



12362 - Everything Everywhere All at Once: Highly Parallelized Grism Spectroscopy for Stellar and Extragalactic Astronomy

Cycle: 5, Proposal Category: AR

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OBSERVATIONS

ABSTRACT

Slitless spectroscopy offers unmatched multiplexing, but at a cost: overlapping spectra. On JWST, NIRISS, NIRCams, and—soon—MIRI grisms deliver extraordinary spatially resolved spectroscopy, yet current pipelines mask or discard contaminated data, wasting information and telescope time. We propose to develop a next-generation analysis framework that models all spectra in a field simultaneously, using GPU-accelerated forward modeling and probabilistic inference to recover accurate fluxes even in dense regions. This approach will measurably improve the fidelity and completeness of JWST grism data. For galaxy evolution, it will reduce catastrophic redshift errors; for stellar populations, it will open crowded-field spectroscopy in the Galactic bulge and nearby dwarfs. The same algorithms will directly benefit Euclid and Roman, sharpening redshift distributions for cosmology. All software, notebooks, and validation datasets will be released openly. Using public JWST datasets (e.g., CANUCS, GLASS, PASSAGE, OutThere, NGDEEP, FRESCO, SAPHIRES), we will establish a community standard for slitless spectroscopy, ensuring these data reach

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their full scientific potential.

OBSERVING DESCRIPTION