AENEAS: An SKA Regional Centre for Europe

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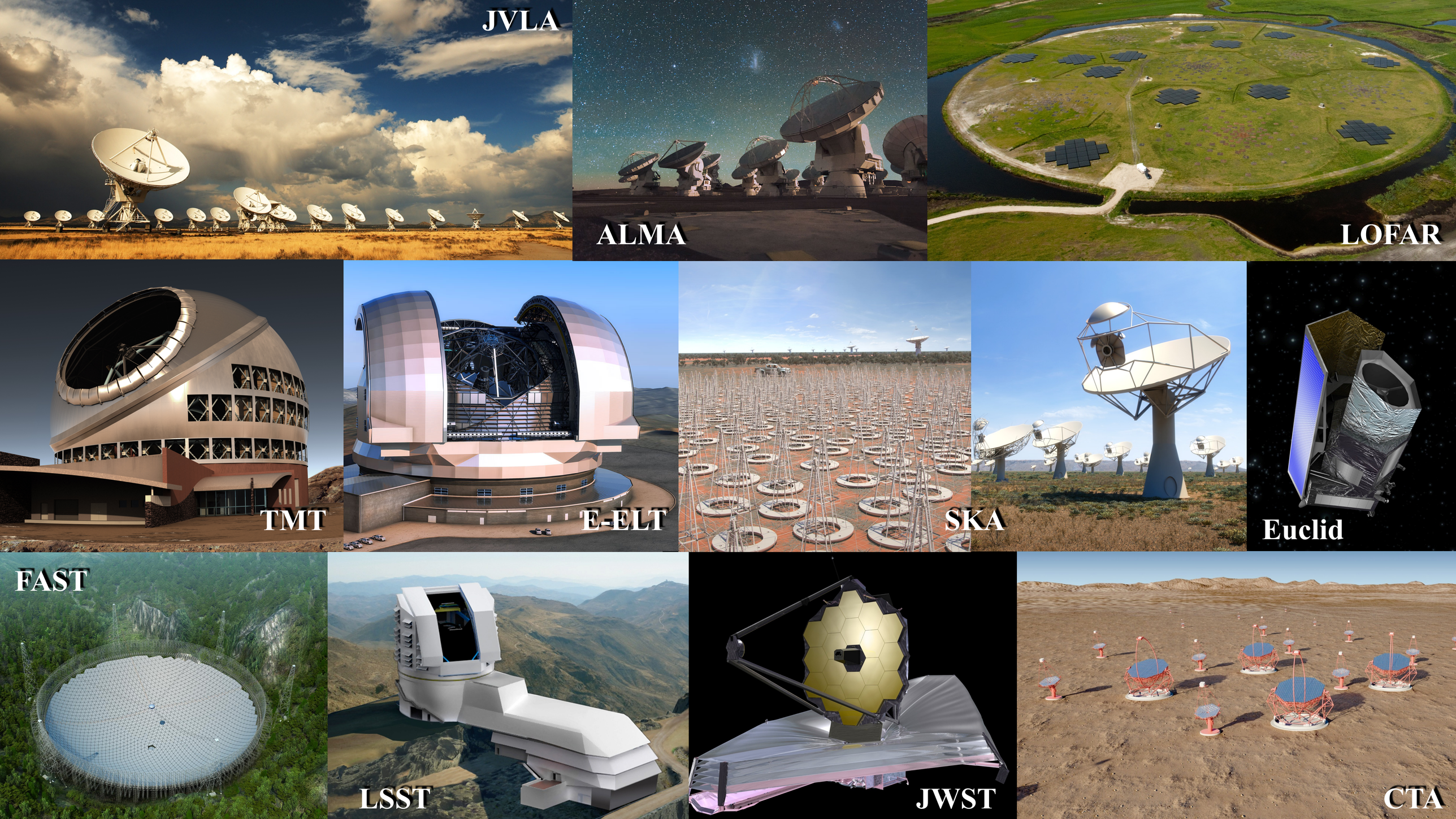
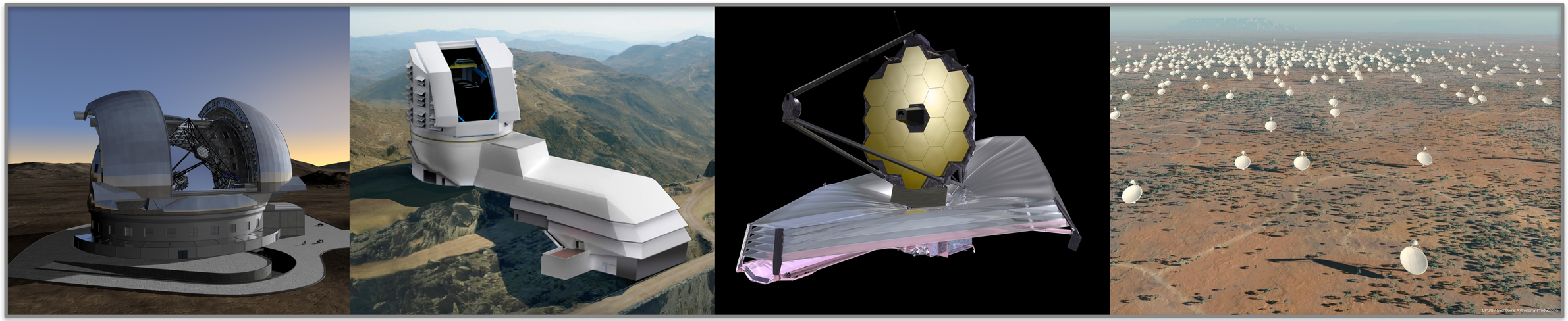

JVLA
ALMA
LOFAR
TMT
E-ELT
SKA
Euclid
FAST
LSST
JWST
CTA

Data Intensive Astronomy



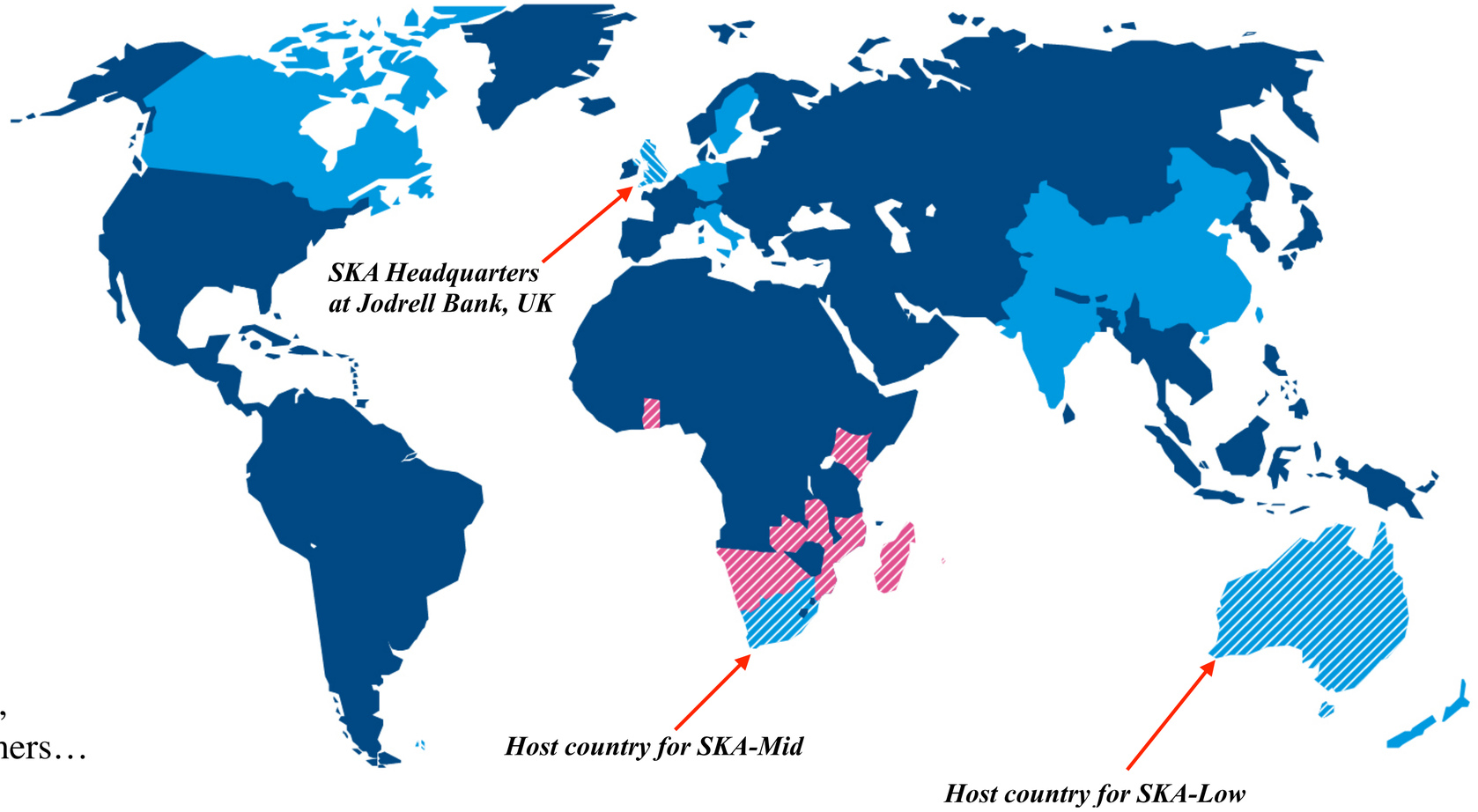
- Science is increasingly driven by large data sets
- Massive data collections and large scientific collaborations
- Most science extraction is based on the archived data
- Current instruments already producing petascale datasets

New science infrastructures will produce exascale data!

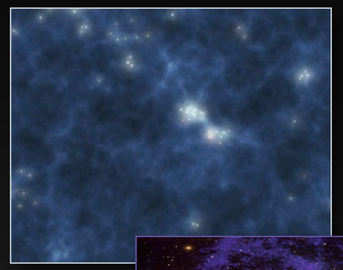
The Square Kilometre Array

- Australia
- Canada
- China
- India
- Italy
- Netherlands
- New Zealand
- South Africa
- Sweden
- UK

Potential new members: Spain, Portugal, Germany, France, others…

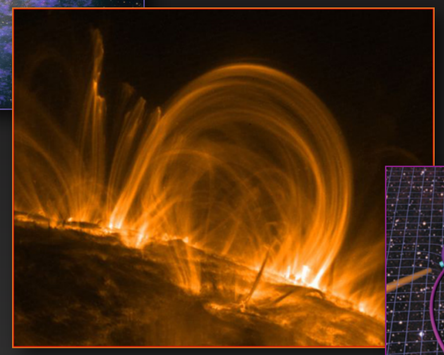


SKA Science Drivers

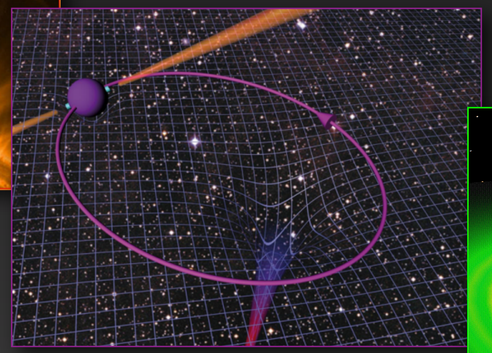


The First Stars

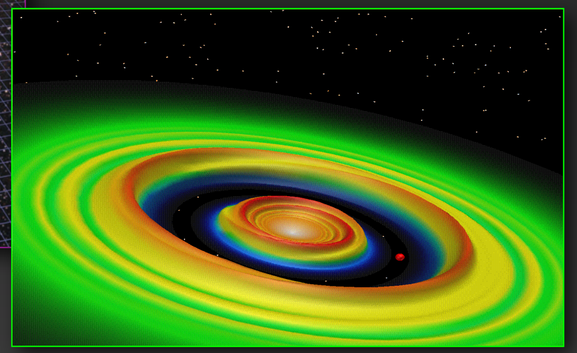
Cosmic Evolution



Cosmic Magnetism

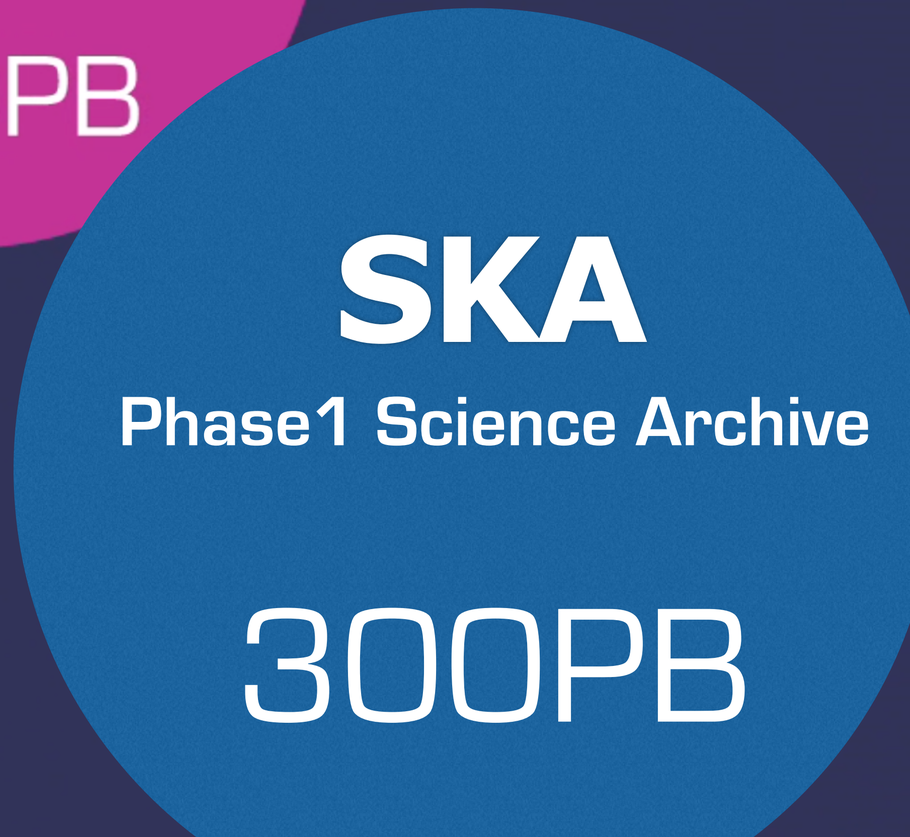


Gravitational Physics



Origins of Life

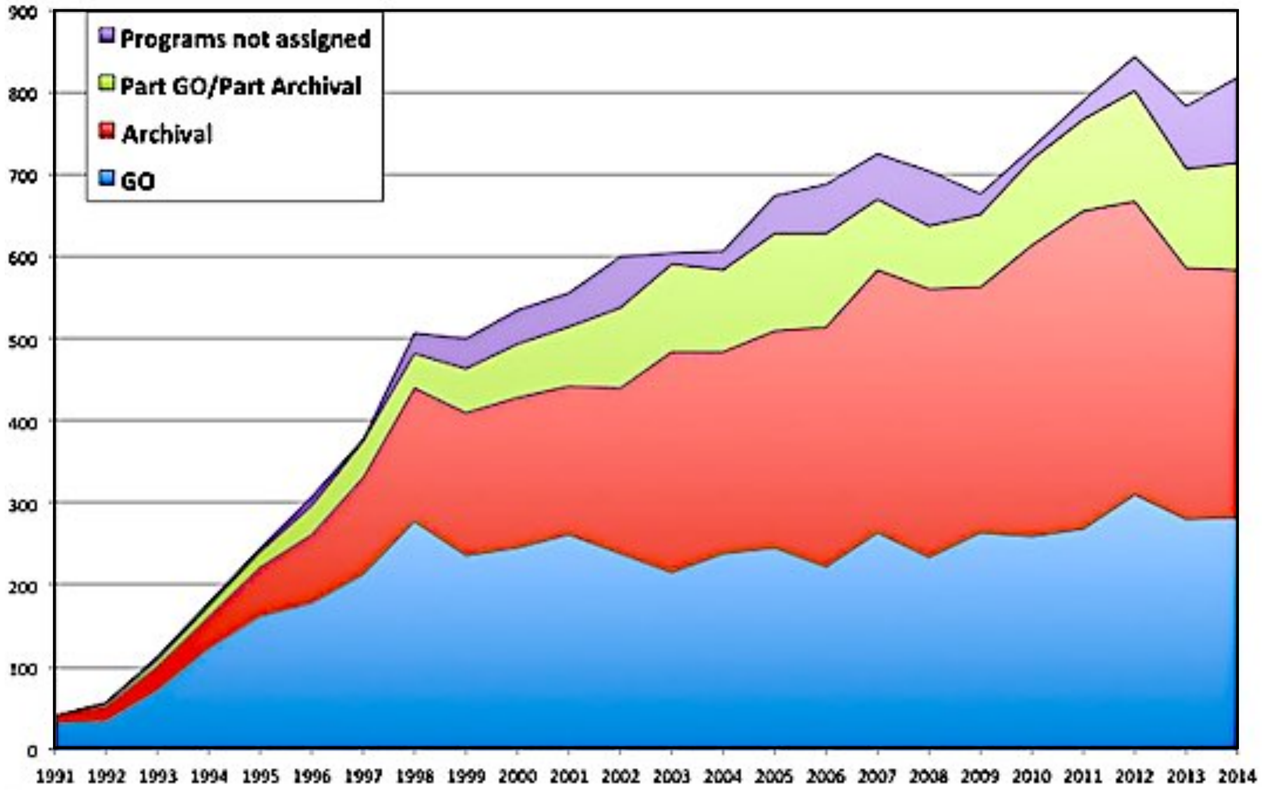
Future SKA Science Archive



PER YEAR

- 1 Petabyte

Impact of Science Archives

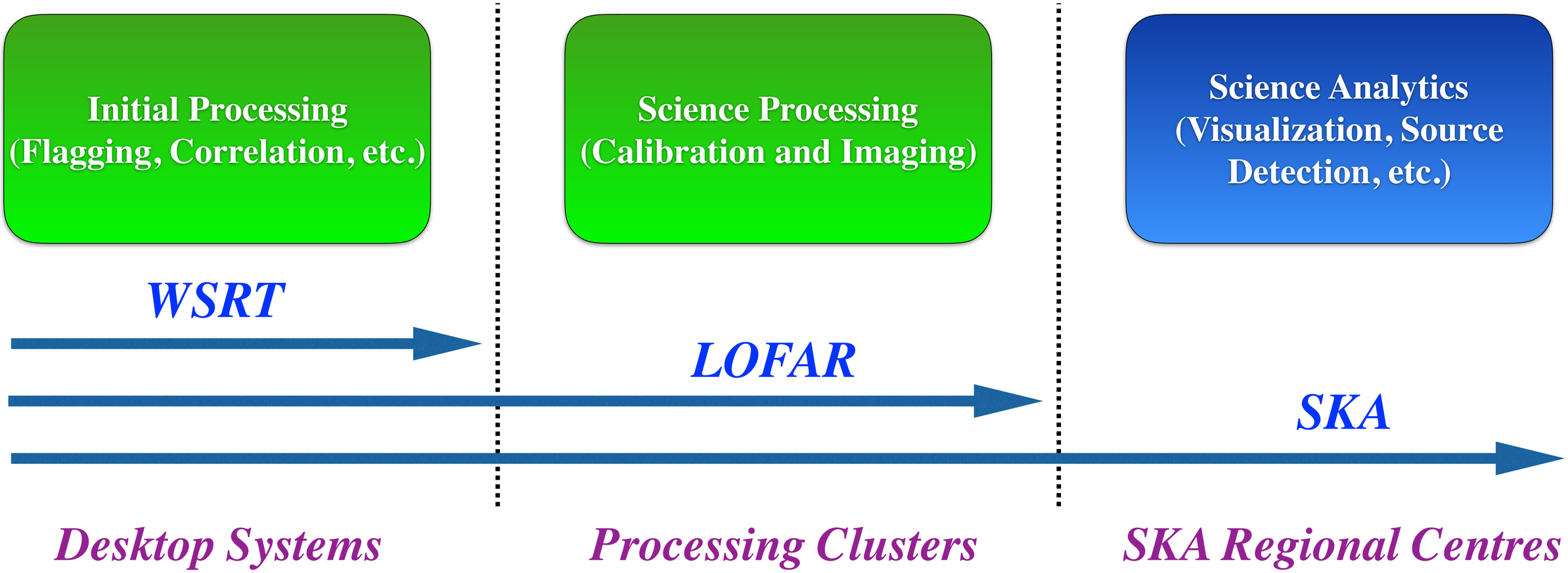


Hubble Space Telescope Publication Rate

Science archives increase the total science output!

- Assumes the archives are persistent
- Assumes archival data is accessible
- Assumes data products stored are appropriate for general use
- Assumes users have sufficient resources to fully extract science

Full Cost of Science Extraction



What is an SKA Regional Centre?

Astronomers

Place to find their data
Place to analyze their data
Place to find support

Funding Agencies

Way to fund science
Way to maximize investment
Way to spur innovation

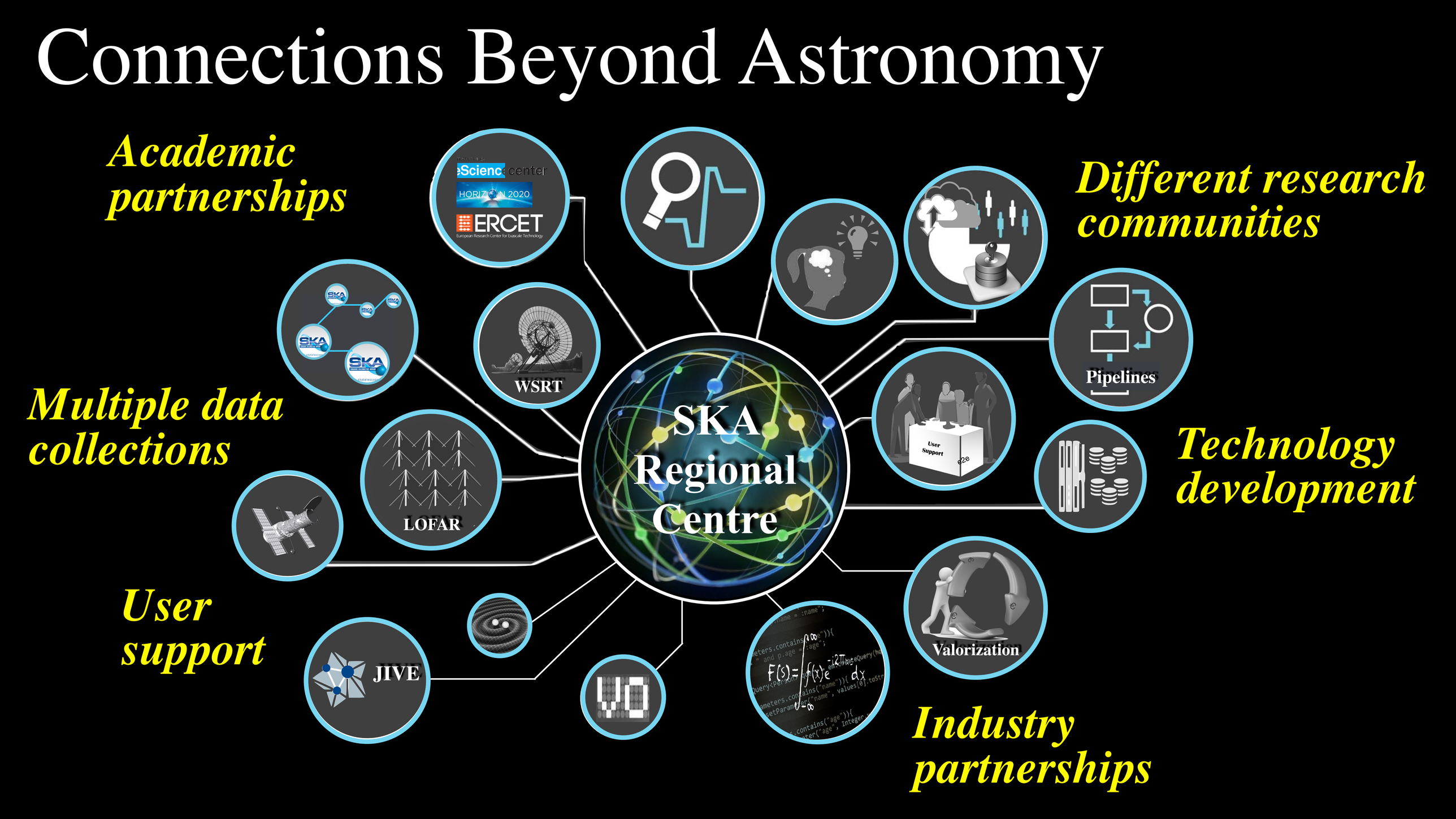
Observatories

Place to curate their data
Place to develop new capabilities
Place to support their users

Industry

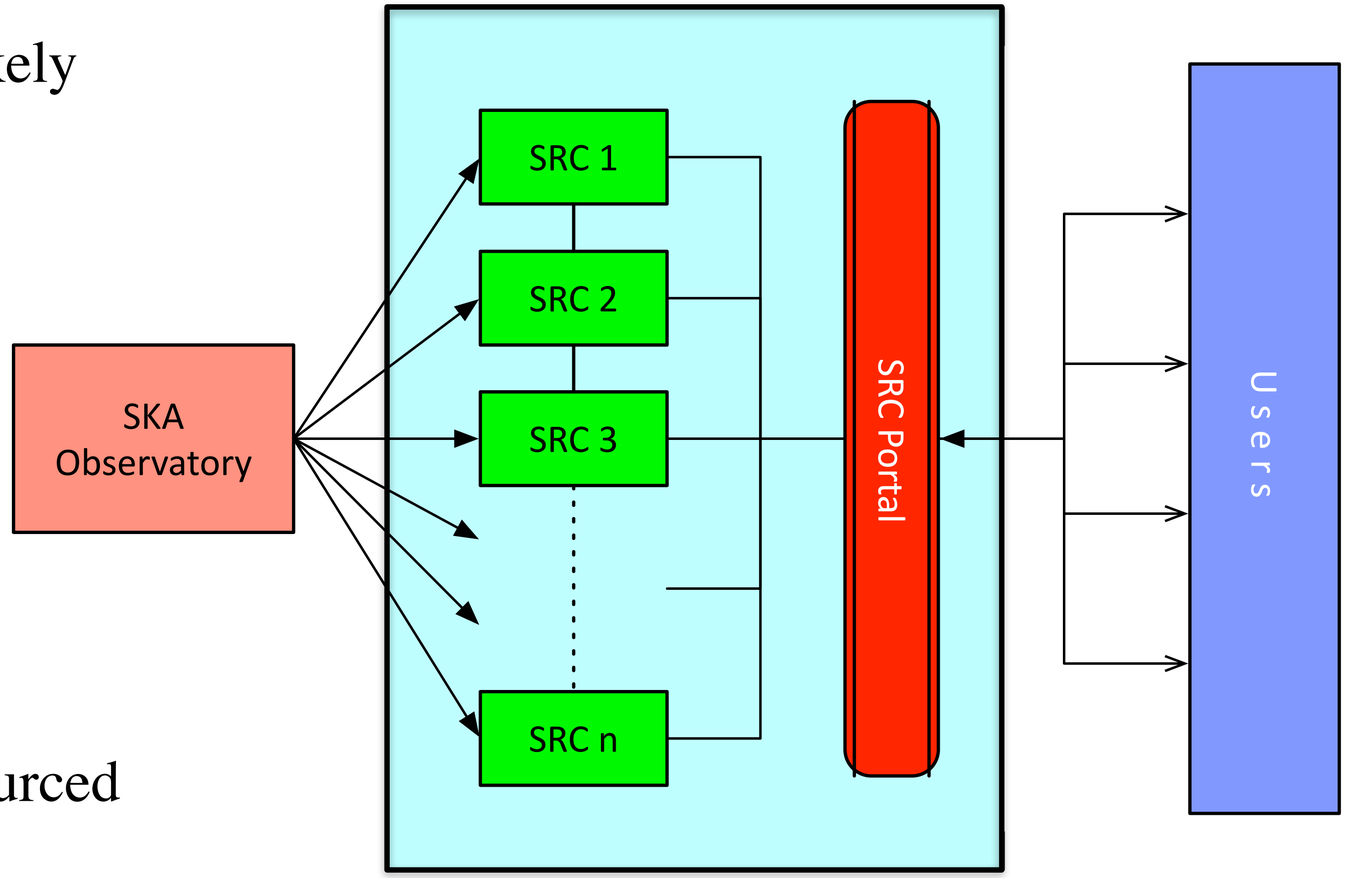
Place to find new challenges
Place to collaborate with academia
Place to test new technologies

Connections Beyond Astronomy



SKA Regional Centres

- Science Data Centres (SDCs) will likely host the SKA science archive
- Provide access and distribute data products to users
- Provide access to compute and storage resources for users
- Provide analysis capabilities
- Provide user support
- Multiple regional SRCs, locally resourced

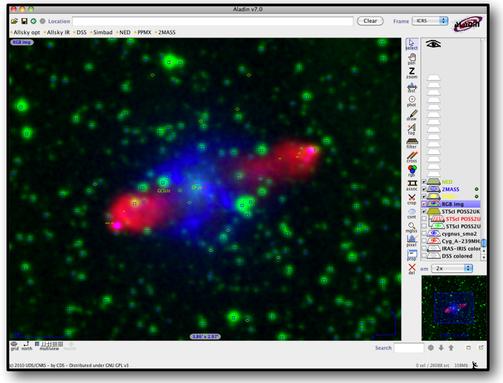


Global Network of Centres

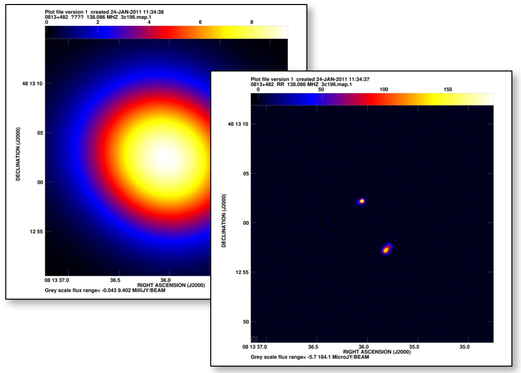
Regional Centre Functionality

Data Discovery

- Observation database
- Quick-look data products
- Flexible catalog queries
- Integration with VO tools
- Publish data to VO



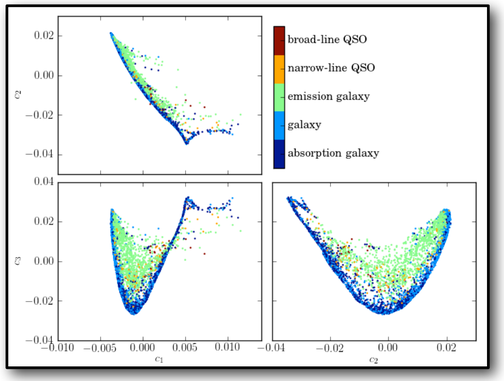
Data Processing



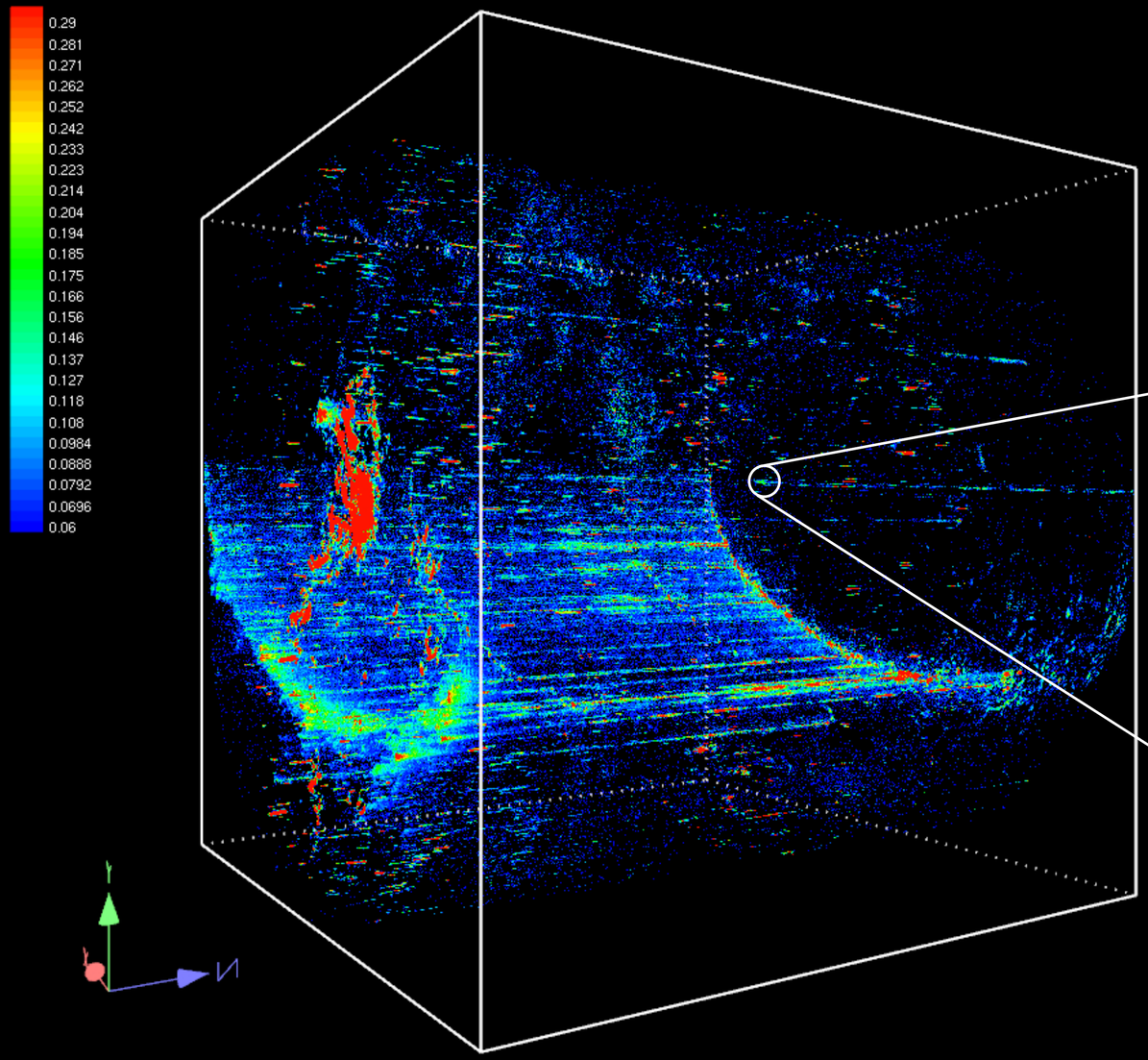
- Reprocessing
- Calibration and imaging
- Source extraction
- Catalog (re-)creation
- DM searches

Data Mining

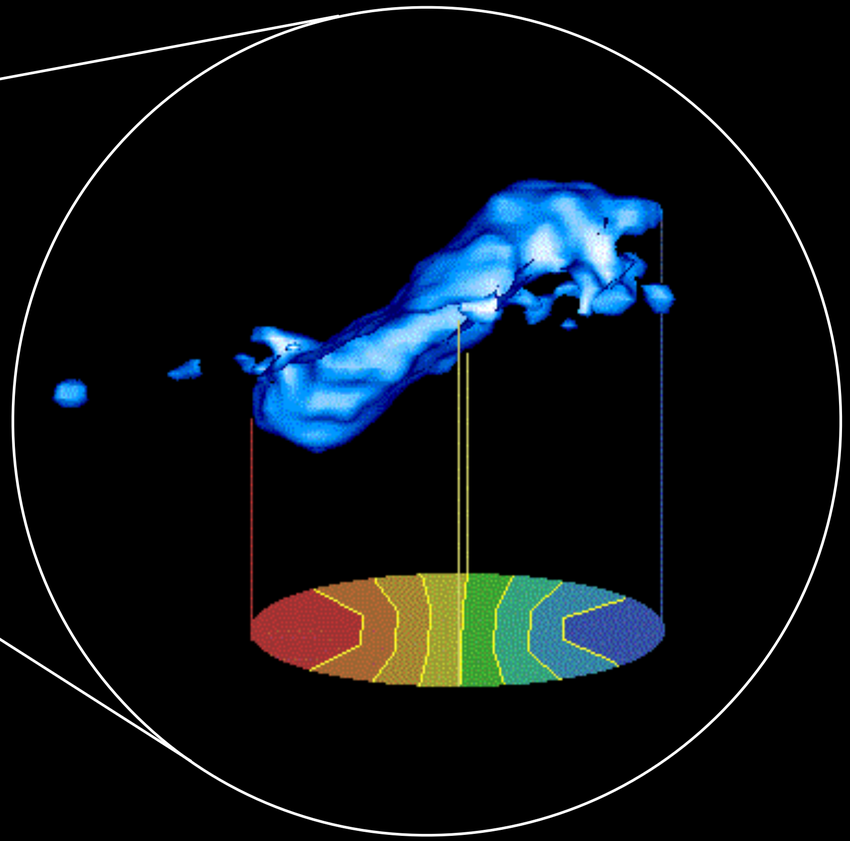
- Multi-wavelength studies
- Catalog cross-matching
- Transient classification
- Feature detection
- Visualization



Visualization, Classification, Inference



Automated detection and calculation of galaxy rotation curves in HI surveys



HIPASS HI Cube (Jurek et al. 2010)

Division of Responsibilities

Essential SRC functions:

- Development and provision of long-term SKA Science Archive
- Provision and management of computational resources for post-processing and analysis
- User support for SKA Science Archive data products and analysis
- Provide platform for continued development of software (pipelines and tools)

Joint SKAO/SRC functions:

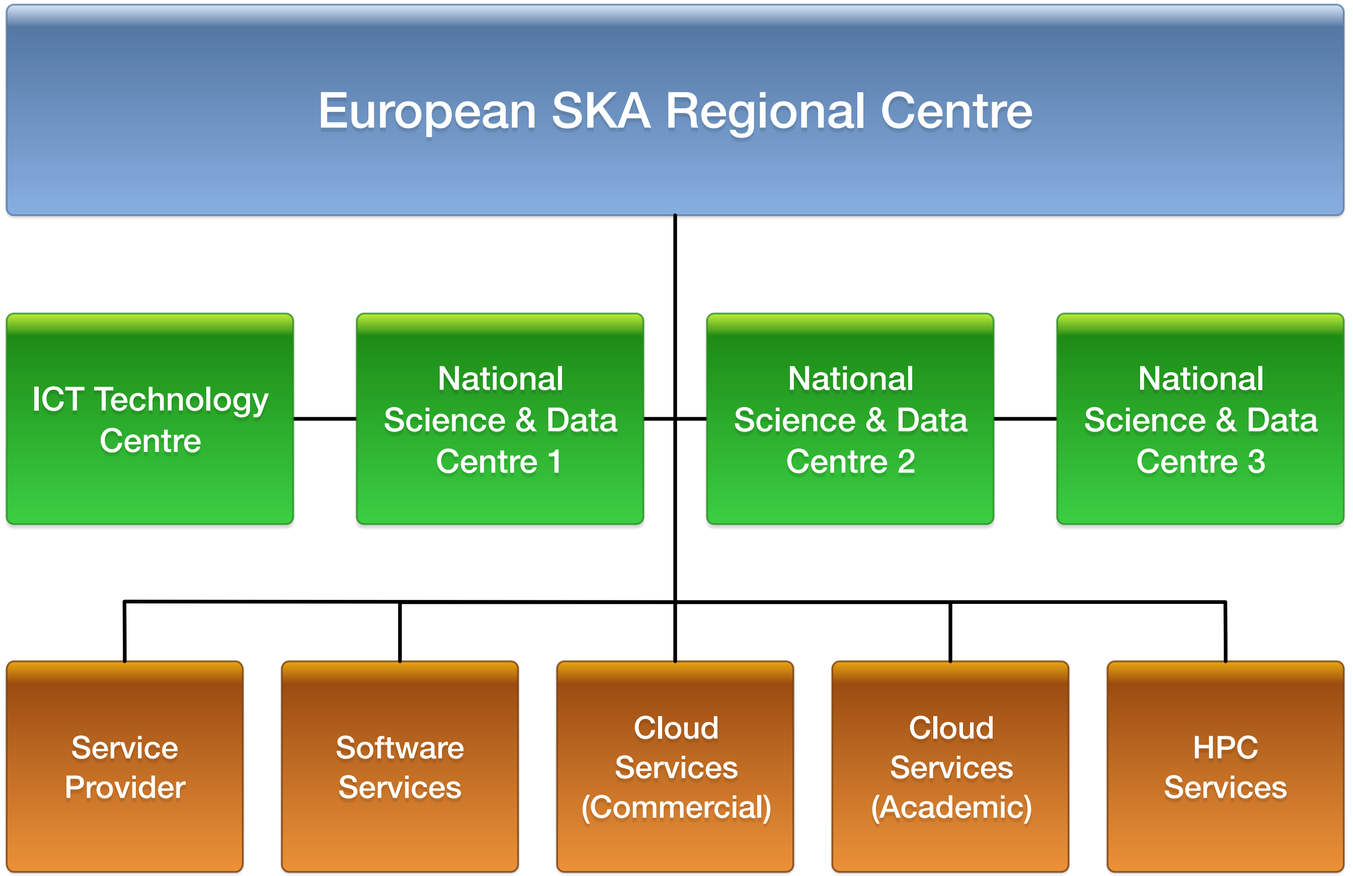
- User support for SKAO data products
- User support for SKAO provided software and tools
- Distribution of SKA data packs to users (potentially SDP or SRC)

Boundary Conditions

- SKA Regional Centres must adhere to the data policies as defined by SKA
- SRCs must meet minimum requirements to join the network
- An accreditation process for SRCs in the network will be defined by SKAO
- SRCs will be heterogeneous in nature with common, core functionality
- Some SRCs may provide additional or community-specific functionality
- SRCs must support the Key Science Project Teams as well as general users
- Support for regional SRCs will come from the local communities

European SKA Regional Centre

- Create a European-scale, federated Regional Centre for the SKA
- Provide resources for SKA science extraction to users
- Coordination with ICT communities, industry, and service providers
- Facilitate shared development, interoperability, and innovation
- European counterpart for engagement with other SRCs internationally



Open Questions

Where will the SKA science archive data be hosted?

How will that data be transported from the sites to Europe?

How can we take optimal advantage of existing infrastructure?

What are the processing requirements and technologies to consider?

What interfaces, tools, and techniques will users need for analysis?

How do we setup and operate an international network of SRCs?

AENEAS

Advanced European Network of E-infrastructures for Astronomy with the SKA

Design and specification of a distributed, European SKA Regional Centre to support the pan-European astronomical community in achieving the scientific goals of the SKA

EC Horizon 2020 (€3 million)

13 countries, 28 partners, SKAO, host countries, e-infrastructures (EGI, GÉANT, RDA), NREN's

Three year project (2017-2019)

- WP1: Project Management
- WP2: Governance Structure and Business Models
- WP3: Computing and Processing Requirements
- WP4: Data Transport and Optimal European Storage Topologies
- WP5: Data Access and Knowledge Creation
- WP6: User Services

Summary

- Regional Centres will be essential for the scientific success of the SKA
- SRCs will be the primary interface for SKA science extraction
- An international network of SRCs will be required to serve the SKA community
- A European SKA Regional Centre will be a key part of that network
- The AENEAS project is a first step in establishing such an European SRC