

LSC Six-Month Progress Report

Organization Inter-University Centre for Astronomy and Astrophysics (IUCAA)

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Extended hierarchical search for inspiraling binaries
Period: August 2002 to February 2003

The improved scheme extends the Mohanty-Dhurandhar hierarchical strategy to yet another parameter, namely, the time-of-arrival so that the hierarchy is now carried out over three parameters.

The essential idea is to carry out the search in two steps:

- (i) Trigger stage: the parameter space is coarsely sampled along with a low threshold ;
- ii) Follow up the first threshold crossings with a fine search with a high threshold.

During this period the focus was on the implementation of the hierarchical search. The main goal here was to design an algorithm to place the templates in the parameter space for the first stage of the hierarchical search. This is a tiling problem where one must fully cover the parameter space without leaving any `holes'. The algorithm cuts out rectangular tiles within the contours and the entire parameter space is covered by these rectangles. The algorithm takes into consideration the rotation and varying sizes of the rectangles across the parameter space. A paper on this work entitled:

Faster implementation of the hierarchical search algorithm for detection of gravitational waves from inspiraling compact binaries

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was submitted to Physical Review D. The paper was also internally reviewed by the LSC. The paper was also accepted by Phys. Rev. D for publication.

Also work on speeding up the template placement algorithm was started with the goal of placing the templates online given the psd curve. The code for the hierarchical search was written and has been implemented on a stand alone machine.

S. Dhurandhar visited the LIGO laboratories, Caltech, US from 15th August 2002 to 6th September 2002 for a period of three weeks. During this visit he participated in the LIGO Science Collaboration (LSC) meeting at Hanford from 19th August to 23rd August 2002, in which he gave a talk entitled *A faster implementation of the hierarchical algorithm in searching for gravitational wave signals from inspiraling compact binaries.*

Also he gave a seminar on *The mathematical structures underlying LISA data analysis* at the physics dept., Caltech, on 3rd September 2002.

Peter Shawhan visited IUCAA, India from 20th October 2002 to 27th October 2002. In this visit the focus was on writing of the computer code for the hierarchical search algorithm. The main goal was to implement the code in the environment of the LIGO Data Analysis Software (LDAS). The stand alone code was ported to the LDAS environment and several data pipeline jobs were submitted.

A. Lazzarini visited IUCAA, India from 10th December 2002 to 14th December 2002. He took stock of the overall progress of the project. Steps were taken with a view to implement the hierarchical code on real data available from the LIGO detectors. The paper on the implementation of the algorithm was discussed and the final version of the paper was prepared and submitted to LSC.

A. Lazzarini participated in the Indian Association of General Relativity and Gravitation meeting held at IUCAA, Pune from 11th –14th December 2002 in which he gave an invited talk entitled *LIGO: An update after the first Science Run*.