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Map-making of the polarized Cosmic Microwave Background with next-generation ground-based observatories, Simons Observatory and CMB-S4

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Since its discovery in 1965, the Cosmic Microwave Background (CMB) has become one of the main cosmological probes for studying the Universe. The CMB is a major piece of evidence in favor of a "hot Big Bang" model, and it has provided us with very precise measurements of the parameters of the standard cosmological model, in particular thanks to ESA's Planck satellite. However, questions remain concerning the origin of the Universe and the first moments after the Big Bang.
Many theories predict that gravitational waves were produced in this very early time, during an epoch of accelerated expansion known as "cosmic inflation". Those waves thus encode invaluable information about the physics that take place at extremely high energies, where our current theories break down. The polarization of the CMB, potentially bearing trace of those events, is one of the most promising probes in that regard.
As a consequence, the next generation experiments will measure the polarized CMB with unprecedented sensitivity and precision, thereby challenging our ability to analyze huge data sets, which will exceed the petabyte (10^{12} bytes) in size. My work, in the Simons Observatory and CMB-S4 collaborations, consists in reconstructing the sky signal observed by the telescopes over many hours of observation, a process known as "map-making". During this operation, we must characterize as well as possible the statistical properties of the reconstructed maps in order to retrieve the full cosmological information at the later stages of the analysis.

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