ESASky

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Astronomy evolving to a data-rich field

- While the amount of data is growing exponentially, the number of scientists working with it is growing linearly.
- This means that in the future data might compete to get users to look at them, and not vice versa as it happens now. (!)
A growing number of archival papers

- Image from the HST 10,000 science publications press release in June 2011, showing the number of archival papers (AR) increasing whilst General Observer (GO) papers are around the same number from 1997 to 2010:

- One reason for the surge -> the telescope’s longevity. Hubble has amassed almost 27 years of data, and astronomers are finding new uses for the data. Projects not imagined when observations were taken.
Goal: to facilitate data discovery and archival science for ALL users

- Multi-wavelength
- Project agnostic
- Exploration

Interface to all astronomy archives

First release in May 2016:
http://sky.esa.int

Legacy:
- IUE
- Herschel
- XMM-Newton
- HST
- Planck
- ISO
- Integral
- EXOSAT

Future:
- Gaia
- JWST
- Euclid

ESASky concept

Legacy Archives

Active Archives

Archives in dev.
**Goal**: to facilitate data discovery and archival science for ALL users

- Multi-wavelength
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Interface to all astronomy archives

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ESASky data contents roadmap

Prototype (summer 2014)
- **All-sky HiPS mosaics:**
  - XMM-Newton (CDS)
  - HST (CDS)
  - Planck (CDS)
  - Herschel-SPIRE (ESA)
- **Science ready data (imaging):**
  - XMM-Newton
  - HST (core)
  - Herschel-SPIRE
- **Catalogs:**
  - 3XMM-DR4
  - XMM Slew
  - XMM OM

First Release (May 2016)
- **All-sky HiPS mosaics:**
  - EXOSAT (ESA)
  - INTEGRAL (ESA)
  - XMM-Newton (ESA)
  - HST (ESA)
  - ISO (ESA)
  - AKARI (ESA)
  - Herschel (ESA)
  - Planck (ESA)
  - JAXA/SUZAKU
- **Science ready data (imaging):**
  - INTEGRAL
  - XMM-Newton
  - HST
  - ISOCAM
  - Herschel
  - JAXA/SUZAKU
- **Catalogs:**
  - 3XMM-DR5
  - XMM Slew
  - XMM OM
  - Hubble Source catalog
  - Hipparcos
  - **Gaia**
  - AKARI catalogs
  - Herschel Point Source Catalogs
  - Planck catalogs

Second release (fall of 2017)
- **All-sky HiPS mosaics**
- **Science ready data (imaging and spectra):**
  - EXOSAT
  - INTEGRAL
  - XMM-Newton
  - IUE
  - HST
  - ISOCAM
  - Herschel
- **Catalogs:**
  - 3XMM-DR6
  - XMM Slew
  - XMM OM
  - Hubble Source catalog
  - Hipparcos
  - **Gaia**
  - AKARI catalogs
  - Herschel Point Source Catalogs
  - Planck catalogs

Aim: continuous integration, testing and releasing
ESASky feature roadmap

Prototype (summer 2014)
- Web interface
- All-sky HiPS mosaics from CDS
- Detailed footprints (imaging)
- Multi-target functionality

First Release (May 2016)
- Scientific validation of footprints and ESA all-sky HiPS by ESA
- Download management
- Multi-target summary table
- Interoperability with VO tools
- Documentation
- Helpdesk Support
- Hardware scaling requirements
- Refactoring of prototype into robust and stable application

Second release (fall 2016)
- Link to Vizier/Simbad
- Generation of detailed footprints (spectra)
- Imaging and spectroscopic data
- Online visualization of data
- On demand overlaying of footprints for pre-planning

Third release (2017)
- Sample manipulation
- Time-series
- Observation planning
- State-fullness
- Massive data visualization
- Link to publications?
- Mobile app?

Aim: continuous integration, testing and releasing
Try the ESASky yourself!

http://sky.esa.int

Video at https://youtu.be/OfcKznpxUr4
JWST observation quicklook planning tool

![JWST Observation Quicklook Planning Tool](image)

Bruno Merin | ESASky | LineA Webinar | 6/April/2017 | Slide 10

ESA UNCLASSIFIED - Releasable to the Public
Thanks!

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http://www.cosmos.esa.int/web/esdc/esasky-help
Additional slides
HiPS: Hierarchical Progressive Survey

- HEALPix sky tessellation
- Number of levels depend on pixel angular resolution
  - Planck (low) 3 levels
  - Herschel (medium) 7 levels
  - HST (high) 14 levels

Footprints

- HST: Provided by project
- Herschel: Footprint Finder (ST-ECF)
- XMM: Instrumental + pointing
ESASky v1.0 - Backend Data Access

- Apache HTTP Server
  - Serves HiPS requests
- Java Servlet container
  - Serves TAP & Target Resolver requests
- Database
  - PostgreSQL DB
  - Spherical data types library (PgSphere)
  - Footprints -> Spherical data types
- Usage of IVOA Protocols & Standards
  - TAP requests
  - ADQL translation to SQL + PgSphere
  - Storage of STC-S footprint information
ESASky v1.0 - Frontend

- Running on a Web Browser (HTML5/CSS3)
- Google Web Toolkit
  - Aladin Lite wrapper (JSNI)
  - Data Visualization (Highcharts)
- Usage of IVOA Protocols
  - TAP accessing archive metadata
  - ADQL describing complex FoVs
- Astronomical services access
  - Target coordinates resolver
  - Angular size resolver
ESASky team

- Fabrizio Giordano (key person, full-time)
- Henrik Norman (full-time, GUI and astropy)
- María Henar Sarmiento (part-time, GUI)
- Elena Racero (part-time, HiPS and footprints)
- Belén López Martí (full-time EXPRO, HiPS development)
- Pilar de Teodoro (part-time, DB)
- Sara Nieto (part-time, DB ingestion)
- Raúl Gutiérrez (part-time, backend)
- Juan González (part-time, DB optimization)