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Searching for clues about the Universe's origins in big data sets

Inflation theories elegantly address a number of problems raised by the standard Hot Big Bang scenario, however one of its major predictions, the existence of a stochastic background of cosmological gravitational waves, is yet to be confirmed. Currently the most promising, if not the only, way to achieving this is through the observation of the Cosmic Microwave Background (CMB) polarization. The primordial gravitational waves generated by inflationary mechanisms leave a specific imprint on the polarization anisotropies of the CMB. Their detection would deeply impact our understanding of cosmology and fundamental physics. The search for this faint signal as well as its precise characterization require unprecedented sensitivities, prompting a rapid growth in the size of the data sets being collected by the experiments. The size of the full raw data sets that we need to process is expected to reach the Petabyte scale in the forthcoming CMB experiments. Processing these data efficiently requires better numerical tools, able to fully capitalize on the computational power of massively parallel supercomputers. In my talk, I will present a brief overview of the scientific context and some of the most exciting experimental efforts planned to hunt these primordial gravitational waves. I will also describe some of the computational challenges posed by their anticipated data sets along with some of the methods we develop to tackle them.

Field

Cosmology/Computer science

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