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Ring closing on transient sources of ultra-high energy cosmic rays

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We explore two generic hypotheses for tracing the sources of ultra-high energy cosmic rays (UHECRs) in the Universe: star formation rate density or stellar mass density. For each scenario, we infer a set of constraints for the emission mechanisms in the accelerators, for their energetics and for the abundances of elements at escape from their environments. From these constraints, we generate sky maps above 40-EeV expected from a catalog that comprises 410,761 galaxies out to 350-Mpc and provides a near-infrared flux-limited sample to map both stellar mass and star formation rate over the full sky. Considering a scenario of intermittent sources hosted in every galaxy, we show that the main features observed in arrival directions of UHECRs can in turn constrain the burst rate of the sources provided that magnetic-horizon effects are at play in clusters of galaxies.

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