Optimization of the control and acquisition system of a 10GHz fossil radiation detection experiment.

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Fossil radiation at 3K is the first light in the Universe and was emitted approximately 380,000 years after the Big Bang. It has a black body spectrum with a temperature of approximately 2.73K and can thus be observed in the millimeter wavelength range. Fossil radiation is the subject of intense research in observational cosmology, particularly at the level of polarization which would contain traces of inflation, a phase of exponential expansion of the Universe in the very first moments.
This internship proposes to repeat the experiment of Penzias and Wilson which made it possible for the first time to detect fossil radiation at 3K in 1965. The use of radio techniques now accessible at low cost makes it possible to detect this radiation in the Paris region , using the same measurement methods as those of Penzias and Wilson. For this we will use a satellite TV reception antenna operating at 10GHz and which has been slightly modified.

The work will mainly focus on the optimization of the control and acquisition system which will be based on a micro-controller to be defined. Additional studies could be carried out to optimize the pointing system, the sky scanning method, the calibration, but also the data processing. A study of the different sources of systematic errors linked to the calibration process and the different approximations used during data analysis could also be considered. The measurements on the sky will be carried out on the terrace of the Condorcet building, at the APC. Other astrophysical sources such as the Sun, the Moon and the galactic plane will also be observed in order to evaluate the performance of the instrument in its different configurations.

The areas of expertise required are essentially acquisition electronics and associated software, mechanics and signal processing. Notions of astronomy, cosmology and millimeter instrumentation will be covered during this internship.