

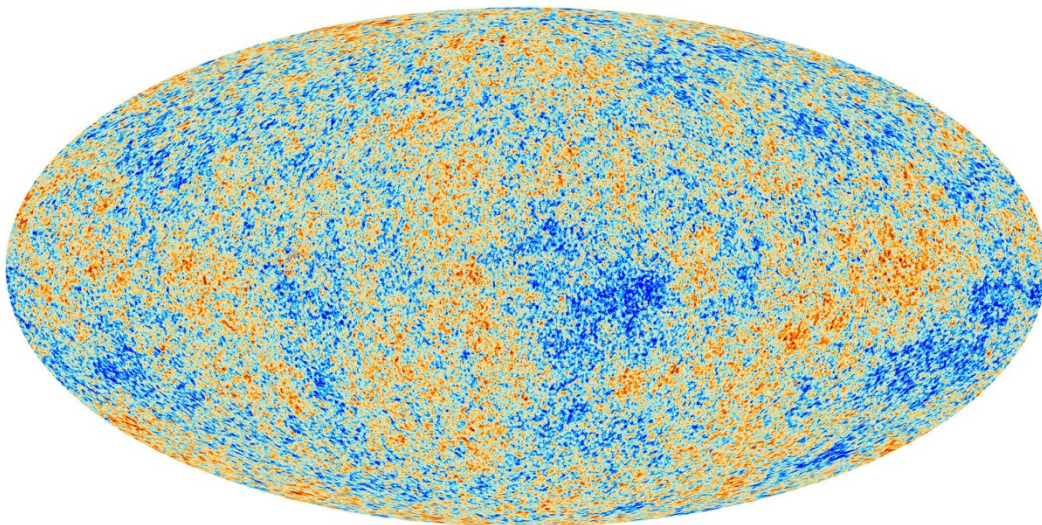
Inflationary cosmology and the early universe

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The standard model of cosmology includes a period of extremely rapid expansion at early times. This period, known as cosmological inflation, lasted for only a tiny fraction of a second, but provided the initial conditions that led to the uniformly expanding Universe we see around us today. As well as this, inflation is known to produce both gravitational waves and fluctuations in the curvature of spacetime itself. These disturbances sow the seeds for the formation of large-scale structure in the Universe, as observed through galaxy surveys and the temperature fluctuations in the Cosmic Microwave Background (as depicted below).

During this project, the PhD student will investigate a topical problem in the modern theory of inflation. This could include:

- Constructing and studying models of cosmological inflation, using fundamental scalar fields or ideas from high-energy theories such as string theory.
- Developing tools for calculating the observable properties of the fluctuations produced by inflation, such as the degree to which they produce structures on different scales.
- Studying the behaviour of spectator fields, which were present during inflation. This could include the Higgs field, and its consequences for our Universe.
- Investigating the production of relics during inflation, such as primordial black holes, gravitational waves, and dark matter.



Note: This project description can be used for the “Research Proposal” part of your application.