

# LSC Six-Month Progress Report

**LIGO-M010031-00-M**

**Organization** Carleton College Relativity Group (CCRG)

**Report Date** February 15, 2001

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**Attachment** A - Advanced Data Analysis

**Participation** Nelson Christensen 100%

## **Data Analysis, Statistics and Parameter Estimation for Binary Inspiral Searches**

An initial study of using Markov chain Monte Carlo (MCMC) more methods for parameter estimation for binary inspiral searches was completed. The results of this study were written up, and distributed to various LSC members (including LIGO staff). The paper, entitled -Using Markov chain Monte Carlo methods for estimating parameters with gravitational radiation data- (Nelson Christensen and Renate Meyer, 2001) can be obtained on the Los Alamos pre-print server, gr-qc/0010052. Gravity wave signals to 2.5 post-Newtonian order were simulated, and added to simulated noise. The MCMC routine could identify the five signal parameters, and probability distributions were generated. We studied the accuracy of the parameter estimation as the signal-to-noise ratio was varied.

In addition, B.S. Sathyaprakash of Cardiff, generated mystery signals, and the MCMC was able to find the parameter values and generate probability distribution functions.

Currently we are working on using the MCMC for binary inspirals where the two compact objects have angular momentum (spin). This results in two angular momentum parameters. The seven parameter code is currently being tested. This is again a 2.5 post-Newtonian order study. Preliminary tests show successful performance.

## **E2 Engineering Run Analysis**

Nelson Christensen is coordinating the effort to look for correlated noise in the various interferometer and environmental channels from the E2 engineering run. This work is being done in conjunction with Adrian Ottewill of University College, Dublin (Ireland). DMT code has been developed and used for this study. Preliminary results can be found on the web <http://physics.carleton.edu/Faculty/res67/E2corr.htm> and a report will be presented at the LSC meeting in March 2001 at Livingston.

## **Stochastic Background Upper-Limit Group**

Nelson Christensen is a member of the LSC group that is charged with trying to use the LIGO detectors to set an upper limit for the strength of the stochastic gravity wave background.

Carleton Group is utilizing their experience from the E2 correlation study, and is actively participating in the Estimation of cross-correlated noise-and-Line removal sub-groups.

## **Inspiralling Compact Binary Upper-Limit Group**

Nelson Christensen is a member of the LSC group that is charged with trying to use the LIGO detectors to set an upper limit for the event rates of coalescing binary systems.

Carleton Group is a member of the following sub-groups: detector characterization, multiple interferometers and statistics.

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Nelson Christensen is chairing the detector characterization sub-group. We will develop code to understand the interferometer performance and to provide vetos for possible events.

Carleton Group is using their statistical experience in conjunction with the multiple interferometer and statistics sub-group. Carleton is developing LAL (C) code for evaluating errors in parameter estimation. We will implement a MCMC routine for this task.