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The powers of the GRB 221009A soft X-ray rings

On 2022 October 9 an extraordinarily bright gamma-ray burst (GRB 221009A) was observed behind the Galactic Plane. One day later, the X-ray Telescope (XRT) onboard the Neil Gehrels Swift Observatory, which was the first imaging X-ray telescope to react to the event, discovered 9 bright expanding rings due to the scattering of X-rays by dust clouds in our Galaxy.
The ESA satellite XMM-Newton observed these rings two and five days after the burst.
In this poster, I will illustrate the dual significance of this remarkable event.
The 20 rings that were identified in the two XMM-Newton observations allowed us to reconstruct the spectrum of the GRB prompt emission in the 0.7-4 keV energy range and to reveal a soft excess in the GRB spectrum missed by the others instruments which are sensitive only to hard X-rays (Tiengo et al. 2023).
Instead, assuming the GRB fluence and spectrum and studying the ring intensity and photoelectric absorption detected by XMM-Newton and Swift in different sectors, we have produced a detailed 3D map of the Galactic interstellar medium in the GRB direction.
This map has a better resolution, both in the plane of the sky (a few arcminutes) and in the radial direction (<1 %), than the other maps previously available for this sky area, which are mainly based on stellar extinction. It will also be used to separate Galactic absorption from the contribution of the host galaxy in the study of the X-ray afterglow, which is crucial for understanding the local environment of the GRB.

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