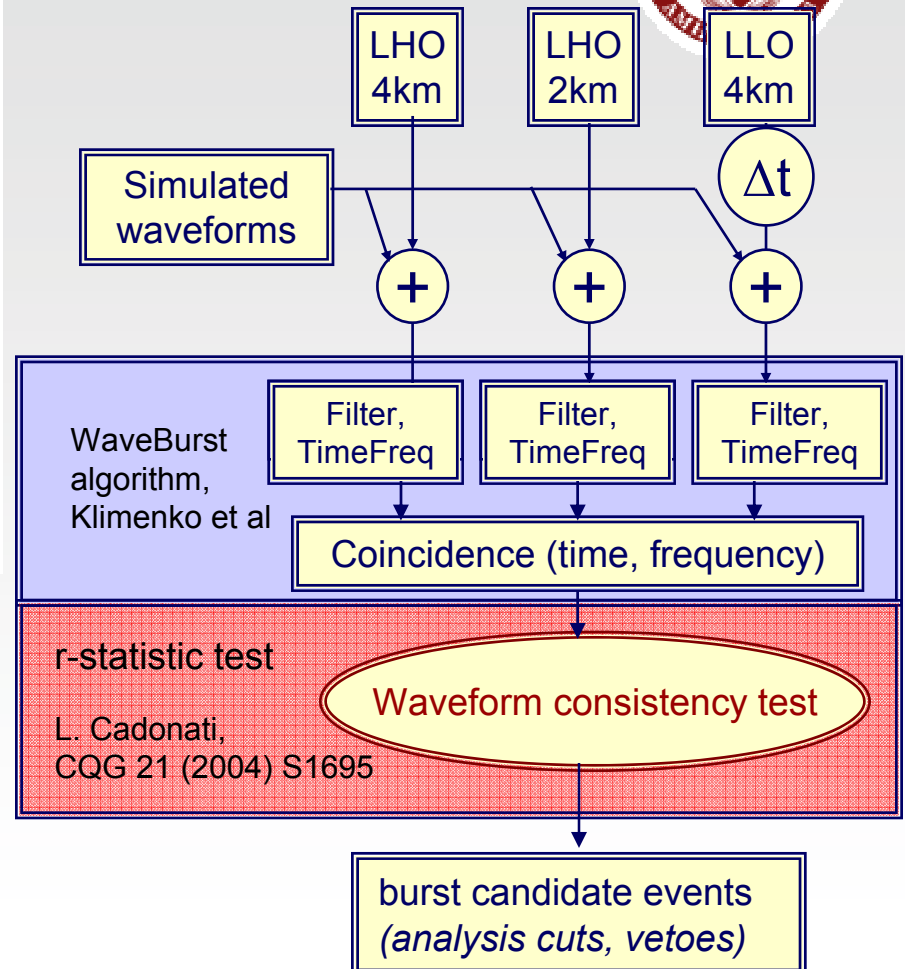


I have been an active member of the Burst Group since the analysis of S1 data, and a developer of the burst analysis pipeline, in close collaboration with many members of the burst group. In particular:

- * Formulation and implementation of the r -statistic waveform consistency test
- * Formulation and tuning of vetoes and analysis cuts
- * Construction of efficiency and upper limit curves
- * Participation in collaborative analysis efforts with other detectors: TAMA, GEO, AURIGA (task lead).

Key contributions to the following LSC papers:

- S1: LSC, PRD 69 (2004) 102001
- S2: LSC, PRD 72 (2005) 062001
- S2: LIGO-TAMA, PRD 72 (2005) 122004
- S3: LSC, CQG 23 (2006) S29
- S3: LIGO-AURIGA: in preparation
- S4: LSC, in preparation
- S4: LIGO-GEO, in preparation
- S5A: LSC, in preparation
- S5: analysis in progress ...



Proposed Activity: Glitch Group



Continued active role in the Glitch Group (co-chair since 2003), a Detector Characterization subgroup, charged with the identification and classification of noise transients in the GW channel and the exploration of their correlation with transients in auxiliary channels.

Data analysis talks to the detector...

the glitch group is a forum for information exchange between data analysts and experimentalists, with important contribution of students, postdocs and instrument operators.

→ **Online:** off-site data analysis shifts where figure-of-merit trends, the output of “glitch”-finding algorithms and the loudest events from inspiral and burst online analysis are carefully examined. Prompt feedback to instrument on findings that need/can be addressed in commissioning.

→ **Offline:** identification of some data quality flags and study of their correlation to transients in the gravitational wave channel. Identification of statistically significant correlations between transients on various data channels. Tuning of vetoes for burst and inspiral searches.

→ Methods and findings of this group are part of the detection checklist for burst and inspiral candidates

Proposed Activity: Inspirals-Burst-Ringdown Followup



A coincident inspiral-burst-ringdown search combining the expertise of burst and inspiral searches, with focus on black hole mergers. Data analysis across Burst and Inspirals groups.

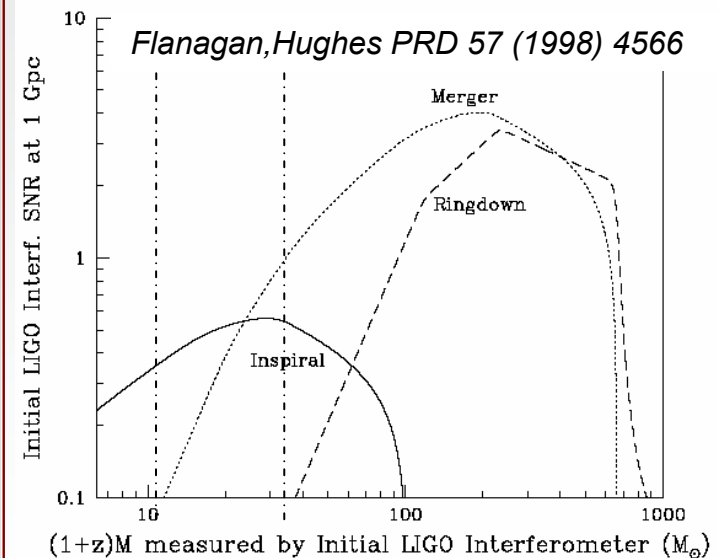
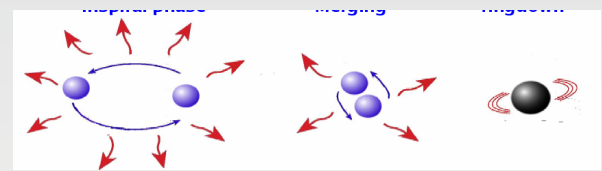
Event Identification and Coincidence: just starting
Exploiting existing burst, inspiral and ringdown searches: **deeply embedded in LSC burst and inspiral groups**

Simulations:

Sources, waveforms, technical aspects... I do not propose to do this all, but to follow closely all the good work that is already in progress.

Data Quality and Veto

Target transients that appear in more than one search – extend to IBR the work that is already happening in the glitch group for burst and inspiral veto



Bonus: we also have lots to learn from such coincident analysis from a DetChar point of view.

Conclusion



Over the past five years I enjoyed working with you all, I learned a lot and had fun too.

Now I am looking forward to more collaboration with LIGO and the LSC and I am committed to continue contributing to this great endeavor and bring UMass on board too.

