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Spectral Imaging with QUBIC: Component separation methods using Bolometric Interferometry

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QUBIC (QU Bolometric Interferometer for Cosmology) is an instrument dedicated to the search for B-modes by measuring the Q and U polarization modes. It brings together the advantages of bolometers with their high sensitivity and interferometers with their exquisite control of instrument systematic effects. The interferometric nature of QUBIC also allows spectral-imaging with high spectral resolution compared to direct imagers, which is a significant advantage for foreground removal. After discussing the instrument details of QUBIC, focusing on its ability to mix spatial and spectral information, I will present two methods using this unique feature to perform component separation. The first one, called Frequency Map-Making (FMM, <https://arxiv.org/abs/2409.18698>), is a standard implementation of spectral imaging with QUBIC where the large bandwidth data is projected onto frequency sub-bands within the physical bandwidth of the instrument. The higher spectral resolution enhances foreground mitigation in the case of complex foregrounds (frequency decorrelation). The second method, called Component Map-Making (CMM, <https://arxiv.org/abs/2409.18714>), is an even more advanced method where foreground mitigation is performed along with the map-making, making extensive use of the spectral imaging capabilities of QUBIC, leading to further improvements with respect to FMM.

Orateur: LACLAVÈRE, Tom