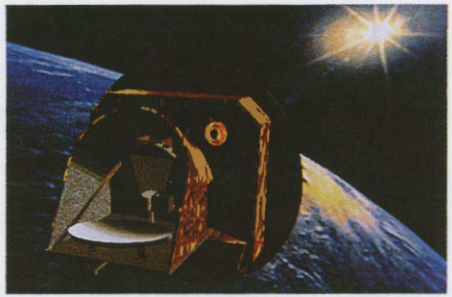
Probing the Early Universe with the PLANCK Surveyor

The Submillimetre-Wave Optics group in the Physics Department of NUI Maynooth is participating in an ambitious European Space Agency project known as the PLANCK Surveyor. The primary aim of the PLANCK mission is to make crucial measurements of a faint source of infra-red radiation known as the Cosmic Microwave Background which fills all of the Universe. This radiation field is the remnant afterglow of the explosive beginning of the Universe in the Big Bang. Astronomers observing this radiation today are effectively seeing the Universe at a very early stage in its history (about 30,000 years after the Big Bang, which happened over 10 billion years ago).

In 1965 Penzias and Wilson first detected the Cosmic Microwave Background at Bell Laboratories in New Jersey. Subsequently it became clear from careful measurements that the radiation is extremely uniform in all directions. Then, in 1992, a famous NASA satellite mission known as COBE revealed the existence of tiny variations or "fluctuations" in the temperature of the Cosmic Microwave Background across the sky. Imprinted on these "ripples at the edge of the Universe" is vital information about the origin and subsequent development of galaxies and large scale structures in the Cosmos.

Inspired by COBE, but carrying much more sophisticated ultra-sensitive detectors, the PLANCK Surveyor will actually be able to image and fully characterise these Microwave Background fluctuations. PLANCK is due to be launched in 2007 into a deep space orbit which will provide an environment suitably free of radio and infra-red interference to avoid degradation of the data from the mission. The results of the PLANCK project are set to have a revolutionary impact on cosmology, the study of the origin and evolution of the Universe as a whole. It will be possible to test the competing theories of the early development of the Universe and the origin of large scale cosmic structures such as galaxies and clusters of galaxies. Indeed it will be possible to determine the age of the Universe to within 1% and predict its ultimate fate.

Maynooth is involved in an international consortium of scientists to design and build the High Frequency Instrument on board the PLANCK Surveyor. The optical design of this instrument is being undertaken in collaboration with Queen Mary and Westfield College, University of London, the Institut d'Astrophysique Spatiale, Paris, the California Institute of Technology, and Stanford University, California. The formidable technical challenges implied in imaging the very faint Microwave Background temperature fluctuations require the development of new technologies and the very precise modelling of the system. This is an extremely exciting opportunity for NUI Maynooth, as it offers Irish participation in an extremely important cosmological experiment.



The PLANCK Surveyor will measure temperature fluctuations in the Cosmic Microwave Background.

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