LSC Proposal
Andrews University
Gravitational Wave Group

Tiffany Summerscales

Andrews University

- Location: Berrien Springs MI
- Founded 1874
  - » 1874 – 1901 Battle Creek College
  - » 1901 – 1960 Emmanuel Missionary College
  - » 1960+ Andrews University
- Number of students – 3017
- Number of undergrads – 1730
- BS in Physics, BS in Biophysics, MS in Mathematics and Physical Science
- Physics department = 4.5 faculty + 3 emeritus

Andrews University Gravitational Wave Group

- Group Head: Tiffany Summerscales
  - » Member of the LSC since 2000 (E2)
  - » Graduate Student at Penn State (Graduated May 2006)
    - – Angular fluctuations of mirrors
    - – Data conditioning for Penn State burst pipeline
    - – Poisson Test for nonlinear couplings
    - – Supernova Study with Christian Ott & Adam Burrows: extracted supernova waveforms from simulated and hardware injection data using maximum entropy method
  - » Assistant Professor at Andrews University
- Undergraduates
  - » 26 majors, 6 minors
  - » Undergraduate Research Scholarships

Proposed Projects & Areas of Interest

- Data Analysis - Bursts
  - » Problem: The detection process modifies a signal from its initial form h_i

$$\mathbf{d} = \mathbf{R}\mathbf{h}_i + \mathbf{n}$$

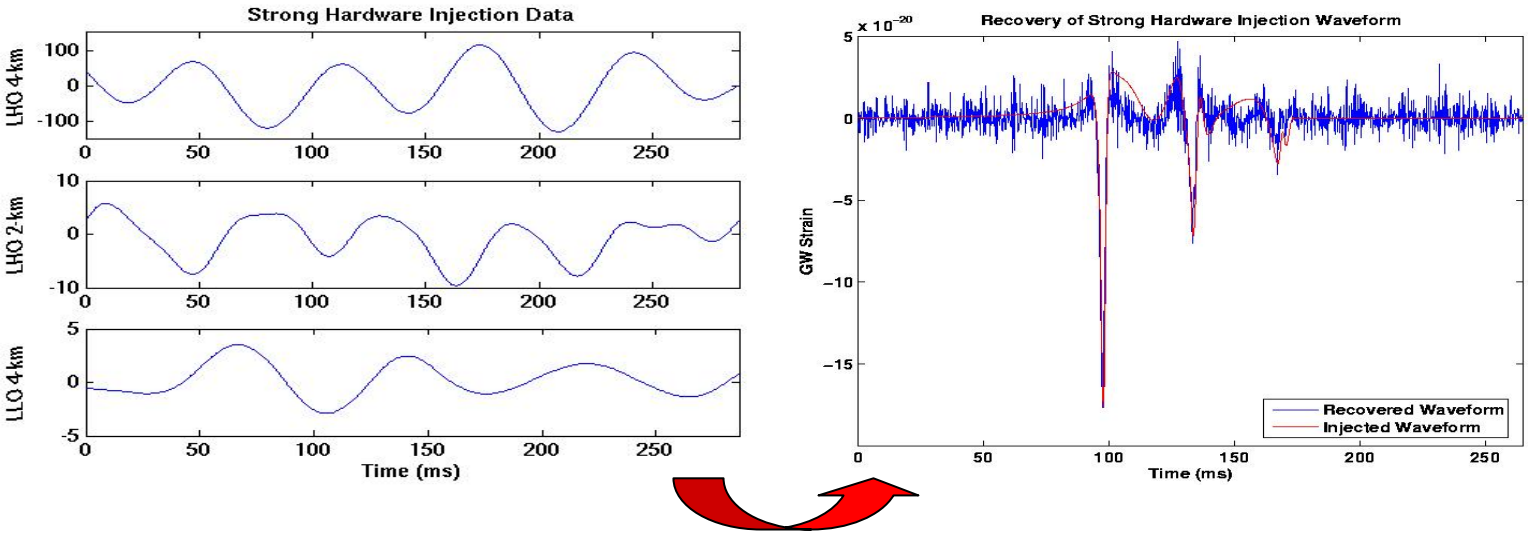
  - » Maximum Entropy = Bayesian method used in radio astronomy, medical imaging, etc. Finds estimate h that maximizes $P(h|d,I) \propto P(d|h,I)P(h,I)$ by minimizing the functional

$$F(\mathbf{h} \mid \mathbf{d}, \mathbf{R}, \mathbf{N}, \mathbf{m}) = \chi^2(\mathbf{R}, \mathbf{h}, \mathbf{d}, \mathbf{N}) - 2\alpha S(\mathbf{h}, \mathbf{m})$$

  - » α is a Lagrange parameter that balances being faithful to the signal (minimizing χ^2) and avoiding overfitting (maximizing entropy)
  - » See *G050090-00-Z, G050341-00-Z*

Proposed Projects & Areas of Interest

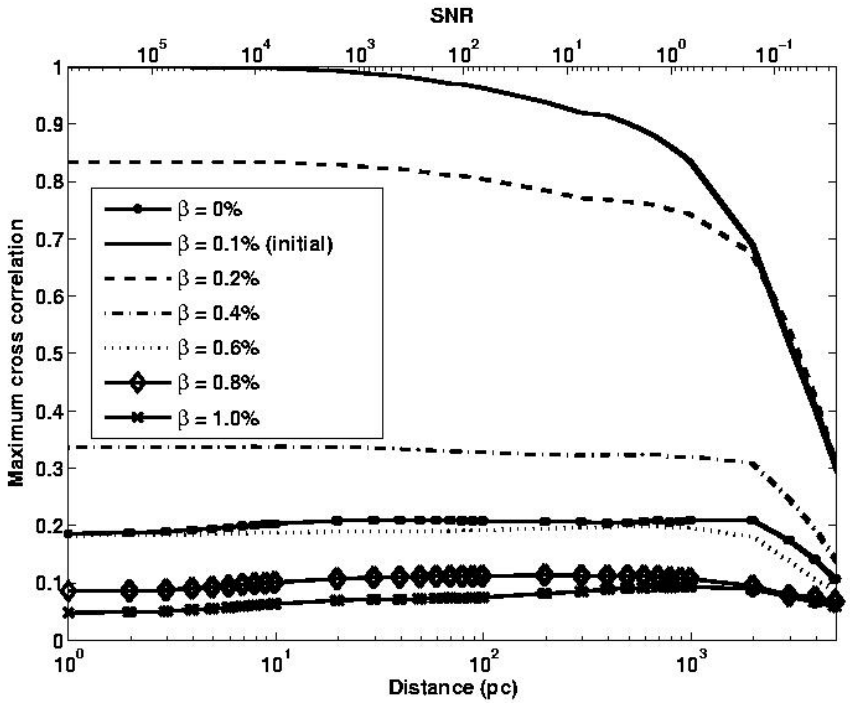
- Data Analysis - Bursts
  - » Maximum Entropy used to recover signals from simulated data & hardware injection data. Sky location assumed known.



  - » Work with Penn State group to make Maximum Entropy into an all-sky method & incorporate into BlockNormal burst pipeline

Proposed Projects & Areas of Interest

- Data Analysis - Bursts
  - » Supernova Study: what information is contained in gravitational waveforms?
  - » Simulated data with supernova signal from Ott et. al. & recovered signal via Maximum Entropy
  - » Computed cross correlation between recovered signal & catalog waveforms
  - » Recovered waveform carries information about progenitor mass & spin as well as bounce type for SNe within a few kpc
  - » Work with Burrows group & new waveforms



Proposed Projects & Areas of Interest

- Detector Characterization
  - » S5 elog entries
  - » Compile list of data quality flags
  - » Include times and segments affected