

Highlights from the AASKAI chapter *"The Role of Artificial Intelligence in the SKA Era"*

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AASKAI/Denzel01

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The chapter summary

Content

- Chapter (Methods and Techniques) in **AASKAII**
Advancing Astrophysics with the SKA – II
- Overview of AI applications for the SKAO
- Six scientific problem areas, each mapped onto AI-based remedies
- From current problem to future directions

Message

*"AI is not only an automation tool for coping with scale.
It is a catalyst for discovery."*

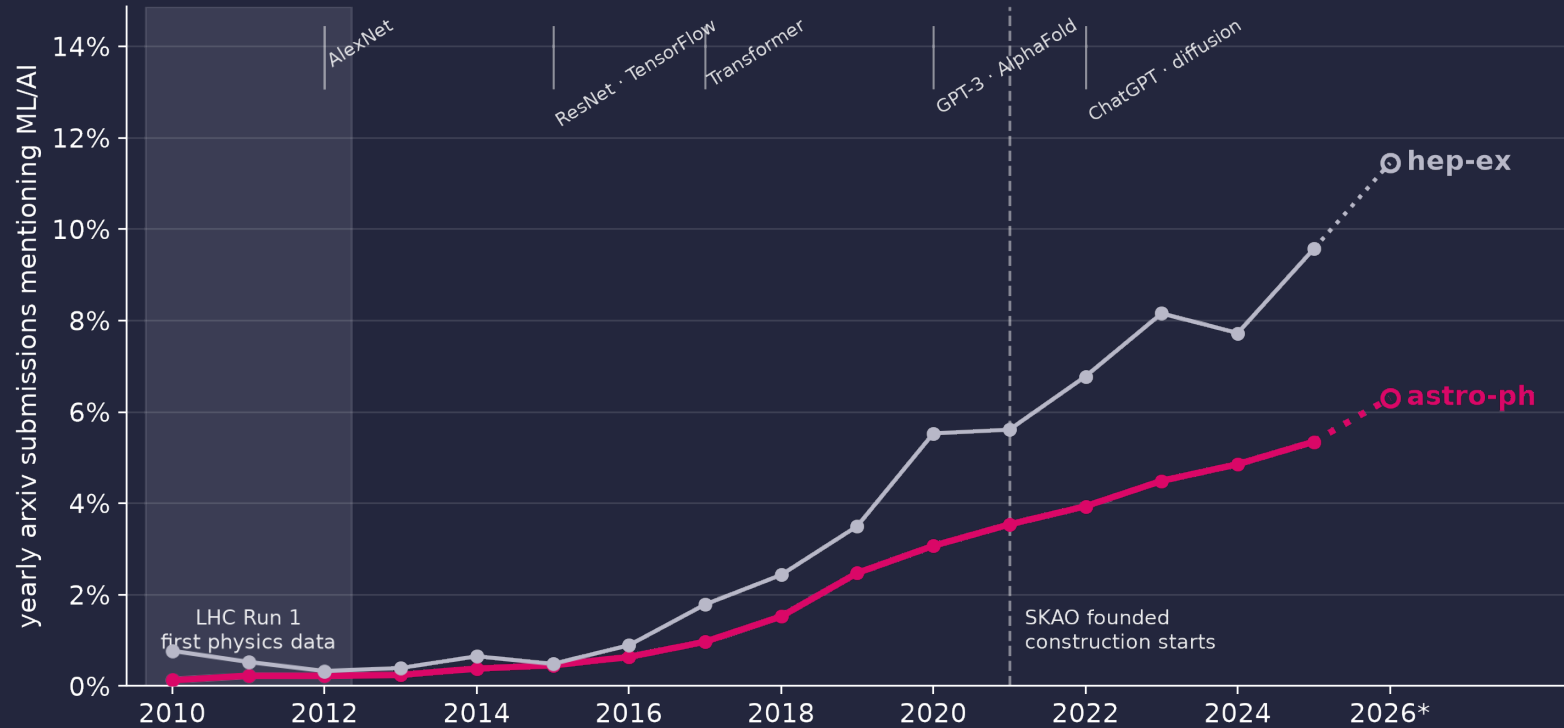
Operational necessity — real-time triage, faint signals under extreme compression, calibration under time-variable systematics

Scientific leverage — non-Gaussian information, accelerated forward modelling, uncertainty-aware field-level inference

Problems with traditional solutions

- **Imaging & sky simulations** — CLEAN scales poorly, needs manual convergence, no calibrated confidence
- **Epoch of Reionization / 21-cm** — foregrounds 4–5 orders brighter; robustness bought with sensitivity
- **Radio galaxies** — PyBDSF/Aegean assume fixed morphology, break on multi-component and rare sources
- **Pulsars & transients** — RFI, rare-event imbalance, real-time latency
- **Cosmic magnetism** — faint Stokes V and RM signals under instrumental artifacts
- **Gravitational lensing** — thousands of radio lenses expected; radio AI work still scarce vs. optical

AI arrived between CERN's first data and SKAO's



arXiv API, abstract keyword match. *2026 projected from an exponential fit to the last 7 complete years (astro-ph +13%/yr · hep-ex +16%/yr). Date: 2026-08-26.

What CERN teaches us

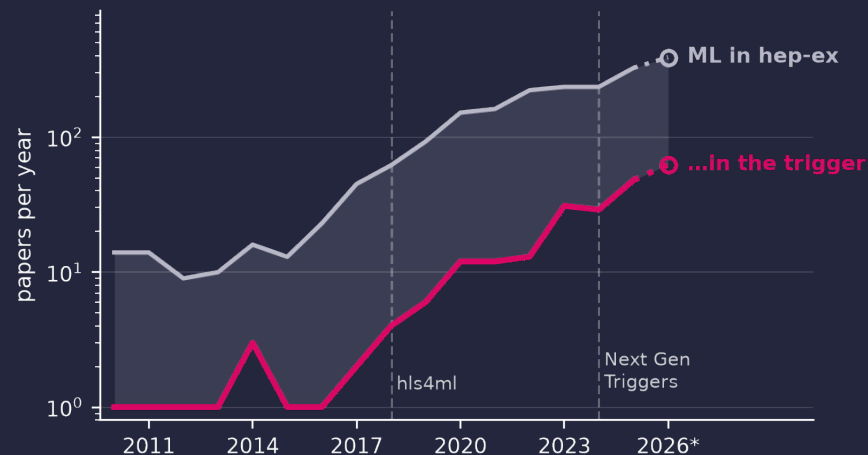
AI for mitigating the data deluge

- A global federated computing fabric planned a decade before first light — WLCG: ~1.4 M cores, 1.5 EB, 170+ sites. **SRCNet is the analogue.**
- A shared software stack and a real open-data and reproducibility culture

Lessons not yet in focus

- CERN **retrofitted** ML into the system design
- SKAO can be **AI-native at design time** — learned triage in the SDP, specified now, not 2040

ML reached analysis years before the trigger



arXiv API. *2026 projected from an exponential fit to the last 7 complete years. Date: 2026-08-26.

The LHC trigger keeps roughly 1 event in 20 000. Everything else is discarded, permanently, by cuts hand-designed in the 2000s.

- But: an AI trigger that discards data must be uncertainty-aware and auditable, or the "unknown unknowns" go first

The Swiss strengths

1st

SKA+AI papers per capita

9

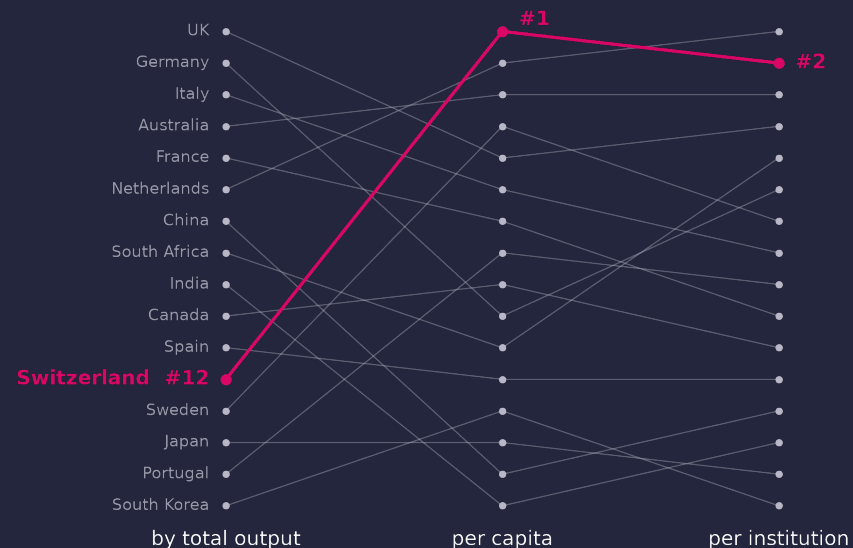
SKACH institutions

2nd

SKA+AI papers per institution with A&A programme

Member since Jan 2022 · ~100 people · contributions concentrated in science with AI, the software and data layer (Karabo, SDP, SRCNet)

Small country, outsized share



SKA + AI/ML papers, OpenAlex 2020-2026, SKAO member and host states. Rank among the 16 states shown.

Take-home message

1. AI is a **prerequisite** for SKA-scale science, not an optimization.
2. Unlike CERN, we get to design for it from the start — so the burden shifts to **explainability, uncertainty quantification and MLOps, now!**
3. Switzerland concentrates talent for AI and the software layer.

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