Planetary Science with Data and Tools from IRSA

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& the IRSA Team

IRSA is a NASA Astrophysics Archive

- NASA Astrophysics supports an integrated system of **science data archives** for legacy, active, and future astrophysics missions:

  - **HEASARC** (High Energy Astrophysics Science Archive Research Center) at GSFC (extreme UV/X-ray/gamma ray data)

  - **MAST** (Mikulski Archive for Space Telescopes), STScI (primarily UV/visible/near IR)

  - **IRSA** (Infrared Science Archive) at Caltech/IPAC (primarily IR and submillimeter)

- **KOA** (Keck Observatory Archive) holds ground-based data from the W.M. Keck observatory

- Thematic archives enable comprehensive views of particular classes of objects

  - **NED** (NASA Extragalactic Database) at Caltech/IPAC: fusion of multiwavelength data and bibliography for objects beyond the Milky Way

  - **LAMBDA** (Legacy Archive for Microwave Background Data) at HEASARC: multimission center of expertise for cosmic microwave background radiation research

  - **NEA** (NASA Exoplanet Archive) at Caltech/NASA Exoplanet Science Institute (NExScI): collating data on exoplanets and their host stars

- **ADS** (Astrophysics Data System) at Smithsonian Astrophysical Observatory: a digital library with bibliographic databases (the topic of a dedicated talk later in the Workshop)

- Central to each archive is the scientific and technical expertise of their staff, and their support for users.

NASA/IPAC INFRARED SCIENCE ARCHIVE

IRSA serves data sets of high value to planetary scientists
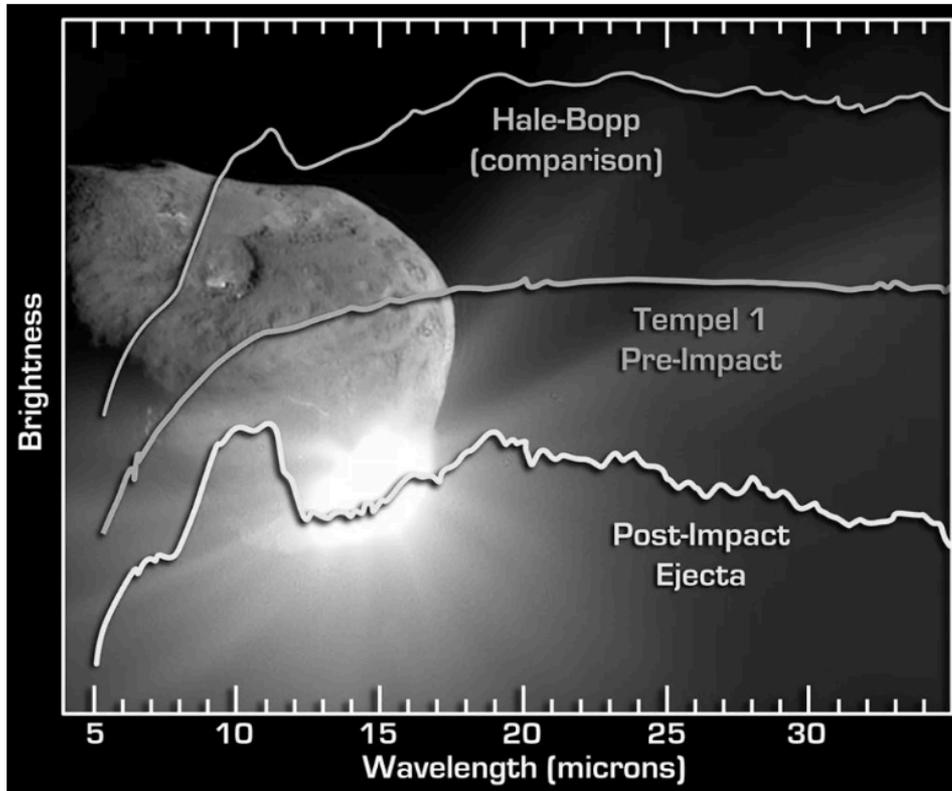
Spitzer

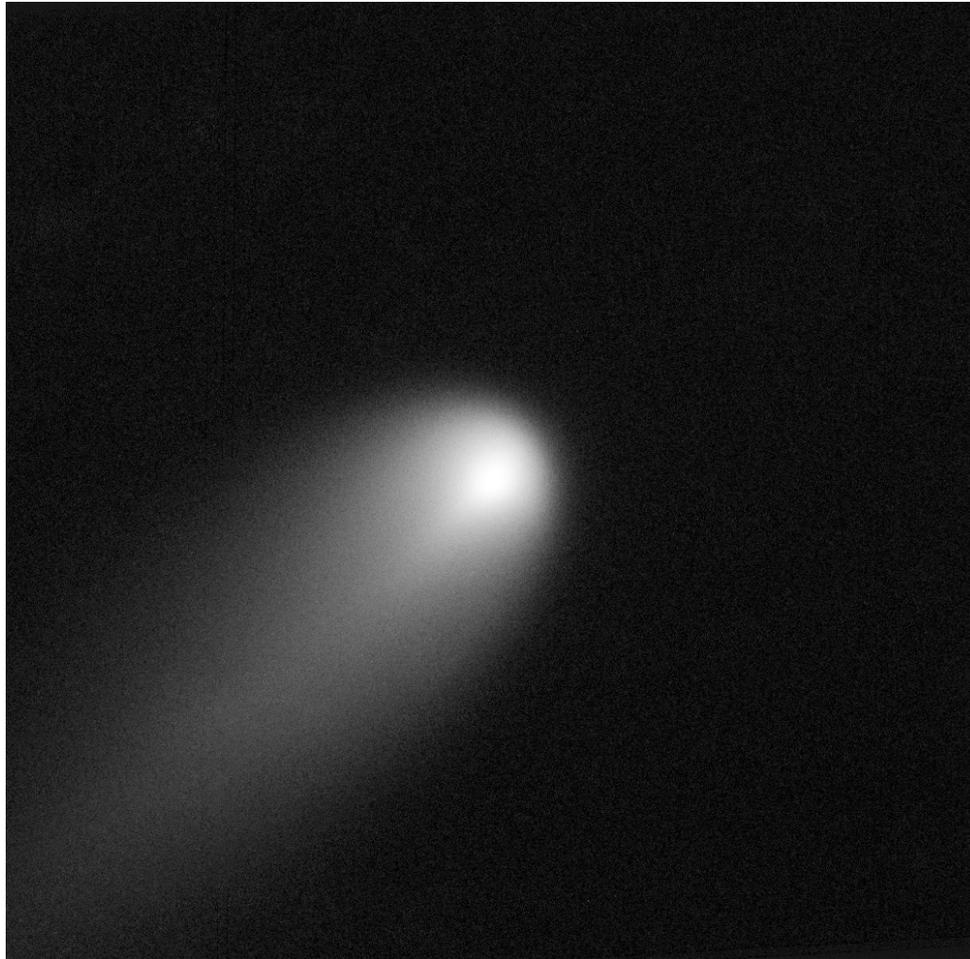NASA/JPL-Caltech/C. Lisse, Johns Hopkins University/University of Maryland

IRSA serves data sets of high value to planetary scientists
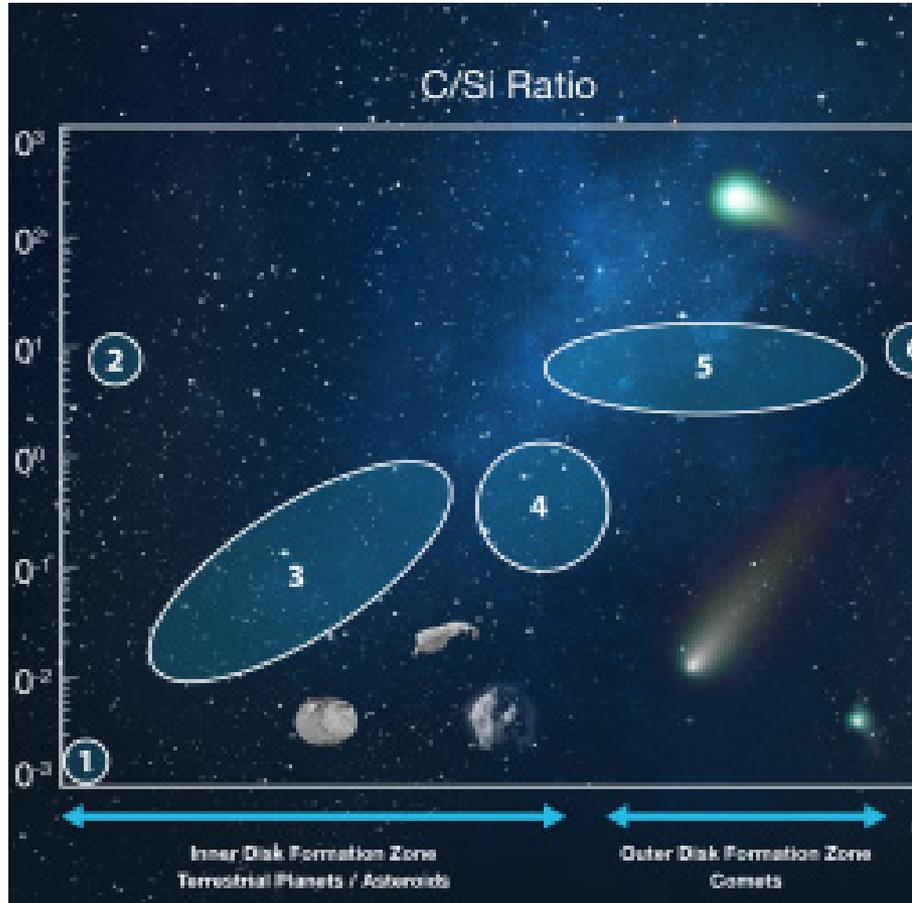

Spitzer
NEOWISE

Vishnu Reddy

IRSA serves data sets of high value to planetary scientists

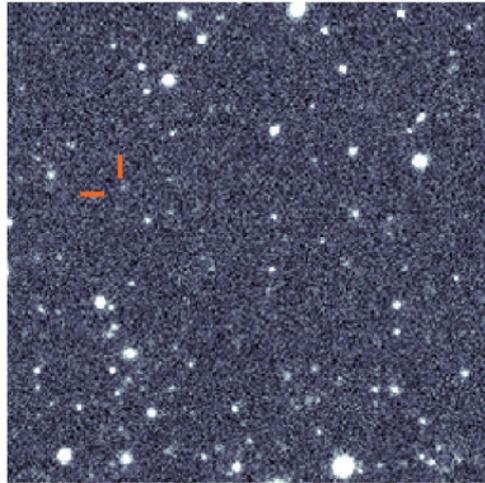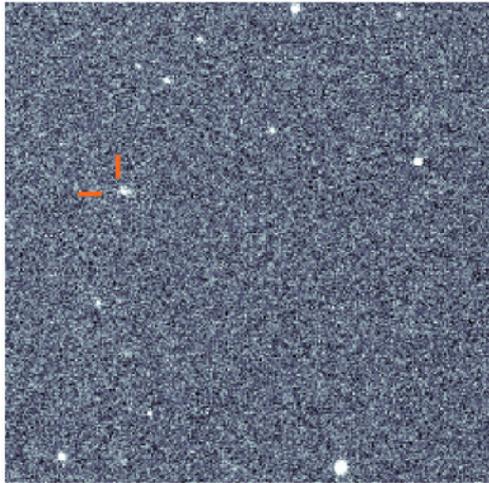NASA IRTF

Spitzer
NEOWISE
IRTF

IRSA serves data sets of high value to planetary scientists
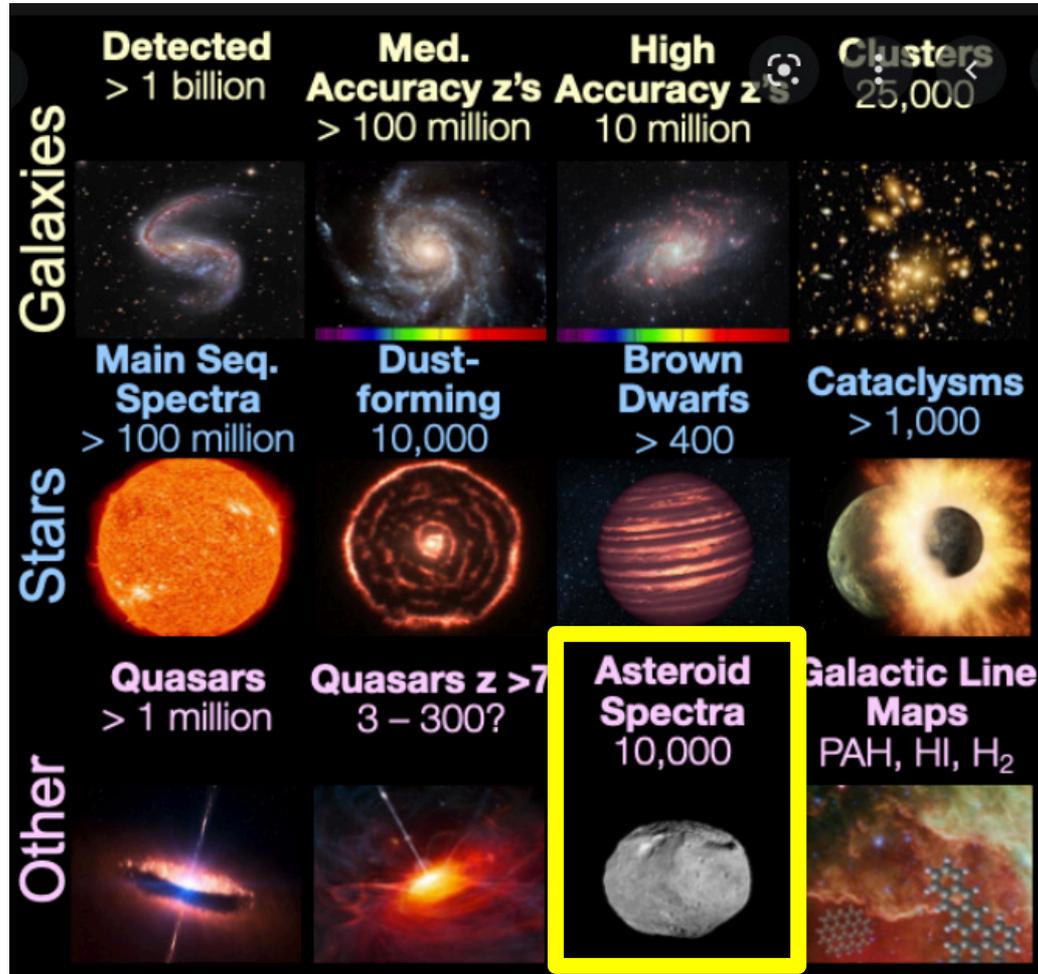

Spitzer
NEOWISE
IRTF
SOFIA

Woodward et al. (2021)

IRSA serves data sets of high value to planetary scientists

Spitzer
NEOWISE
IRTF
SOFIA
ZTF

Duev et al. 2021

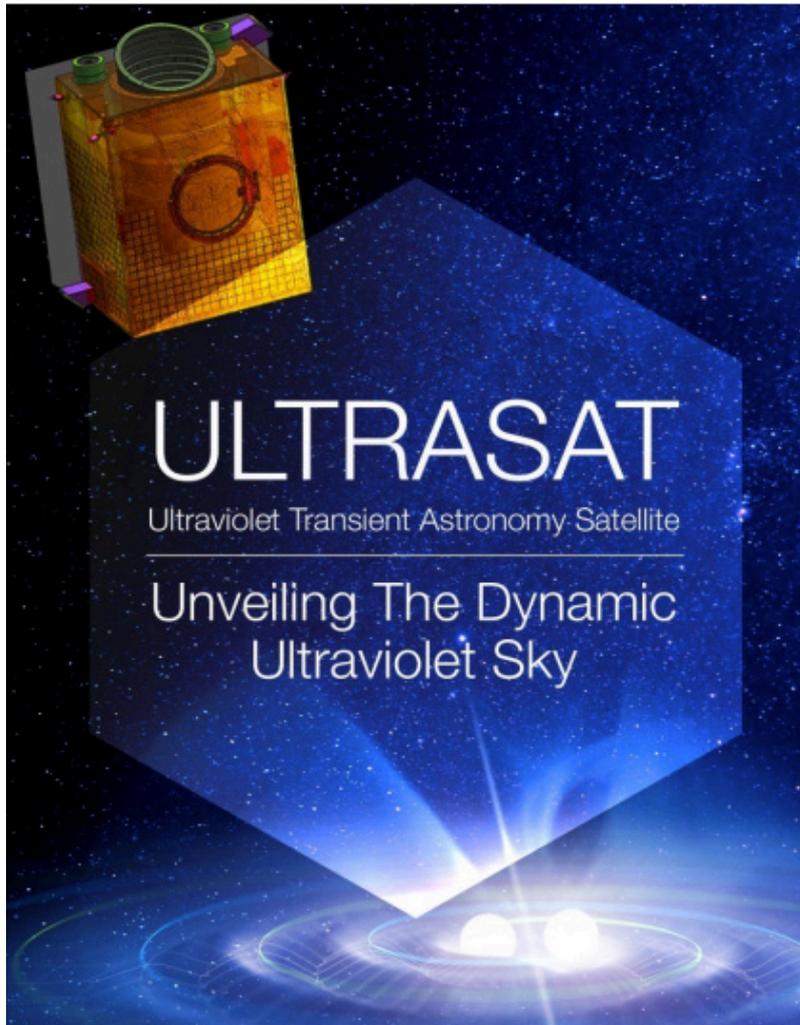# IRSA serves data sets of high value to planetary scientists

Spitzer
NEOWISE
IRTF
SOFIA
SPHEREx

# IRSA serves data sets of high value to planetary scientists

Spitzer
NEOWISE
IRTF
SOFIA
SPHEREx
Euclid

IRSA serves data sets of high value to planetary scientists

ULTRASAT
Ultraviolet Transient Astronomy Satellite

Unveiling The Dynamic Ultraviolet Sky

Spitzer
NEOWISE
IRTF
SOFIA
SPHEREx
Euclid
ULTRASAT

IRSA serves data sets of high value to planetary scientists
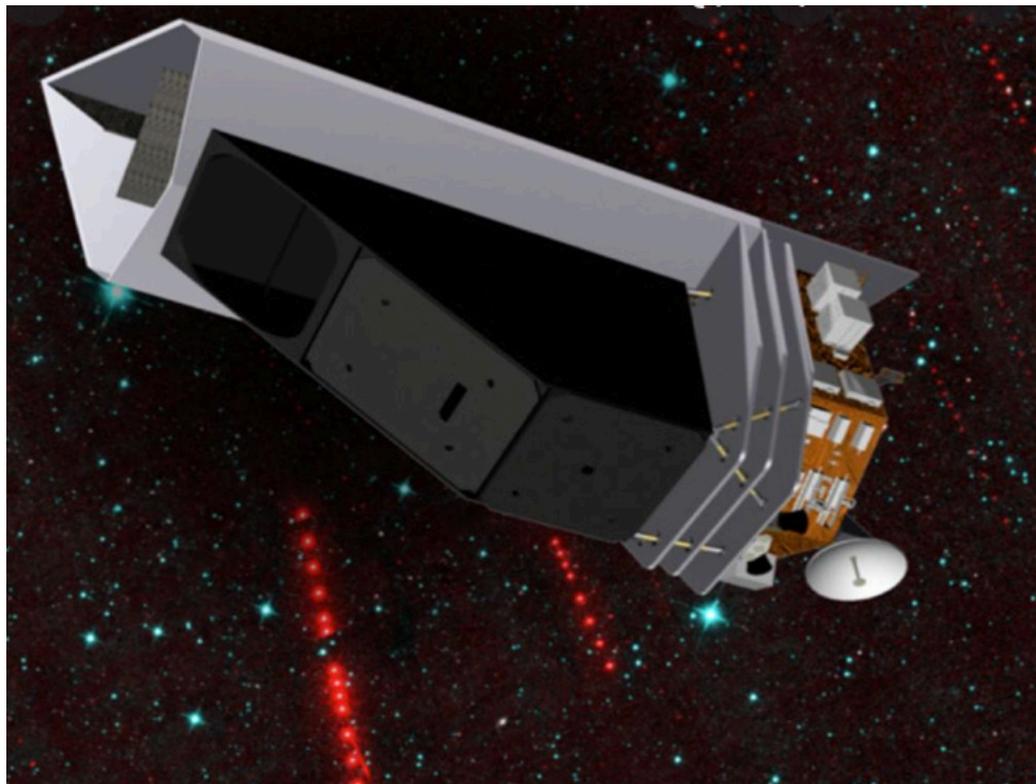
Spitzer
NEOWISE
IRTF
SOFIA
SPHEREx
Euclid
ULTRASAT
NEO Surveyor

IRSA has implemented tools to make planetary objects easier to find

- **Moving Object Search:**
  - Find observations intended to study moving objects
  - Requires observations to be tagged ahead of time
- **Precovery:**
  - Find me observations that were taken at the right time and place to possibly contain detections of a moving object I am interested in
  - Requires knowing the time and spatial extent of each observation

WISE Precovery Example

Search by Solar System Object/Orbit

| **Object Name** | MPC Input | Manual Input |

Object Name or ID: `pallas` ⚠

Name:**2 Pallas**, NAIF ID: **2000002**

Observation Date (UT):   Begin: `yyyy-mm-dd`   End: `yyyy-mm-dd`

Enter date range to search, format example: 2017-12-31.

Return Image Size (leave blank for full images):   `500`   arcseconds ▾

Overlay Catalog   ○ Yes   ⦿ No

Image Set: ☑ All-Sky (4 band)   ☐ 3-Band Cryo   ☐ Post-Cryo (2 band)   ☐ NEOWISE-R

▶ Obsolete preliminary release data

Return the following bands: ☑ W1   ☑ W2   ☑ W3   ☑ W4

[Search] [Cancel]

WISE Precovery Example

Search by Solar System Object/Orbit

Object Name	**MPC Input**	Manual Input

Object Type: Asteroid ▾

MPC 1-Line Input:

Observation Date (UT): Begin: yyyy-mm-dd   End: yyyy-mm-dd

Enter date range to search, format example: 2017-12-31.

Return Image Size (leave blank for full images): 500   arcseconds ▾

Overlay Catalog ○ Yes ● No

Image Set: ☑ All-Sky (4 band) ☐ 3-Band Cryo ☐ Post-Cryo (2 band) ☐ NEOWISE-R

▶ Obsolete preliminary release data

Return the following bands: ☑ W1 ☑ W2 ☑ W3 ☑ W4

Search   Cancel

WISE Precovery Example

WISE Precovery Example

WISE Precovery Example

Moving Object Search Tool (MOST) API

MOST Application Program Interface (API)

The MOST API allows scripting of requests via a command-line call. An example:

curl -o out.tbl "https://irsa.ipac.caltech.edu/cgi-bin/MOST/nph-most?catalog=wise_merge&input_type=name_input&obj_name=Victoria&obs_begin=2014+05+01&obs_end=2014+05+

Calls when using orbital elements are slightly different for asteroids and comets:

Asteroid

curl -o out.tbl "https://irsa.ipac.caltech.edu/cgi-bin/MOST/nph-most?
catalog=wise_merge&obs_begin=2010+01+01&obs_end=2010+05+01&obj_type=Asteroid&input_type=manual_input&body_designation=TestAsteroid&epoch=55273.0&semimajor_

Comet

curl -o out.tbl "https://irsa.ipac.caltech.edu/cgi-bin/MOST/nph-most?
catalog=wise_merge&obs_begin=2010+07+01&obs_end=2010+08+01&obj_type=Comet&input_type=manual_input&body_designation=TestComet&epoch=55368.0&perih_dist=1.49

And similarly for MPC input:

Asteroid

curl -o out.tbl "https://irsa.ipac.caltech.edu/cgi-bin/MOST/nph-most?catalog=wise_allsky_4band&obj_type=Asteroid&input_type=mpc_input&mpc_data=00324+6.82+0.09+K103I+64.
(324)+Bamberga+20150614&output_mode=Brief"

Comet

curl -o out.tbl "https://irsa.ipac.caltech.edu/cgi-bin/MOST/nph-most?catalog=wise_allsky_4band&obj_type=Comet&input_type=mpc_input&mpc_data=PK10N010+2010+08+16.1477+

Summary of Solar System Content in KOA

Solar System Object	Number of Science Observations
Mercury	710
Venus	110
Mars	3,626
Jupiter (*)	31,830
Saturn (*)	24,300
Uranus	9,358
Neptune	10,132
Pluto	21,894
Dwarf Planets (excl. Pluto)	8,420
Asteroids	5,263
Comets	2,898

* Includes satellites

KOA Archives all observations acquired at the Keck Observatory Since 1994

Solar System Content Of KOA

KOA Data Access Services

Coming soon: Access through PyKOA Python client

Web form @ https://koa.ipac.caltech.edu

MOSS output preview for Instrument: NIRSPEC and Object: Phobos

[Image 0]

Subset Image	KOAID	UT Obs Date Time	MJD Obs Date	RA	Dec
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[Spec 0]	NS.20010429.55633.fits	2001-04-29 15:27:13.63	52028.643908	268.0160600000	-24.0847580000
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[Spec 0]	NS.20010429.56120.fits	2001-04-29 15:35:20.69	52028.649545	268.0147900000	-24.0861380000
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Showing records 1 to 20 of 147 (147 total)   Reset Filters

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