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EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Improved Detection of Satellite Trails in Hubble Imaging

David V. Stark, STScI (dstark@stsci.edu) In collaboration with: Norman Grogin, Jenna Ryon, Ray Lucas





How can we improve our automated detection of satellite trails? How have trail properties (rate, brightness) changed over time?

A new approach to identifying satellite trails in HST data



Median Radon Transform: Median value measured along every linear path across an image

- Most paths mainly empty sky (median ~ 0)
- Paths aligned with trails have no empty sky (median >> 0)

 Satellite trails are point sources in the Median Radon Transform



Significantly improved sensitivity over previous methods

- Weak trails much more pronounced in the transformed images
- Trails detectable down to a mean brightness of 0.1-0.3 times an image's noise level
- Sensitivity is 5-10 times better than previous software developed at STScI (Borncamp & Lim 2016)



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- New method applied to thousands individual ACS Wide Field Channel (WFC) exposures between 2002 and mid-2022.
- We examine evolution in:

 (a)The rate of satellite trail occurrence in ACS/WFC data
 (b)The typical brightness of satellite trails

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Increase in satellite trail occurrence over the last 20 years

- Rate of satellite trails has doubled
- Percentage of affected exposures has doubled



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Do satellite trails impact HST science?

Single Exposure



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Do satellite trails impact HST science?







- We have developed a new method of identifying satellite trails in individual Hubble exposures
- Our approach is 5-10 times more sensitive than prior routines developed at STScI
- We apply our method to the last 20 years of HST ACS/WFC imaging data:
 - The rate of satellite trail presence has increased by a factor of 2 (from 5-10% of exposures affected)
 - The typical satellite trail brightness has remained the same
- Despite the increase, satellite trails have no significant impact on HST science
- For more information:
 - See ACS Instrument Science Report <u>ACS ISR-2022-08</u>
 - See <u>iPoster 304.02</u>
 - Email me: dstark@stsci.edu