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Scientific results with the QUIJOTE-MFI wide survey: The anomalous microwave emission in our galaxy and M31

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The detailed understanding of the Galactic emission processes in the frequency range from 1 to 3000 GHz is crucial for a state-of-the-art characterization of the Cosmic Microwave Background (CMB) anisotropies both in intensity and polarization. The Q-U-I JOint TEnerife (QUIJOTE) experiment is one of the current observational efforts devoted to study the CMB anisotropies and the microwave sky. The latter is dominated by four mechanisms: synchrotron, free-free, thermal dust and Anomalous Microwave Emission (AME).

The new QUIJOTE-MFI wide survey (Rubiño-Martín et al., 2023), covering the northern sky in the 10-20 GHz range, is useful for pinning down the AME spectrum at low frequencies. This allows a more reliable separation between the AME and other components than in previous analyses. In this talk we presented a brief overview of these aspects, with emphasis on the new results about the study of the AME in different environments (see Poidevin et al. (2023); Fernández-Torreiro et al. (2023, 2024); López-Caraballo et al. (2024)) coming from the recently released QUIJOTE data. For example, the AME emissivity ($\epsilon^{30\mathrm{GHz}}_{\mathrm{AME}}$, in units of K/τ_{353}) suggests a similar behaviour of the AME component in the Milky Way and M31 (on scales of 1°). We obtained 4.0 ± 2.7 for M31 (integrated SED, Fernández-Torreiro et al. (2024)) and values of $13.6^{+14.3}_{-6.9}$ (compact sources, Poidevin et al. (2023)) and $5.1^{+2.7}_{-1.6}$ (Galactic plane, Fernández-Torreiro et al. (2023)) for our Galaxy. Fig. 1 also displays the AME emissivity reported by Harper et al. (2023) (CBASS data) and the estimated from Battistelli et al. (2019) (SRT data at 25 GHz) for M31.

Finally, we also presented the status of the QUIJOTE MFI2 instrument (Hoyland et al., 2022), the upcoming upgraded version of the former MFI instrument. We expect to improve the sensitivity by a factor 2–3 with respect to the MFI. The MFI2 has a digital FGPA (Field Programmable Gate Array) based back-end to improve the radio frequency interference (RFI) removal. MFI2 commissioning will take place at the beginning of 2024, while the implementation of the FGPA system is expected for the next year.

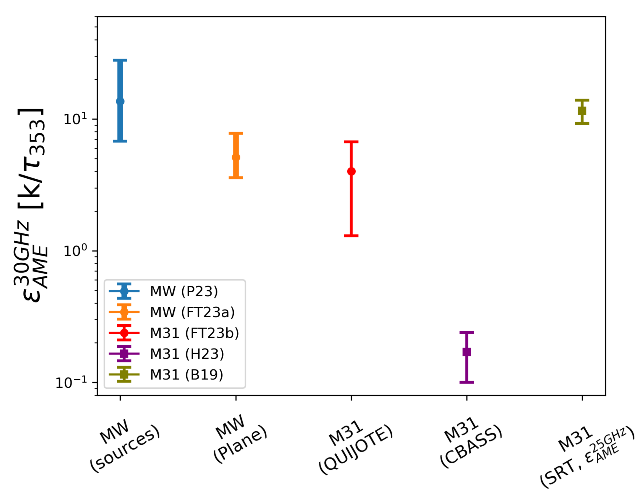

Figure 1. The Milky Way AME emissivity obtained from the statistic of compact sources (Poidevin et al. (2023), blue) and diffuse emission from the Galactic plane (Fernández-Torreiro et al. (2023), orange). For M31, measurements are recovered from the integrated spectral energy distribution (Battistelli et al., 2019; Harper et al., 2023; Fernández-Torreiro et al., 2024).

The MFI2 instrument will be used in the second phase of the future European Low Frequency Survey (ELFS) collaboration, in the Simons Array telescope (Aniello & et al., 2023). ELFS aims to characterize the southern

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sky from the Atacama desert (Cerro Toco, Chile) on scales of ∼10 arcmin covering the frequency range 5–120 GHz. This project will be in synergy with other CMB experiments located in the Atacama desert such as the Simons Observatory (The Simons Observatory Collaboration et al., 2019; Aniello & et al., 2023).

The QUIJOTE-MFI wide survey maps and derived data products can be found at https://research.iac.es/proyecto/quijote.

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