The WFI Relative Calibration System for WFIRST

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WFI’s 18 detector mosaic images 100 times the sky area of HST and JWST
WFIRST science goals require highly accurate relative calibration

Supernova Primo in the Hubble Ultra Deep Field

NASA, ESA, A. Riess (STScI and JNU) and S. Rodney (JHU)

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WFI is a simple instrument with a filter wheel and detector mosaic.
WFI needs a calibration system meeting stringent requirements

- Broad range of illumination levels
- Temporally stable illumination
- Angle of incidence matches science light
- Sufficiently bright light
- Spatially smooth and uniform illumination
- Simultaneous calibration and science light
WFI needs a calibration system meeting stringent requirements

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The RCS must provide illumination intensity over five orders of magnitude over the mission life.

Relative Illumination Level

- 100,000x
- 10,000x
- 1,000x
- 100x
- 10x
- 1x

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Sphere 1

Sphere 2

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A closed-loop feedback system keeps illumination constant
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Direct fiber illumination provides light but does not match sky angle of incidence
Direct fiber illumination provides light but does not match sky angle of incidence
Indirect fiber illumination matches angle of incidence but provides too little light
Free-space projection optics yield greater illumination and match angle of incidence

- Mosaic
- Diffuser
- Filter wheel
- Projection optics
- RCS source
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Element wheel diffuser provides smooth and uniform light on detector array

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The RCS must provide “background” light in sky images to calibrate count-rate non-linearity.
Pupil mask diffuser allows simultaneous illumination with calibration and science light
Ball, SDL, and GSFC have designed a cutting-edge calibration system for WFIRST

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