

“GISMO”: A New Flavor for SAFIR? A Conceptual Design for a Giant (30 m) Very Cold (~ 13 K) FIR and Submm Fresnel Space Telescope

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We propose a 32-zone, 30 m diameter Fresnel lens 2.2 mm thick, made of Ultra-High Molecular-Weight Polyethylene (UHMW-PE), with a 3000 m focal length, for use in the (F)IR and submm bands. In an Earth-Sun L2 halo orbit, behind a 5-layer sunshade, the lens will cool to ~ 13 K in a year. At its focus a 6 m \times 3 m off-axis Ritchey-Chretien field optics system re-images the lens on a Fresnel corrector to produce an achromatic output beam. The lens performs well from ~ 700 μm down to 50, possibly 20, μm . The design is error-tolerant, so that simple deployment strategies should be possible. The Field Optical System requires only 3 mirror segments. Equipped with comparable instruments, GISMO would outperform a 10 m 4 K (segmented-mirror) telescope by $3\times$ in angular resolution and by $2\times$ to $6\times$ in sensitivity for observations at all wavelengths, except for spectroscopy at ~ 300 μm where GISMO might be up to $3\times$ less sensitive. We believe that this conceptual design (launch mass ~ 5 tons, volume ~ 4.3 m \times 3 m \times ~ 13 m) is scientifically attractive, probably cheaper and possibly less risky than the multiple-segmented, cryogenic, 10 m aperture designs being examined for SAFIR at present.