

ESASky SSOSS: A new window for Solar System Data Exploration

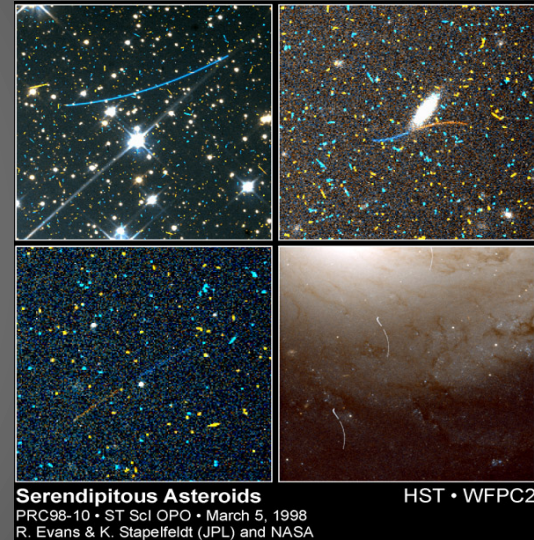
Elena Racero and Fabrizio Giordano

On behalf of ESAC Science Data Centre (ESDC), European Space Agency

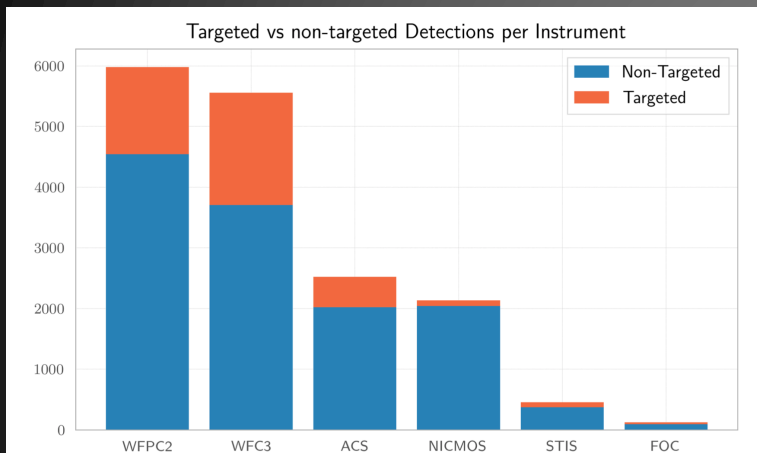
In Collaboration with Benoit Carry, Observatoire de la Cote d'Azur (OCA) & Jerome Berthier, Institute for Celestial Mechanics and Computation of Ephemerides (IMCCE)

27th May 2021

- ❑ Allow users to search through the entire astronomical archives for observations containing Solar System Objects (SSOs), targeted and **serendipitous!**
- ❑ **Scientific exploitation** of ESDC data holdings.
- ❑ HST, Herschel and XMM-Newton missions.

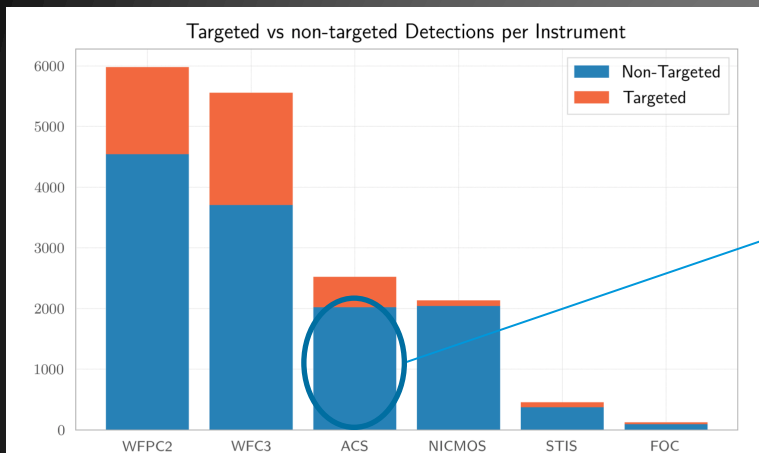


HST Near Earth Object (NEO) population: Total #Detections

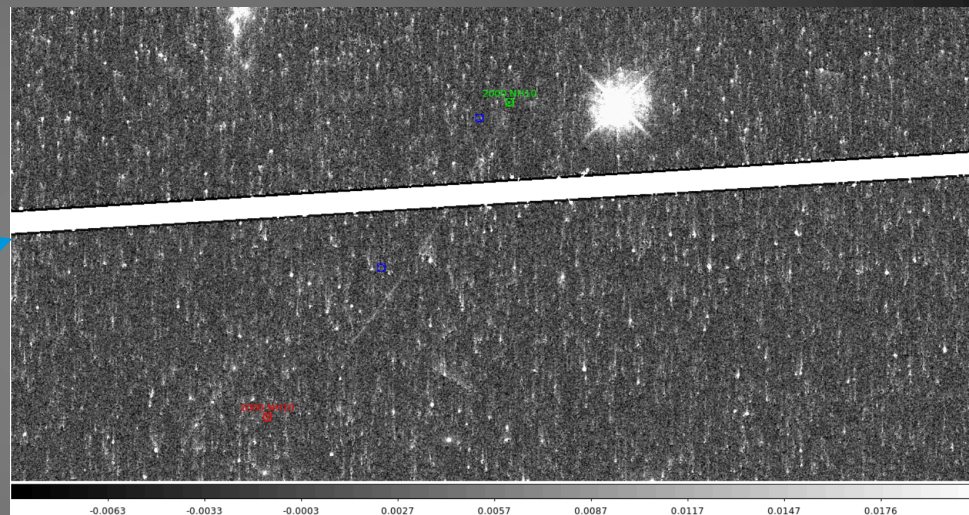


Work presented at ESA SSW11 @ESTEC.
Credits: A.Mahlke

HST Near Earth Object (NEO) population: Total #Detections

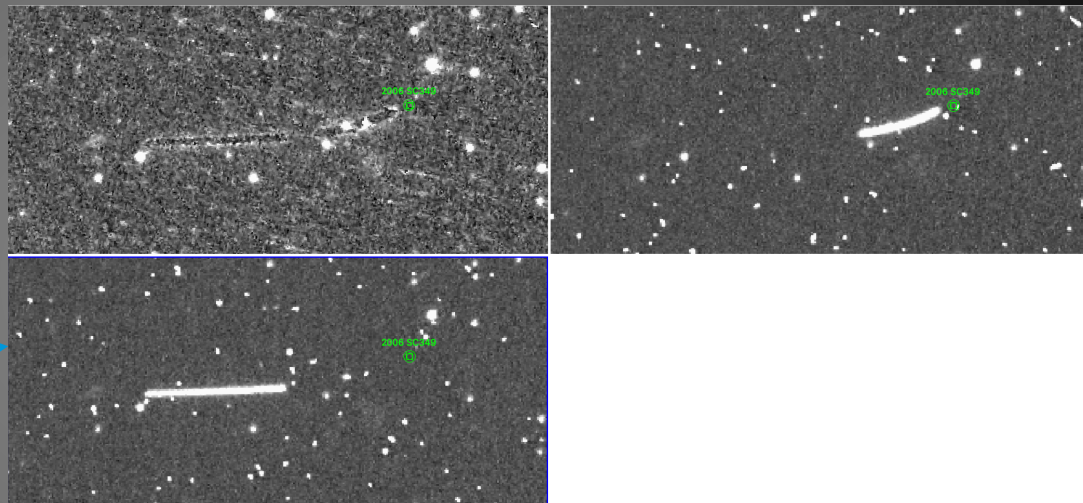
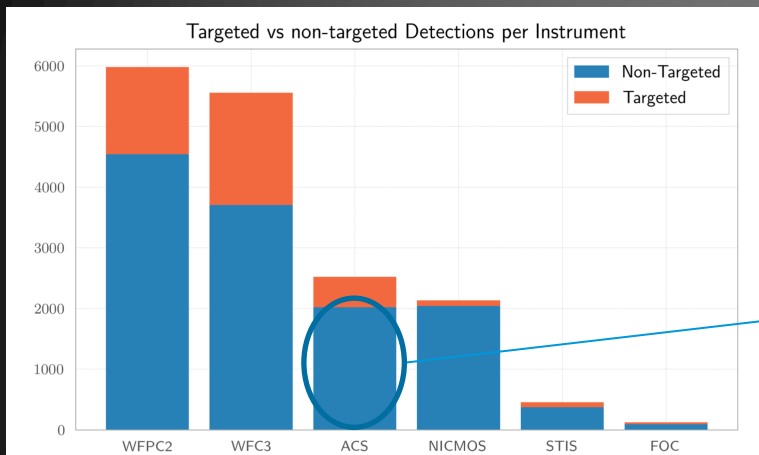


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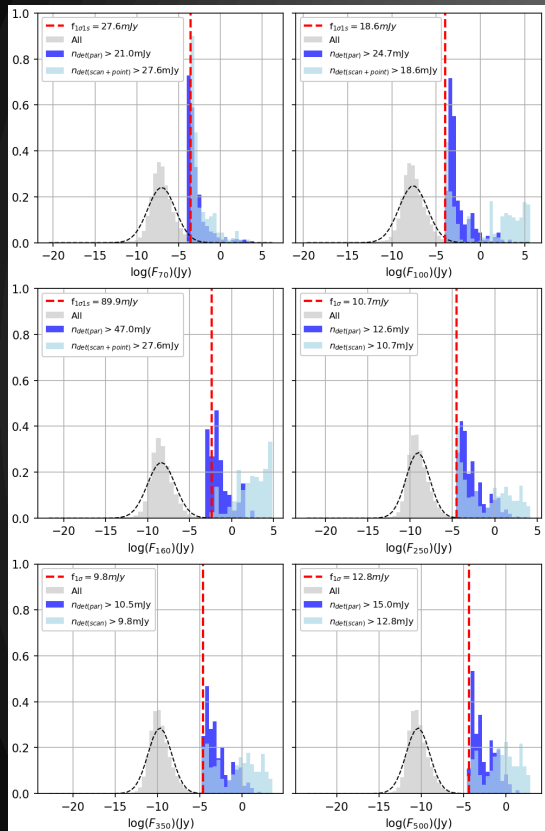
Example 1: a non-targeted observation from ACS for NEO 2000 NH10. Green and red regions mark calculated start and end of asteroid streak by the ESASky algorithm.

HST Near Earth Object (NEO) population: Total #Detections

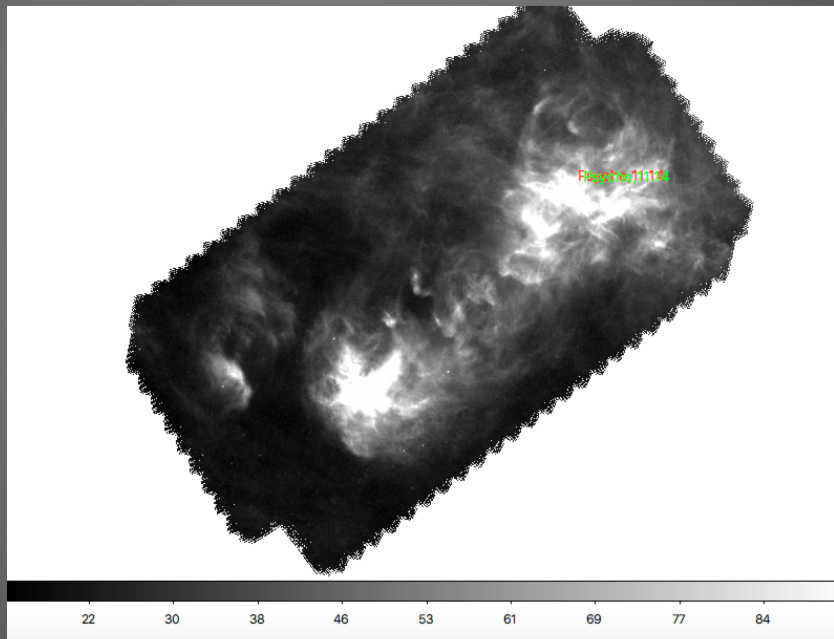


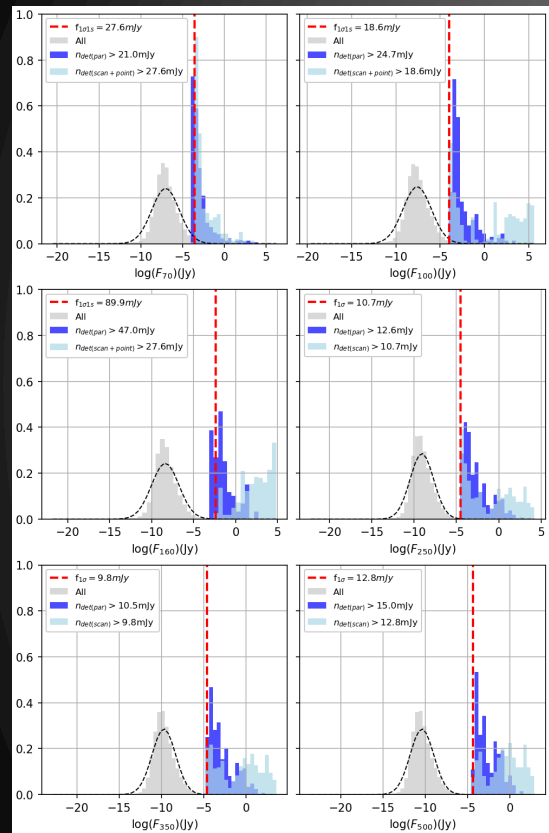
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Example 2: Serendipitous observation of NEO 2006 SC349 by the ACS. The predicted position at the beginning of the observation is shown in green.



Herschel total #detections of SSOs above flux limit:
>900





Herschel total #detections of SSOs above flux limit: >900

SAOImage ds9

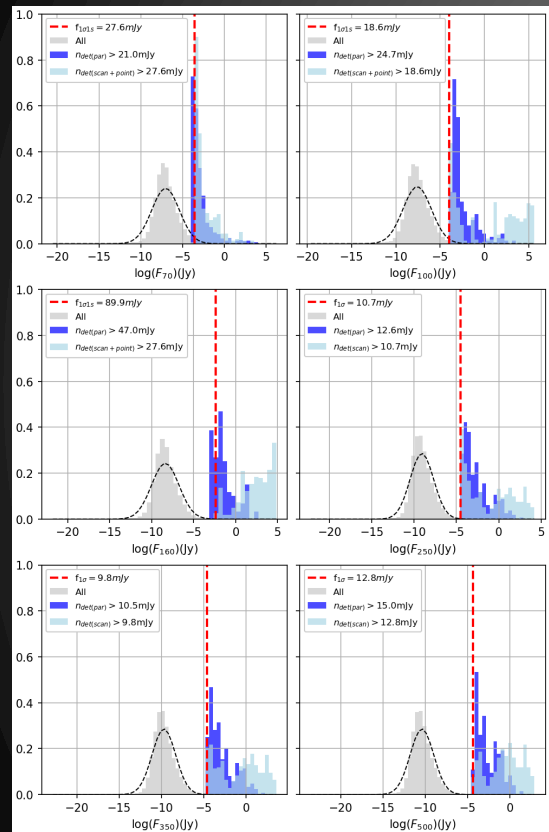
File: hspirepsw275_25pxmp_0430_p2424_1342190654_1342190655_1462372634790.fits[image]

Object Value	62.4696	
fk5 α	4:34:22.918	δ +24:12:24.280
Physical Image X	482.502	893.412
Image X	482.502	893.412
Frame 1 x	2.48832	0

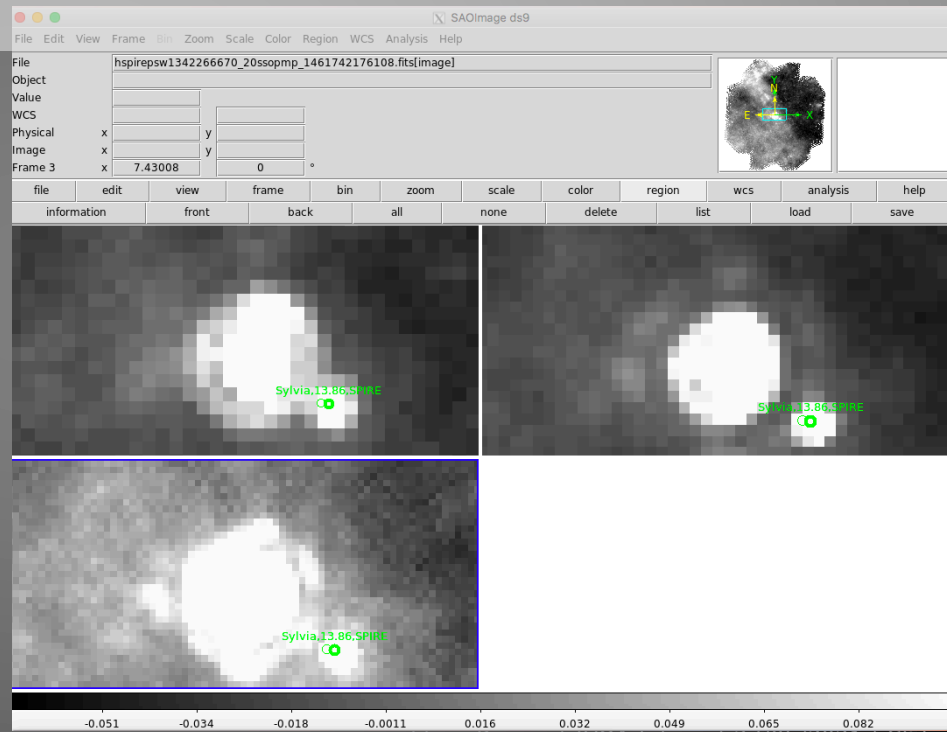
Buttons: file, edit, view, frame, bin, zoom, scale, color, region, wcs, analysis, help

Buttons: linear, log, power, sqrt, squared, asinh, sinh, histogram, min max, zscale

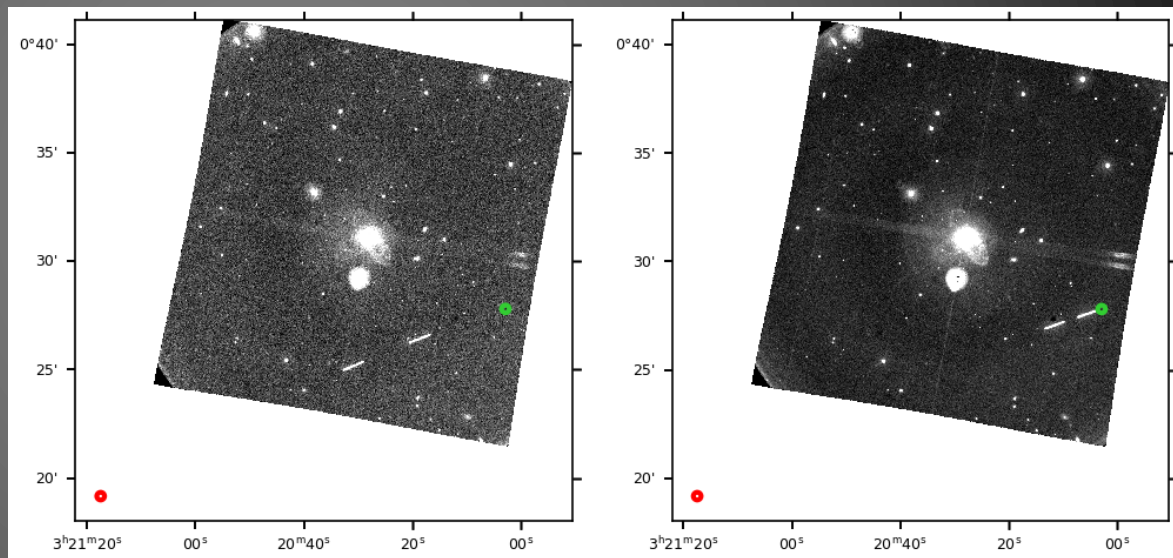
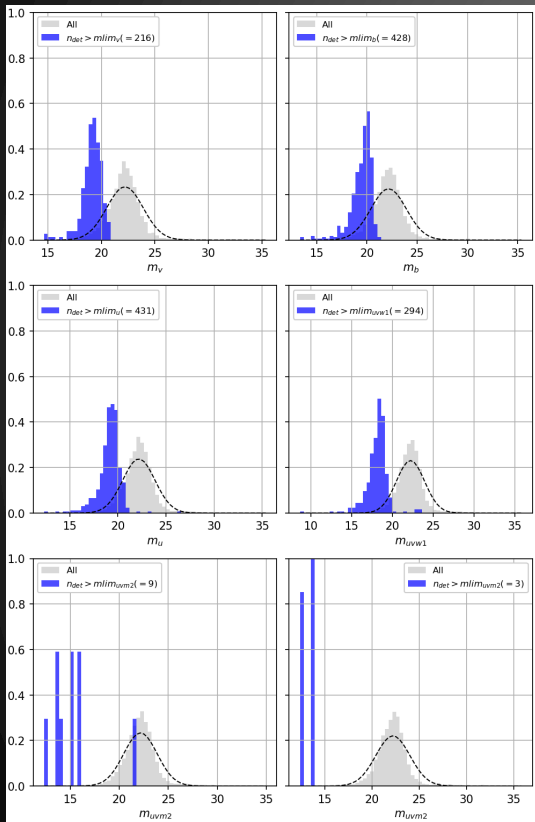
Image showing a Herschel image of a protoplanetary disk with a red dot marking the location of Herpin 13.07. A green circle highlights the detection.



Herschel total #detections of SSOs above flux limit:
>900



XMM-Newton OM total #detections of SSOs above limiting magnitude: > 900







ASTORB

Asteroid dataset @ Lowell Observatory



COMETPRO

Comet dataset @





- Eproc v3.2 
- Orbit sampled evenly every 10 days



- ❑ Eproc v3.2



- ❑ Orbit sampled evenly every 10 days

- ❑ Spacecraft SPICE kernels:

HST: public @ <http://naif.jpl.nasa.gov/pub/naif/HST/>

Herschel: OEM provided by SOC and kernel produced in-house.

XMM-Newton: provided by SOC (P.Rodriguez)

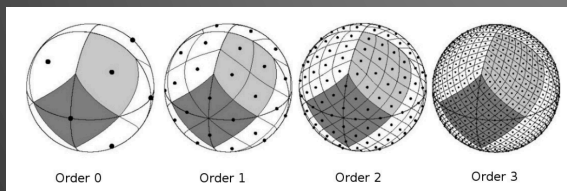
Orbital
Parameters

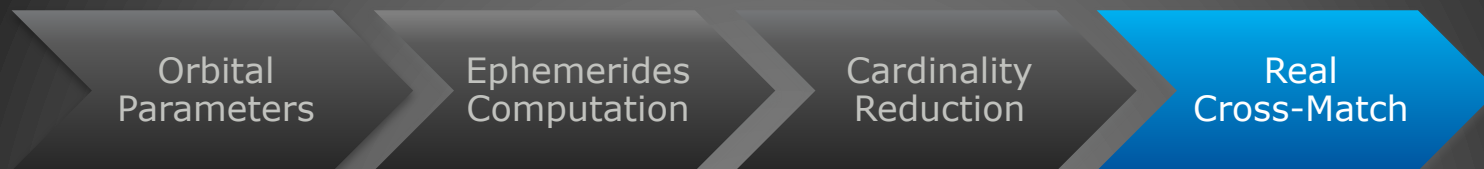
Ephemerides
Computation

Cardinality
Reduction

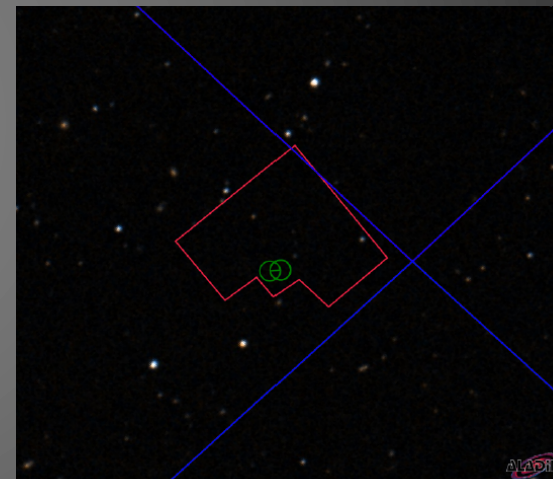
Real
Cross-Match

- ❑ Possible candidates selection based on HEALPix sky tessellation.
- ❑ HEALPix order selected based on distance to the object and proper motion.





- ❑ Precise cross-match: position of SSO re-computed using start time and duration of observation and cross-match performed against image footprint.

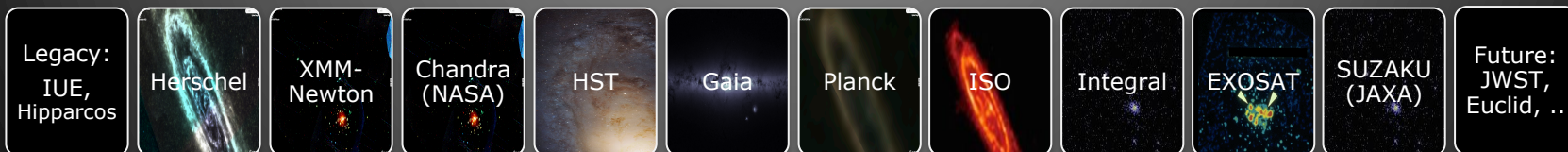


Goal: to facilitate data discovery and archival science for ALL users

- Multi-wavelength
- Project agnostic
- Exploration

Interface “on top of” all ESA astronomy archives

ESASky - sky.esa.int



- ❑ In collaboration with IMCCE, we've added functionality through ESASky that **allows fast discovery of observations from ESA missions that potentially contain SSOs within their field of view.**
- ❑ The value of this service is that it allows you **to visualize the exact predicted position of the solar system object superimposed to a satellite image.**
- ❑ Current version contains all asteroids, comets and planets observed by HST, Herschel and XMM-Newton (EPIC) missions.

- ❑ Future work:
 - Orbital parameters input interface
 - EPN-TAP integration
 - Include more missions

Thanks!



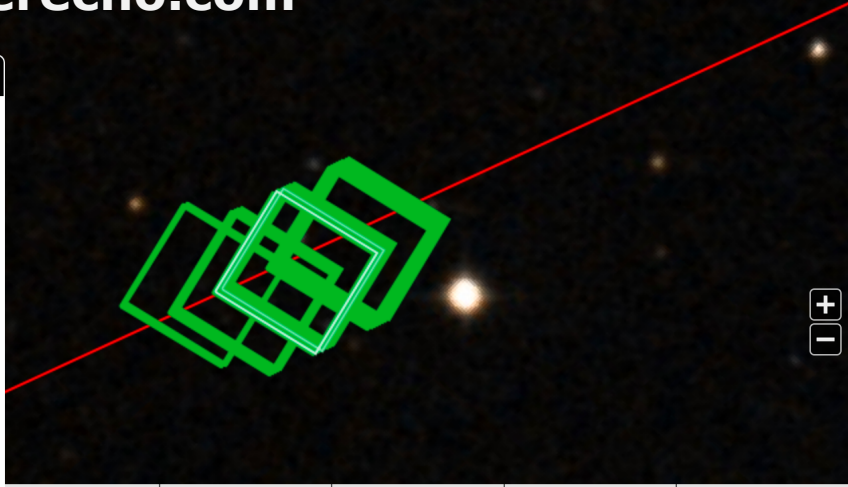
J2000 11 24 00.029 +06 19 54.85 FoV: 09.95' DSS2 color

Sci. Mode Feedback

57 9 683 1 408 6

Feedback: <http://esasky.userecho.com>

Saturn



HST ? X

Observation								
<input type="checkbox"/>			ub963208m					
<input type="checkbox"/>			ub963206m					
<input type="checkbox"/>			ub963207m					
<input checked="" type="checkbox"/>			ub963203m	SATURN-TITAN	170.965636	6.341017	170.965636	6.341017
<input type="checkbox"/>			ub963205m	SATURN-TITAN	170.965331	6.341086	170.965327	6.341087
<input type="checkbox"/>			ub963204m	SATURN-TITAN	170.965456	6.341058	170.965453	6.341059
<input type="checkbox"/>			ub963201m	SATURN-TITAN	170.965966	6.340929	170.965963	6.340930

Dec end	Pos.Err Start	Pos.Err End	Mag. V	Distance
341173			0.67	8.4173
341115			0.67	8.4173
341144			0.67	8.4173
Total mission coverage				
			0.67	8.4174

<http://sky.esa.int>

➤ **How to use ESASky and links to help pages:**

<https://www.cosmos.esa.int/web/esdc/esasky-how-to>

➤ **API: Astroquery python module information:**

<https://www.cosmos.esa.int/web/esdc/esasky-astroquery-module>

➤ **API: ESASky TAP:**

<http://sky.esa.int/esasky-tap/tap>

➤ **How to contribute data to ESASky:**

<https://www.cosmos.esa.int/web/esdc/esasky-contributing>