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Modelling Galactic Microwave emission with ML techniques

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One of the major challenges in the context of the Cosmic Microwave Background (CMB) radiation is to detect a polarization pattern, the so called B-modes of CMB polarization, that are thought to be directly linked to the space-time metric fluctuations present in the Universe at the very first instants of life. To date, several challenges have prevented to detect the B-modes partly because of the lower sensitivity of the detectors partly because of the polarized emission coming from our own Galaxy acting as a contaminant. In this talk, I will show how novel techniques involving unsupervised learning (e.g. clustering methods) can improve the quality of the recovered CMB polarization maps once Galactic emission is removed.
This work has been recently published online in Puglisi et al. 2022.
Moreover, I will show recent developments (Puglisi&Bai 2020 and Krachmalnicoff&Puglisi 2021) in improving modeling of the Galactic polarized emission at sub-millimetric wavelengths by means of Deep Neural Networks like Generative Adversarial Networks and Auto-Encoder. This is particularly relevant in the context of future CMB experiments (e.g. SO, LiteBIRD, CMB-S4) where high sensitivity measurements are expected to be achieved and a better characterization of the foreground contamination is thus required.

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