# Advanced web application for X-ray research with *XMM-Newton*

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and the team of *citizen scientists*

# Talk outline

- *XMM-Newton* catalog and motivation
- Website: what batteries inside?
- New development model (citizen science)
- Demo

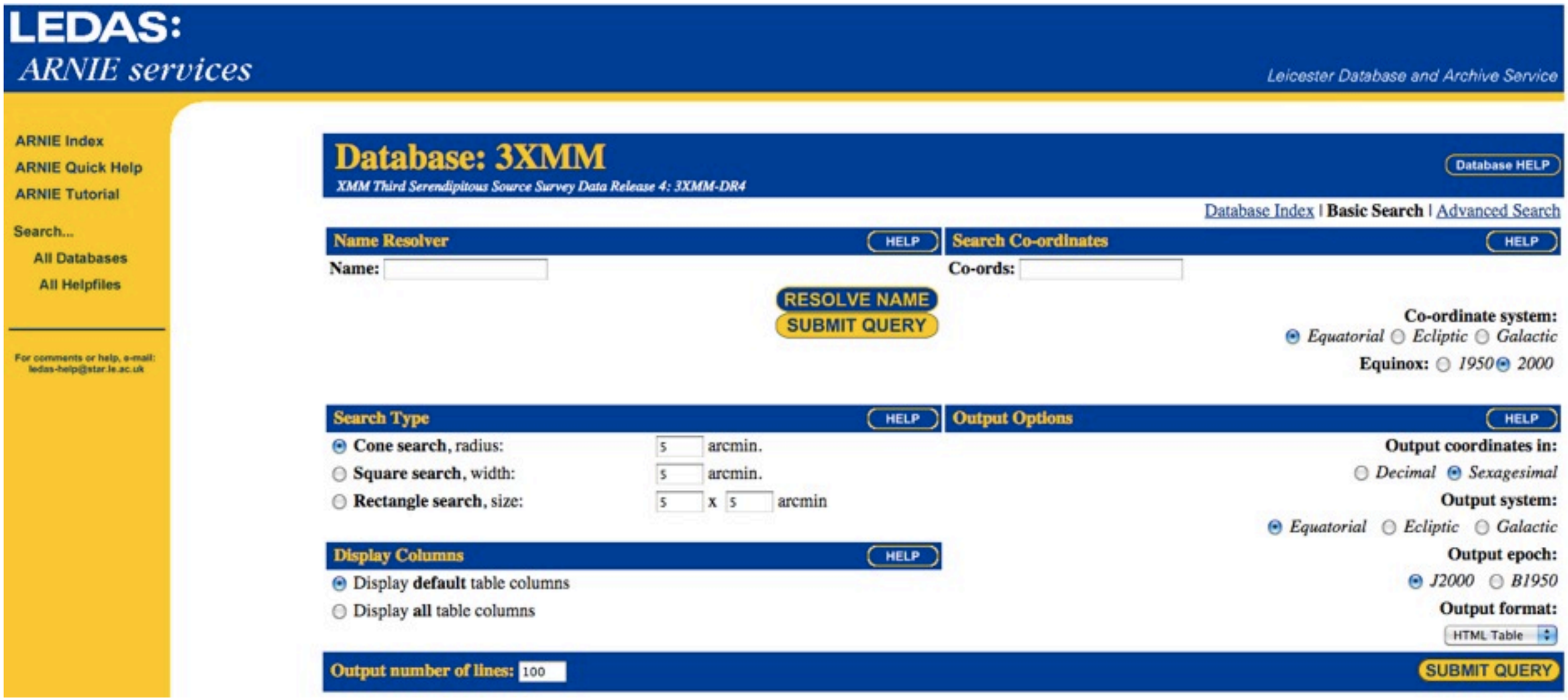
# *XMM-Newton* catalog

- XMM-Newton is X-ray observatory by ESA launched in Dec 1999
- Large FOV: ~70 sources / pointing
- 3XMM-DR5 is the largest X-ray source catalog ever created: 2.5% of the sky, 560k detections, 400k sources (credit: XMM Science Survey Center)

# Motivation

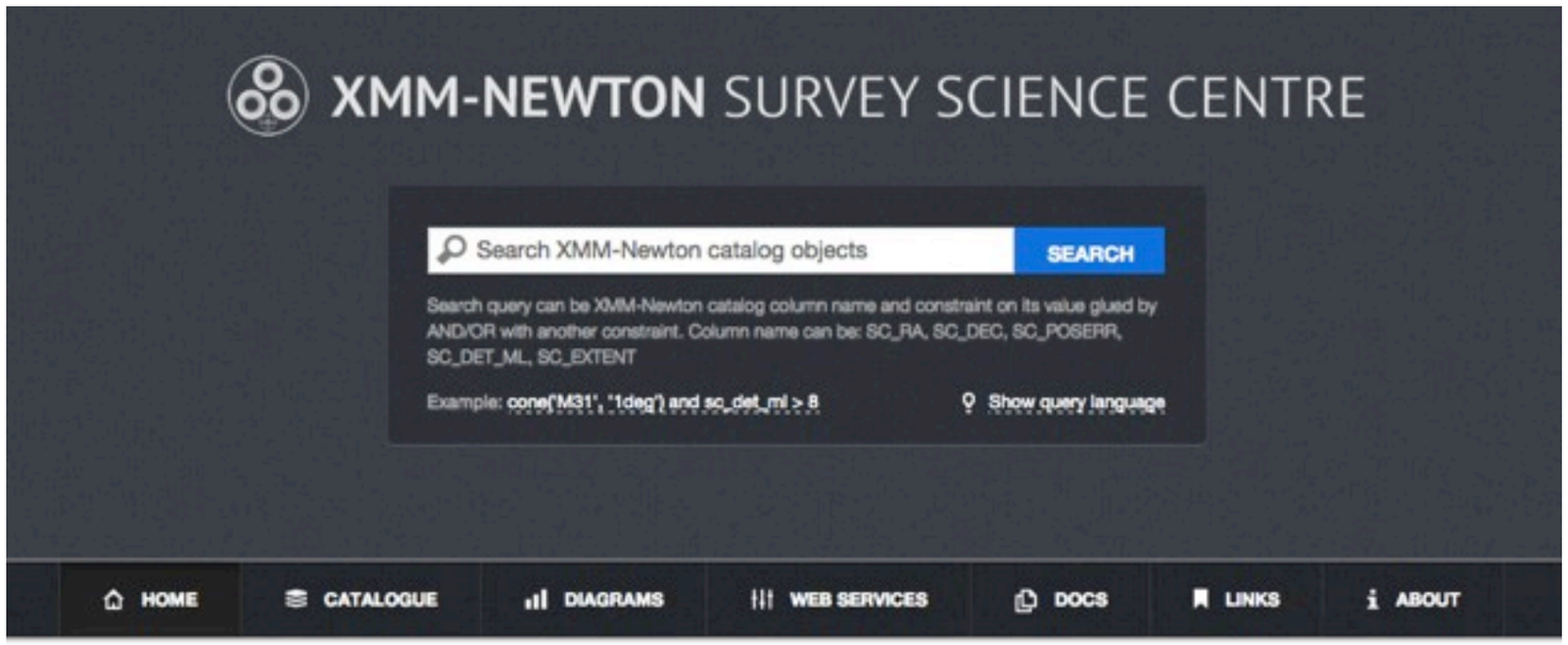
- I was main responsible for the 3XMM-DR5 catalog compilation
- Old *XMM-Newton* catalog webpages: expensive to take over
- Time cost comparable to reimplementing improved version from scratch
- Unlimited source of a manpower as an experiment: why not trying it?

# *XMM-Newton* catalog




before

# *XMM-Newton* catalog





# after

# Legacy

Reincarnation of the world reference exoplanet database, http://exoplanet.eu

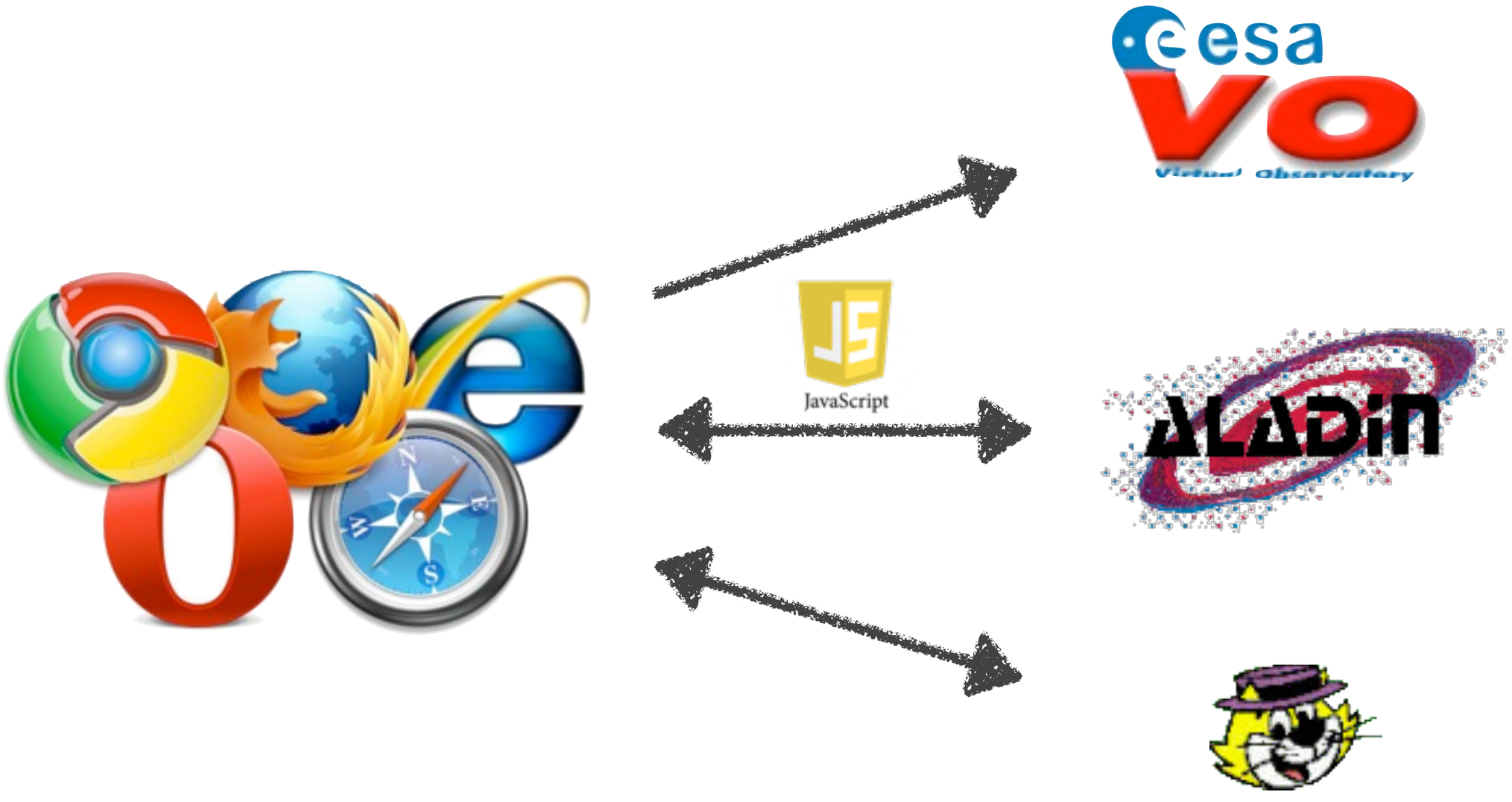
# Technology stack

- RDMBS: **PostgreSQL**

- Application language: **Python**

- Web framework: **Django**

# SAMP in a browser




AstroTools library: http://goo.gl/zyF0id

# X-ray spectral fitting

- Web implementation of a complex thing: source, background, RMF, ARF
- Wrapper over Sherpa
- Powered by Xspec

# Query language

Boolean expressions instead of endless forms (think Google) + SIMBAD resolver

## Query examples

- `M82` – select sources in 10 arcmin vicinity of M82 center
- `cone('M31', '1deg') AND sc_det_ml < 100` – select faint X-ray sources not
- `is_ulx = true AND n_detections > 2` – select ULXs which were detected r
- `iauname IN {"3XMM J053406.7+220337", "3XMM J053406.6+220438"}` – select
- `srcid IN {3, 4}` – select specific sources by their source IDs (useful for la

# More batteries

- Web sessions (personalization)
- Name resolver
- JavaScript diagrams (jQuery, Angular)
- Aladin Lite by CDS
- Java WebStart of Aladin and TOPCAT



# New development model

- High-level full-time employed IT engineers a.k.a. volunteers
- Coordination through Bitbucket (git)
- New type of **citizen science**? Unlimited source of free manpower?

# New development model

- **Alexey Sergeev**, Moscow, 10+ years of experience – design
- **Maxim Chernyshov**, Vladivostok, 10+ years of experience but 1st Django project – backend
- **Askar Timirgazin**, Moscow, 5 years of experience – frontend

# New development model

- Project duration: ~1 yr
- My time: 5% FTE
- Volunteers time: up to 3 months FTE
- This team is so far unique, but there are much more citizen science enthusiasts!

# Short demo at

# http://xmm-catalog.irap.omp.eu

(to see why researchers are excited and make
100 clicks 2-hrs long sessions)

# What's next

- A&A paper on this website as a research tool
- *XMM-Newton* photon database – database of all photons ever registered by the *XMM-Newton* (~100 billion)
- + papers on discoveries already made with it!