# C1III: SPACE BASED INTERFEROMETRIC DETECTORS

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## 1 Overview

The session was very well attended and started with an invited review by B.F. Schutz, titled *"LISA science update"*. This complemented a very nice plenary talk, by the same speaker, on *"LISA- Pioneering Space Gravitational Wave Detection"* and set the stage for the presentations done in the workshop. The session continued with Neil Cornish talking about *"measuring and mapping the gravitational wave background"* and ended with B.S. Sathyaprakash with a talk entitled *"digging signals out of LISA confusion noise"*.

## 2 Summary of The Talks

**B. F. Schutz** started reporting the latest news on the LISA project. In 2001, ESA and NASA exchanged letters of agreement to share the project equally, and ESA invited NASA to contribute to a technology demonstration mission called SMART2, due for launch in 2006. The two agencies formed a joint LISA International Science Team (LIST), that will organize the community. It has two chairs, T. Prince (JPL, Caltech) and K. Danzmann (AEI). Theorists and astronomers who want to contribute to the science required before LISA's launch in 2011 are welcomed to join in the projects encouraged by the *LIST's Sources and Sensitivities Working Group*, jointly chaired by S. Phinney and B.F. Schutz. There are still many open questions about sources of gravitational waves that have the potential to affect LISA's final design. Schutz encouraged further research in critical areas of relativity and astrophysics, such as studies of the equations of motion of small bodies near black holes, numerical studies of black-hole mergers, studies of binary evolution, and estimates of astrophysical and cosmological sources of background gravitational radiation. Schutz reviewed the different contributions to these topics and how LISA data analysis is envisaged. Unlike the ground-based detectors, LISA will observe many of its sources with extremely high signal-to-noise ratio. LISA could have a mission lifetime of up to 10 years, and is likely to be the first of a sequence of space-based detectors over the next few decades.

Next, **N. Cornish** discussed strategies for measuring and mapping the gravitational wave background with LISA and LISA follow-on missions. The gravitational wave sky, like the microwave sky, is expect to consist of isolated bright sources superimposed on a diffuse gravitational wave background. The background radiation has two components: a confusion limited background from unresolved astrophysical sources; and a cosmological component formed during the birth of the universe. A great deal could be learned by measuring this cosmological gravitational wave background (CGB), but detecting the CGB presents a significant technological challenge. The signal strength is expected to be extremely weak, and there will be competition from unresolved astrophysical foregrounds such as white dwarf binaries. Cornish presented two different strategies to solve this problem. The first is to cross-correlate the output of two independent interferometers. The second is an ingenious scheme for monitoring the instrument noise by operating LISA as a Sagnac interferometer. He derived the optimal orbital alignment for cross-correlating a pair of LISA detectors, and provided the first analytic derivation of the Sagnac sensitivity curve.

Ending the session, **B. S. Sathyaprakash** talked about how to extract information from the "confusion noise background". In the case of sources for which the waveform emitted is known accurately one could dig deeper into the background and extract useful signals. Sathyaprakash is studying the extent to which techniques such as matched filtering and time-frequency analysis could be useful in digging the signals out of confusion noise.

Space based interferometric detectors will allow exciting exploration of many exotic and interesting astrophysical systems. Whether they manage to see a cosmological background is one of the most unpredictable outcomes of gravitational wave astronomy, but LISA is well situated to at least put stringent limits on many early universe scenarios.

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