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Joint component separation for multi-tracer mm-wave intensity mapping

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The constraining power of upcoming line intensity mapping surveys will be limited by the presence of bright foregrounds and line interlopers. In this work, we implement a CMB-style multi-component separation framework to isolate emission lines of interest by considering correlations between all sources. Working in the context of CO mapping, we model and jointly fit all relevant mm-wave signals—CO and [CII] line emissions, diffuse Galactic emissions, the CMB and SZ effects, and the cosmic infrared background—within a single power spectrum likelihood that incorporates the multi-frequency covariance of these signals. We highlight the significant cross-power information provided by external galaxy surveys to break degeneracies. By preserving the full statistical content of both the intensity mapping and galaxy datasets, we show that this approach leads to an enhanced recovery of the CO power spectrum.

Author: SIERRA, Carlos (SLAC / Stanford University)

Co-auteur: KARKARE, Kirit (Boston University)

Orateur: SIERRA, Carlos (SLAC / Stanford University)

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