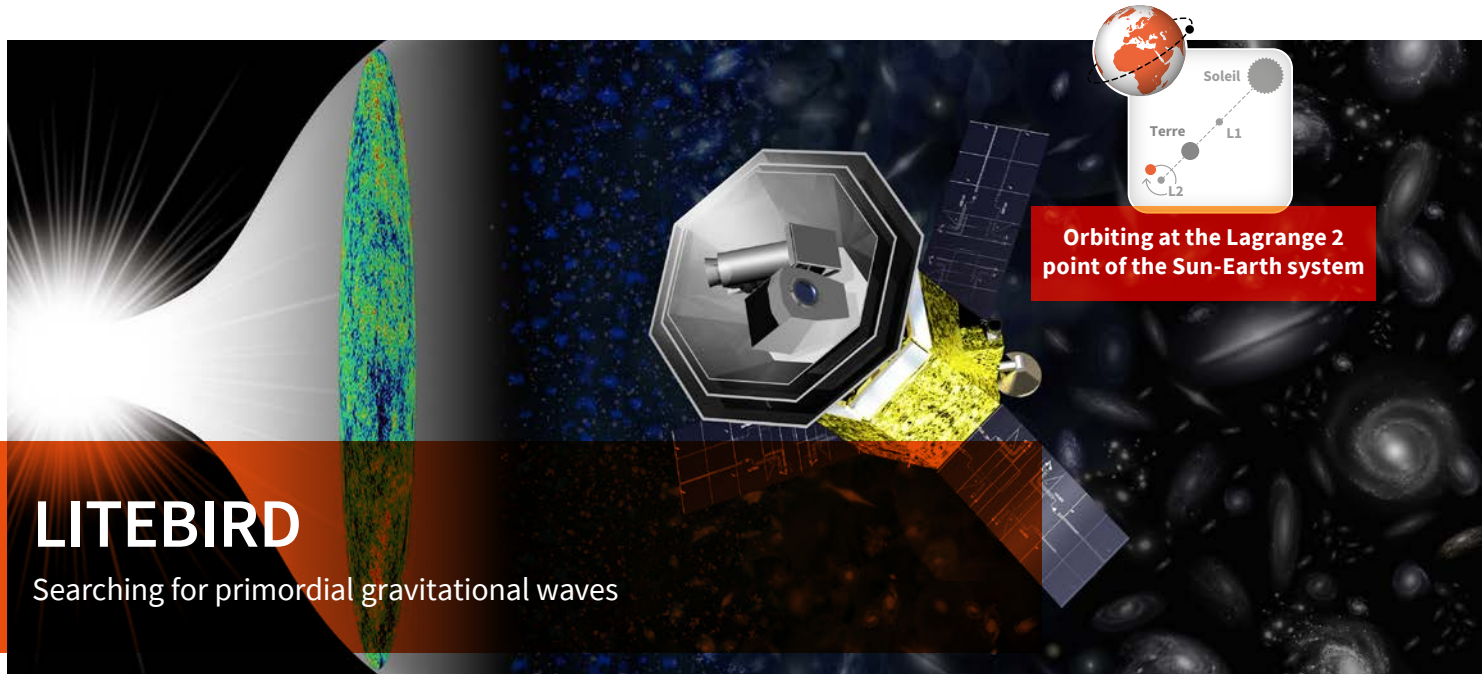
National Institute of Nuclear and Particle Physics

Gravitational waves




# LITEBIRD

## Searching for primordial gravitational waves

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- **Scientific leader:** Matthieu Tristram (IJCLab) *
- **Laboratories involved:** APC (Paris), IJClab (Orsay), LPSC (Grenoble)
- **Nature:** space project (CNES)
- **Statut:** international project in preparation, mainly funded by Japan (JAXA) and France (CNES)
- **Website:** http://litebird.jp/eng/

## SCIENTIFIC OBJECTIVES

LiteBIRD aims to detect primordial gravitational waves emitted during the cosmic inflation phase ($10^{-38}$ seconds after the beginning of the Universe). These are expected to leave an imprint in the Cosmic Microwave Background (CMB) in the form of special polarisation patterns, known as "B-modes". Their observation will make it possible to study the primordial Universe at ultra-high energy scales, to better constrain the mechanisms of cosmic inflation, and to test theoretical predictions of quantum gravity or grand unification of forces.

## RESOURCES DEPLOYED

- LiteBIRD, a satellite weighing about 2.2 tonnes, will carry three telescopes (low frequency LFT, medium frequency MFT and high frequency HFT) and will be sent to the Lagrange L2 point.
- About 5 000 detectors will make observations of the entire sky's fossil radiation in 15 frequency bands between 35 and 450 GHz.
- A complex cryogenic system will cool the telescopes to 5 K and the detectors to 100 mK.
- Development for space conditions of continuously rotating half-wave blades by magnetic levitation.
- Deployment of a platform for ground calibration and optical measurements in flight conditions (< 4K).

**15** frequency bands mapping the sky

**3** years of operation

**12** participating countries

**500** million dollars (consolidated cost)

**5** main contributors: Japan, France, Italy, Canada

## IN2P3 CONTRIBUTIONS

- Design and delivery of the mechanical structure of a prototype refractive telescope to perform the first optical tests. If selected, IN2P3 will provide the mechanical structure for the different models, from the engineering model to the flight model.
- Global thermal modelling of the MFT and HFT telescopes.
- Contribution to the thermal and optical part of the ground segment equipment needed for the calibration phase.
- Leading role in the organisation and management of the pre-light calibration phase on the ground.

### OTHER FRENCH LABORATORIES INVOLVED

Irig (CEA Grenoble), Irfu (CEA Saclay), LERMA (Paris), IAP (Paris), IAS (Orsay), Institut Néel (Grenoble), IPAG (Grenoble), IRAP (Toulouse), LAM (Marseille), LESIA (Paris)

**2014** LiteBIRD is selected as a priority project by the Science Council in Japan

**2015** Official invitation from JAXA to the European CMB community

**2019** Selection of LiteBIRD as Large Class Mission by JAXA

**2020-2023** Feasibility study of the MFT and HFT telescopes led by CNES

**2029** Expected launch date

**2033** Expected end of primary mission

* Since 2019

April 2022