

# Early results from the first dedicated search for asteroid dust trails with SALTICAM

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# Disruption of small Solar System bodies

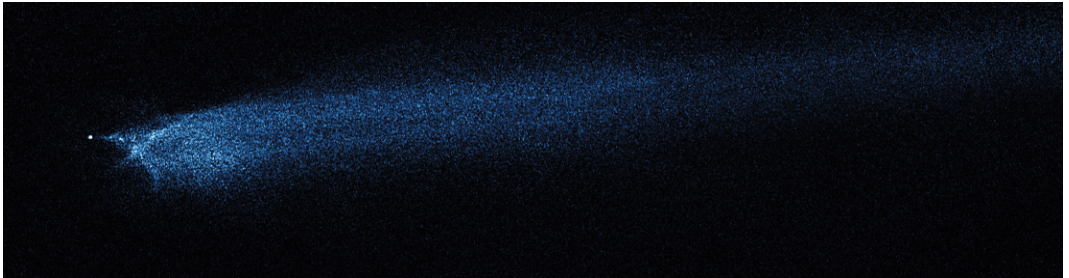


source: <https://commons.wikimedia.org/wiki/File:CometBiela.jpg>

# Ancient Asteroid Disruptions

- The existence of asteroid families (collisions)
- The existence of asteroid pairs and clusters (rotational fission)
- The existence of binary and multiple systems (collisions and rotational fission)
- The existence of dust bands within the Zodiacal cloud (collisions)

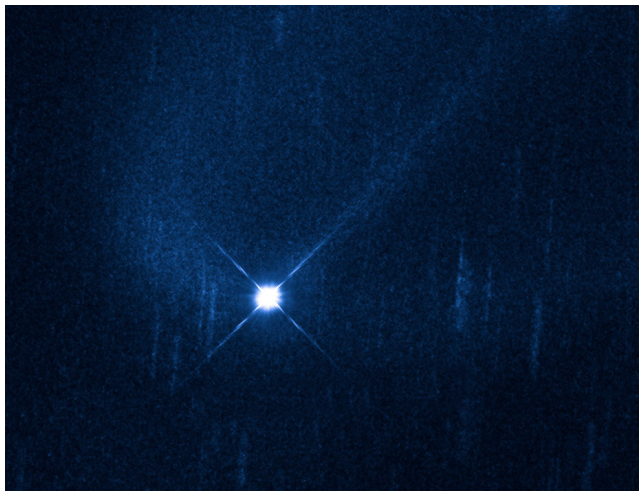
## Recent Asteroid Disruptions - P/2010 A2 (LINEAR)



Jewitt et al. 2010 (Nature 467, 817)

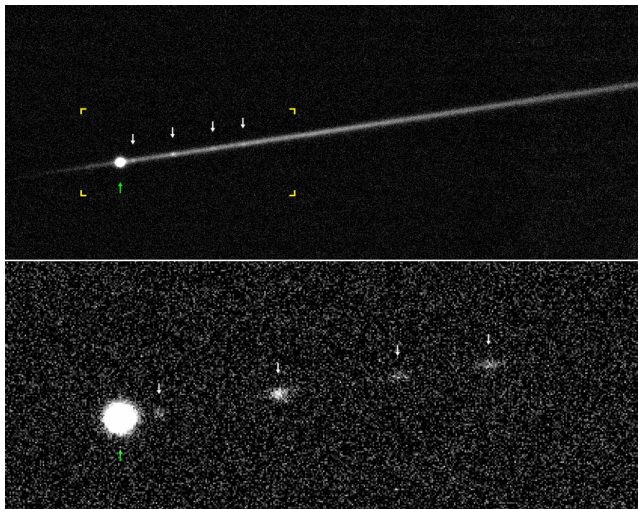


## Recent Asteroid Disruptions - (596) Scheila



Jewitt et al. 2011 (ApJL 733, L4)

## Recent Asteroid Disruptions - P/2012 F5 (Gibbs)



Drahus et al. 2015 (ApJL 802, L8)

## Recent Asteroid Disruptions - P/2012 F5 (Gibbs)



# Hunt for asteroid trails with SALTICAM - the idea

- Search for dust trails in the orbital planes of selected asteroids in the size range 0.5 - 5 km
- Mainly asteroids with fast rotation (including super-fast rotators) - susceptible of rotational and collisional disruption
- Each asteroid observed for at least 1 hour with SALT
- Dust trail is always laying in the asteroid's orbital plane, behind the object - we can precisely calculate its expected shift and position angle on an image.

# Hunt for asteroid trails - why SALT?

- Large aperture
- Dark skies at SAAO
- Excellent seeing not needed
- Absolute flux calibration not needed
- Flexible scheduling

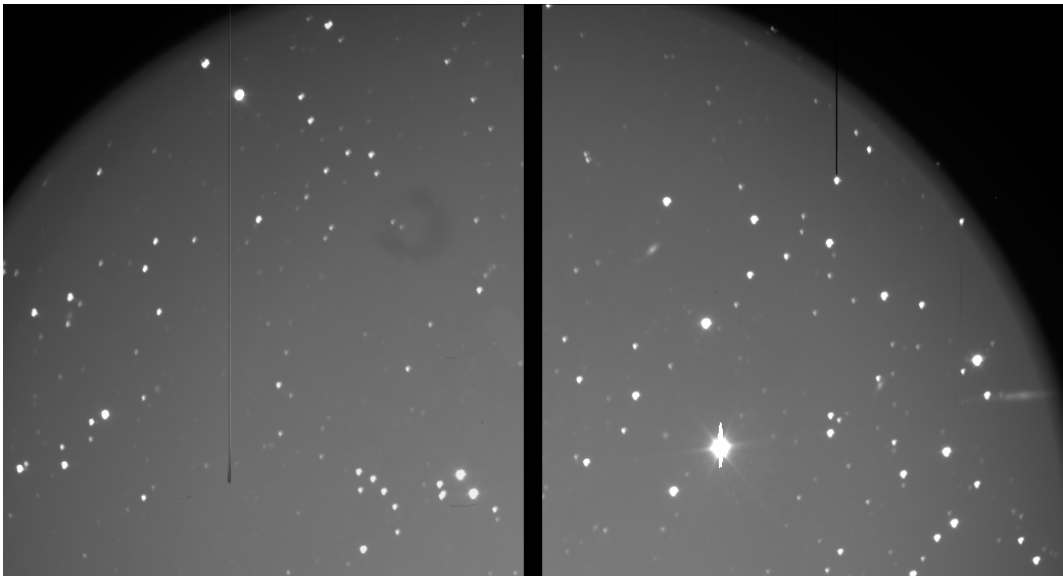
# Hunt for asteroid trails with SALTICAM

Two successful SALT proposals:

- 2017-2-SCI-036 - *Unveiling the recent history of asteroid disruptions with SALTICAM: A pilot*
  - Allocated time:  $\sim 14\text{h}$  (Priority 1 and 2)
  - Completed:  $< 1\text{h}$
- 2018-1-SCI-030 - *Unveiling the recent history of asteroid disruptions with SALTICAM: A pilot*
  - Allocated time:  $\sim 28\text{h}$  (Priority 1 and 2:  $14\text{h}$ )
  - Completed:  $\sim 5\text{h}$

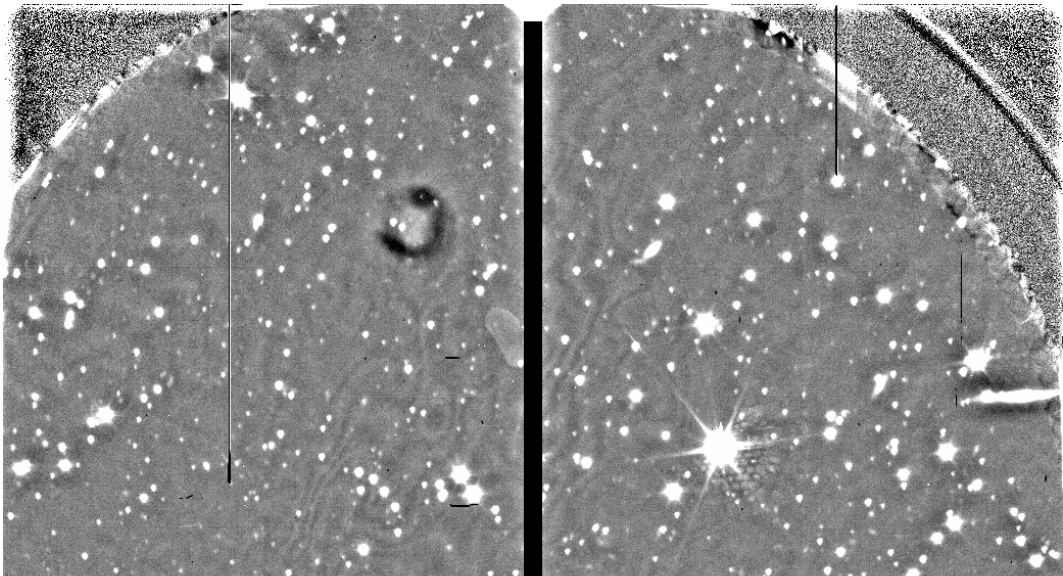


# Test target - P/2012 F5 (SALTICAM data)

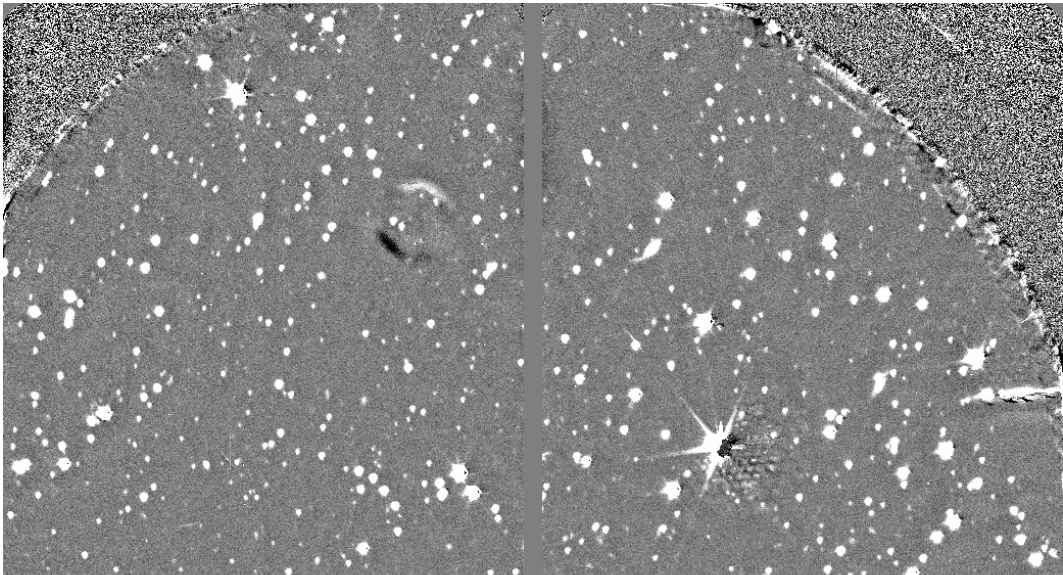




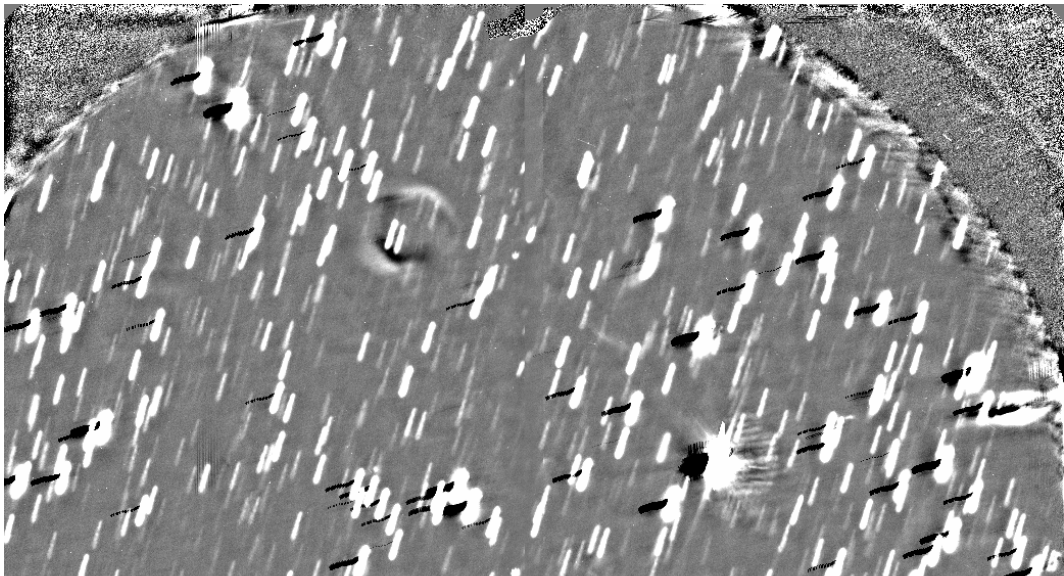
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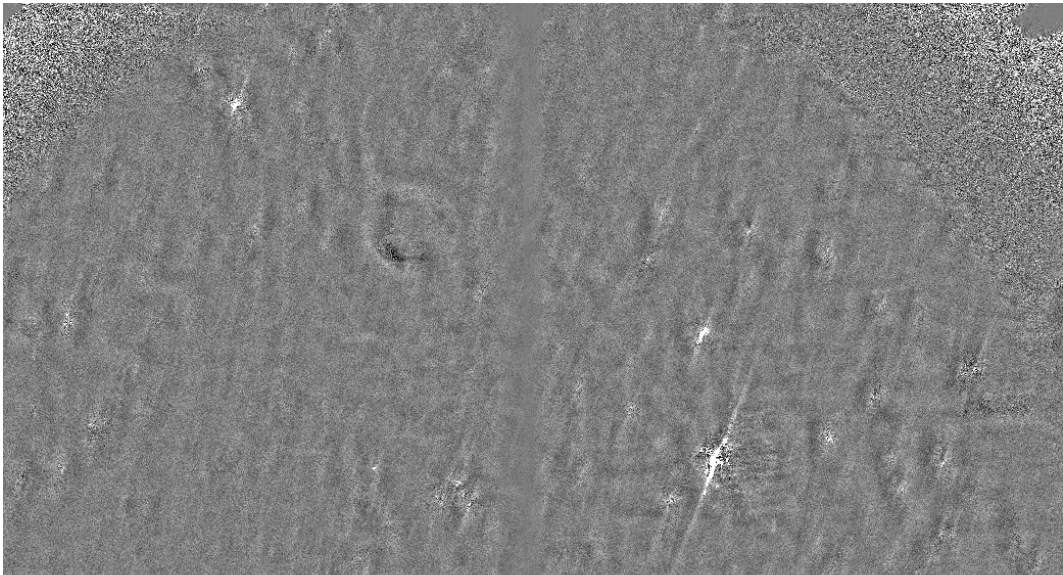


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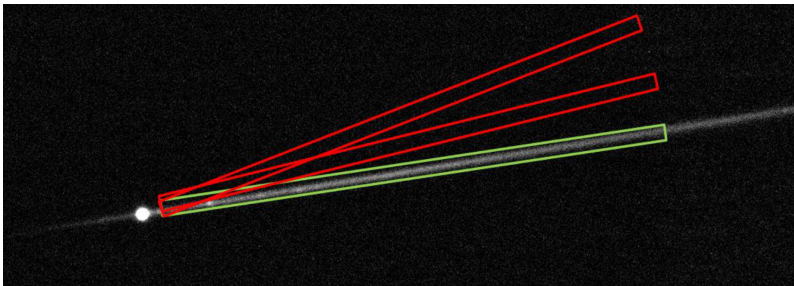




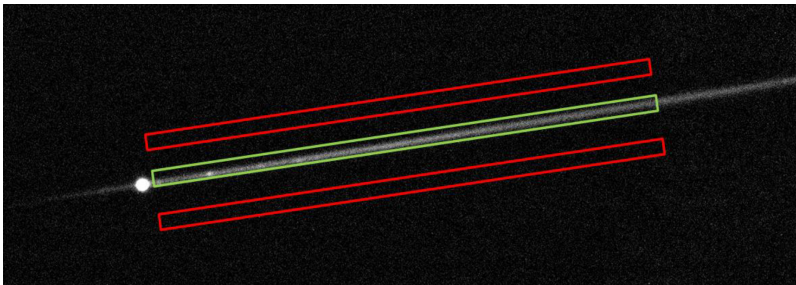
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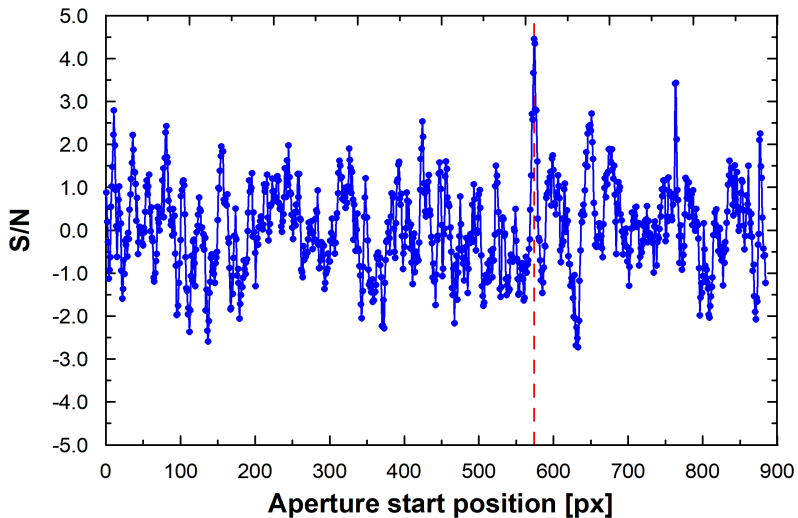
# Detecting the trail



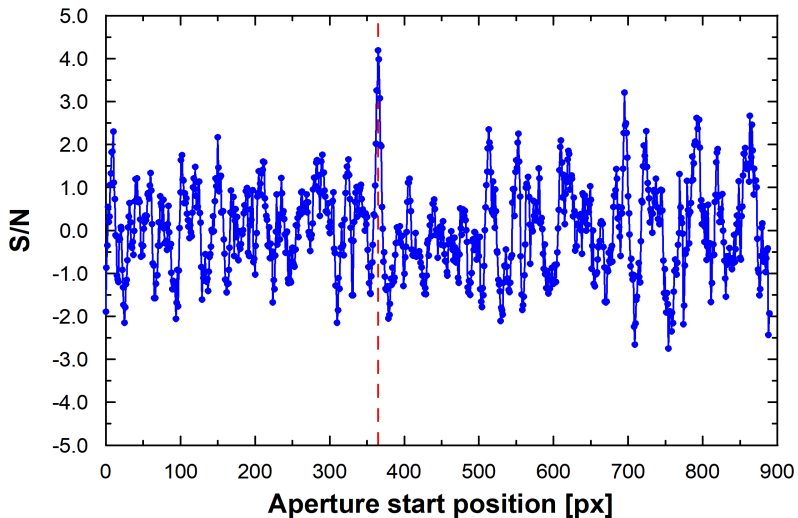
# Detecting the trail



# Detection output - vertical shift

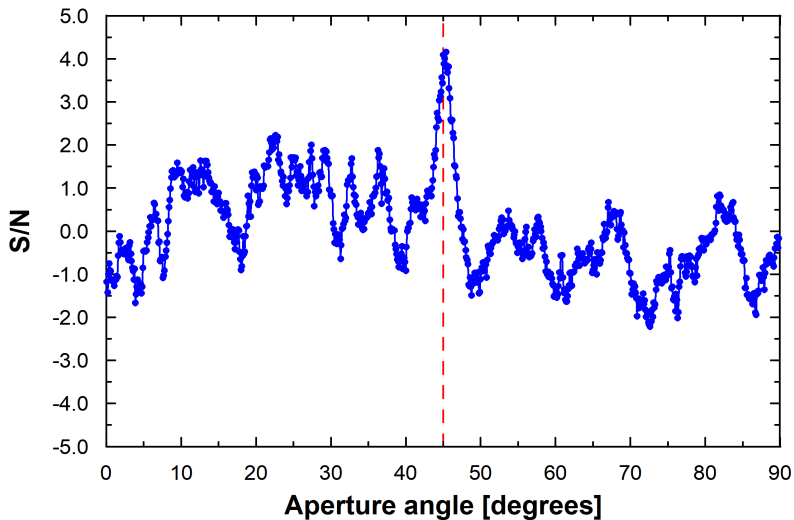


## Detection output - horizontal shift





## Detection output - rotation



# What is limiting our sensitivity?

Identified issues:

- Slowly moving targets - problems with the accurate stars removal
- Non seeing-limited PSF (usually  $\sim 2.5$  arcsec)
- It's impossible to completely disentangle the fringing and flatfield patterns, thus they cannot be completely removed from images.

# How can SALT help us?

Possible improvements:

- new wide filter (possibly VR or similar) with cut-off in IR - significant increase in trails S/N
- seeing limited PSF - increase of S/N for thin trails
- new monolithic CCD; no gap in the middle of an image - no trail signal loss

## Strategy update:

- Smaller number of carefully selected targets
- Each target observed in multiple independent fields - accurate star removal, deeper detection limits
- Targets - super-fast rotators, young asteroid pairs, fast rotators with large rotational lightcurve amplitude