South Korea's Accession to the SKAO

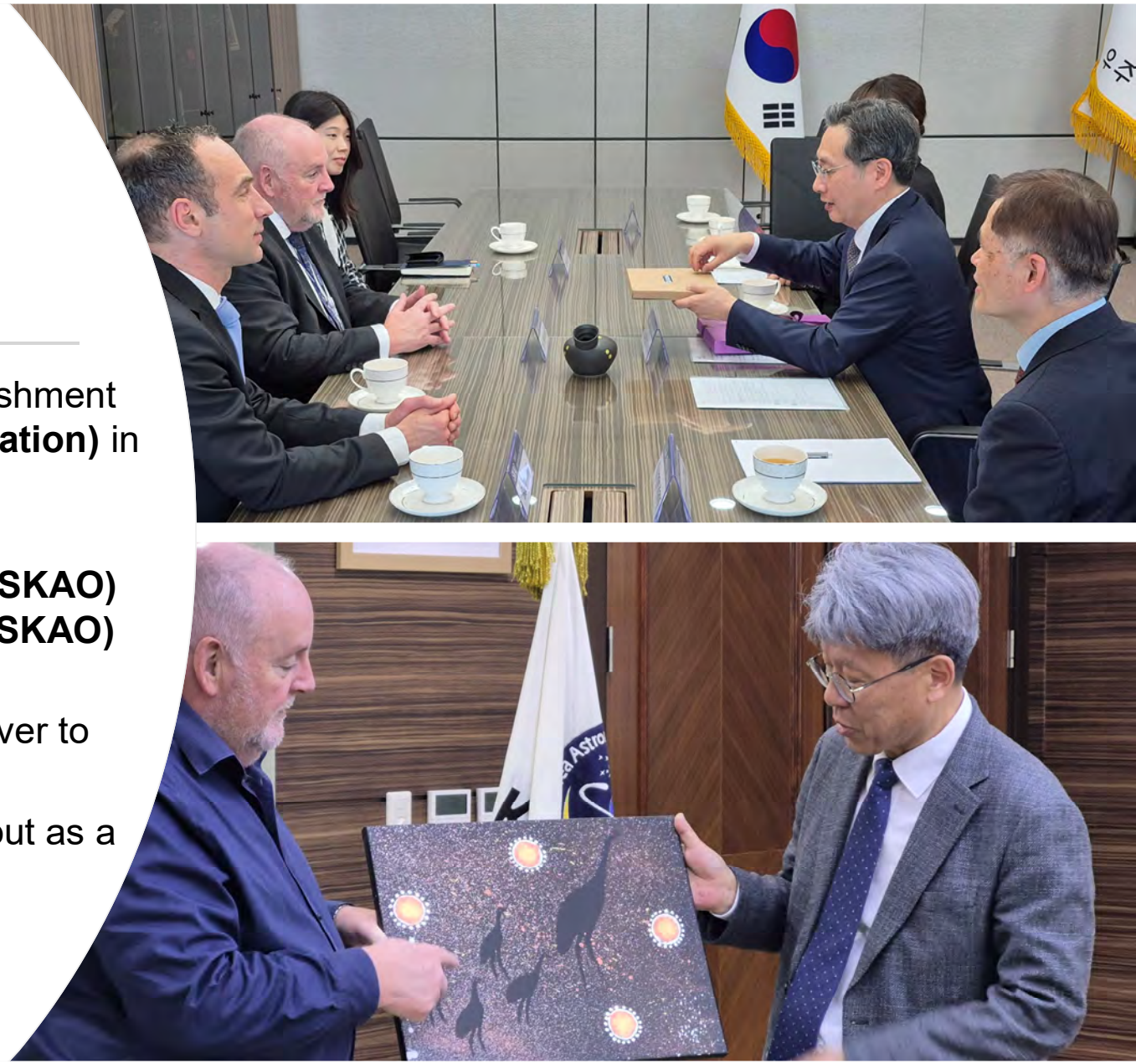
Bong Won Sohn (KASI)
Behalf of SKA Korea

EAMA11, Niigata

2025 Dec. 09

Executive Summary

- **Governance Transformation:** Establishment of **KASA (Korea AeroSpace Administration)** in May 2024 enabled Cabinet-level treaty negotiations
- **2025 Milestone:** Signed **MoU (KASA-SKAO)** and **Cooperation Arrangement (KASI-SKAO)** in May 2025
- **Strategic Goal:** Transition from Observer to **Full Member** by 2026/2027
- **Role:** Participating not just as a user, but as a key architect of technical infrastructure (Correlator, SRC)



SKAO Status Update

- **Construction Status:** Approximately 50% complete as of late 2025
- **Challenges:** Inflation and supply chain issues led to schedule adjustments (Low +12 months, Mid +16 months)
- **Strategic Response (CO-16):** Council approved a **"Deferral" strategy** in Nov 2025
- **Milestone: First SKAO Image** released in March 2025 (150-175 MHz)



The "First SKAO Image" (March 2025)

Korea's Accession Roadmap

- **March 2025:** Letter of Intent (LoI) submitted to Council Chair
- **July 2025 (CO-15):** KASI approved as a "Cooperating Entity"
- **Nov 2025 (CO-16):** Target set for **"In-principle Approval"** of membership by March 2026
- **Future Timeline:**
  - Late 2026: Domestic ratification by National Assembly
  - 2027: Active Membership and full industrial participation

Scientific Frontier: SMBH binaries

- **Synergy:** SKA Pulsar Timing Arrays (PTA) will detect nano-Hz gravitational waves from Supermassive Black Hole Binaries (SMBHBs)
- **Korean Breakthrough:** Study of **3C 66A** using KaVA and 29 years of VLBA data
- **Result:** Detected a **10.94-year periodicity** in jet orientation, strong evidence for a binary system.
- **Impact:** Provides electromagnetic confirmation targets for future SKA GW detections

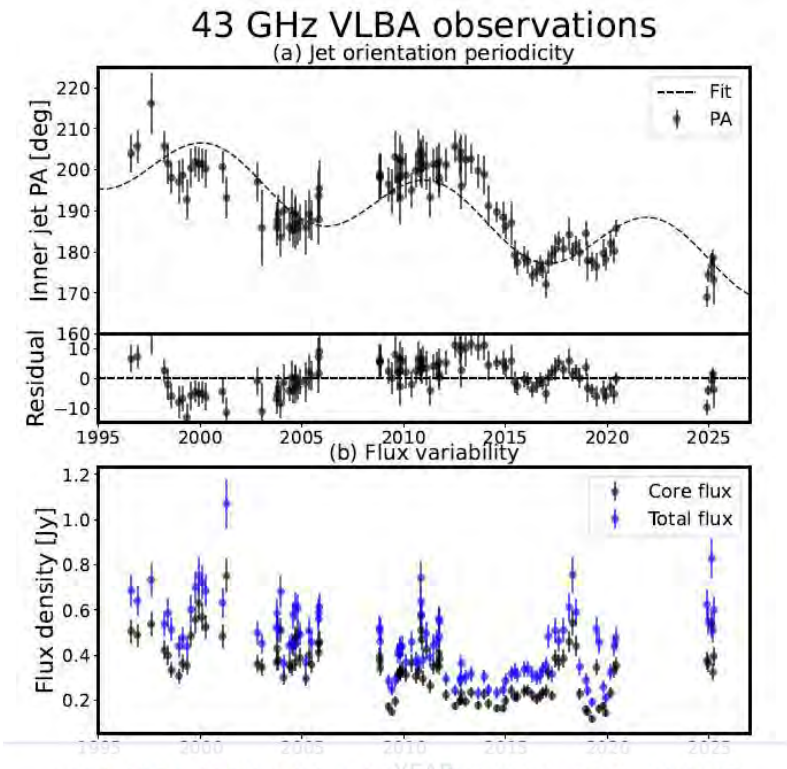


그림 2. VLBA 43GHz 장기 모니터링을 통해 발견한 제트의 주기적 진동

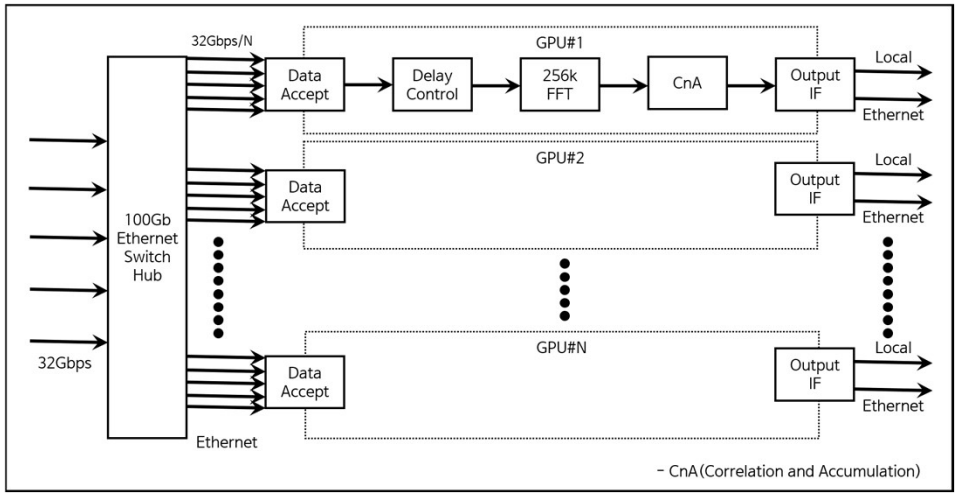


Scientific Frontier: Cosmic Ecosystems

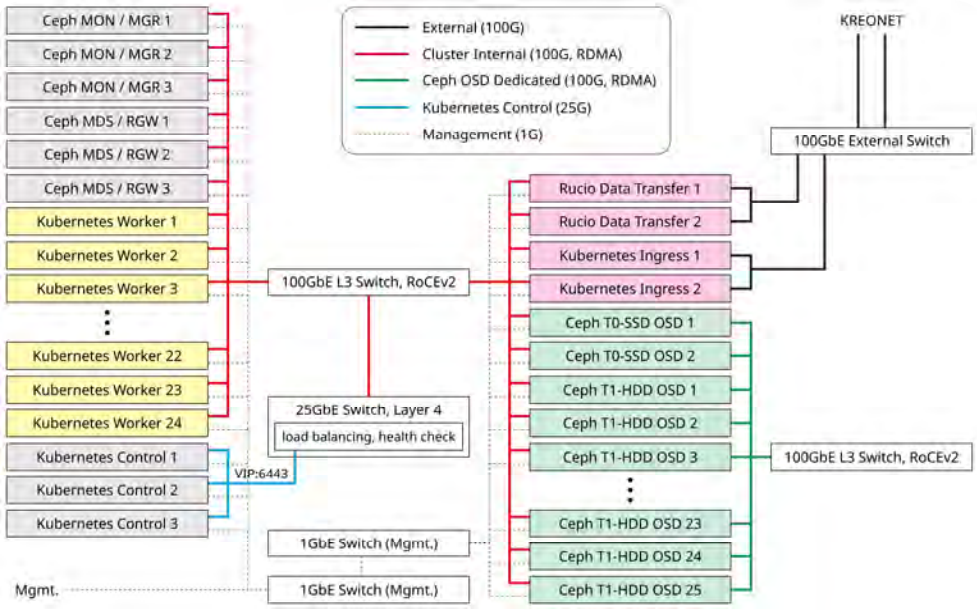
- **HI Science (GASKAP-HI):** Analysis of the Small Magellanic Cloud (SMC) revealed interstellar turbulence scales of **40–90 pc**
- Implication: Stellar feedback is the primary driver of turbulence
- **Transients (FRBs): BURSTT-K** project (VLBI pathfinder with Taiwan) for precision FRB localization
- **Cosmology:** Using FRBs to measure the "Missing Baryons" and constrain Dark Energy
- **Lambda (SKA-Low VLBI) collaboration launched**

Technical Contribution: SKA-VLBI

- **Paradigm Shift:** Moving from FPGA to **GPU-based Software Correlators**
- **Innovation:** Utilizing **Tensor Cores** (NVIDIA H100) for "Correlation and Accumulation" (CnA)
- Mathematically maps matrix operations to radio interferometry
- **Performance: 10x energy efficiency** improvement; >32 Gbps/node throughput via GPU-Direct RDMA
- **Status:** "Halcyon" system validated; CUDA kernels operational



Yeom et al.

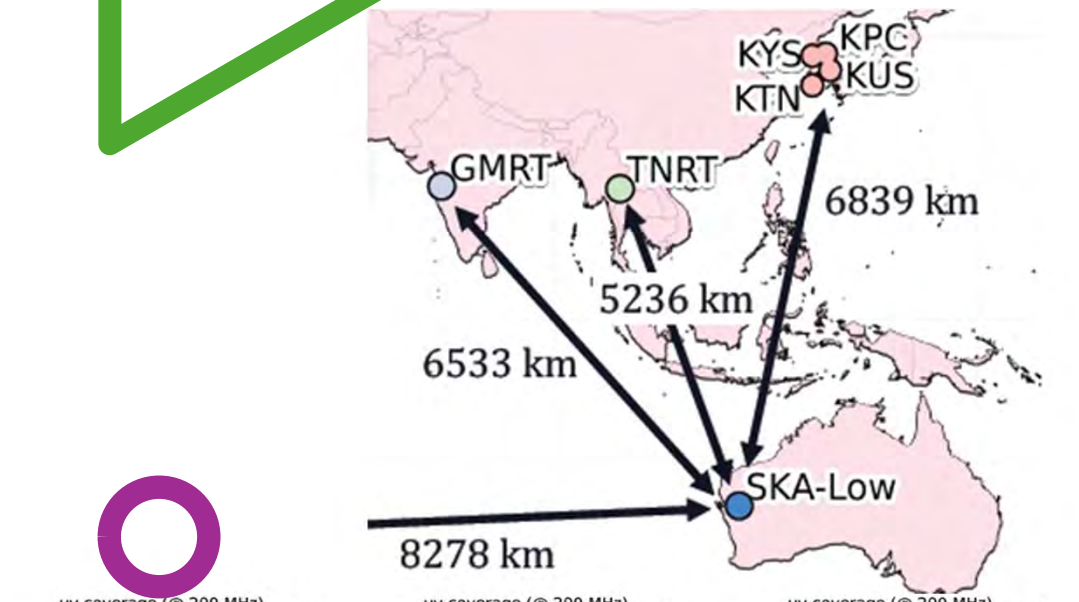


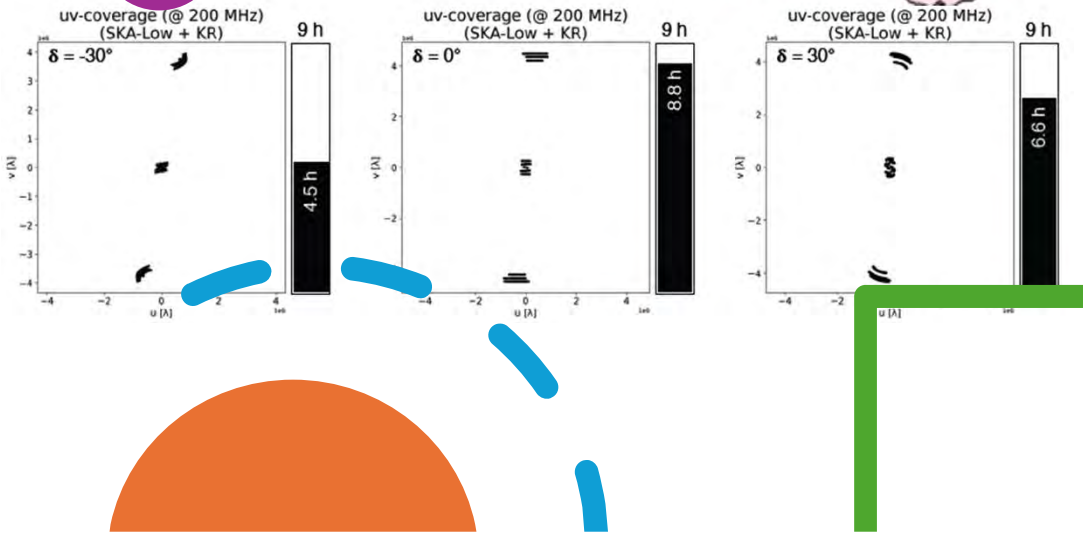
Technical Contribution: SKA Regional Centre (KRSRC)

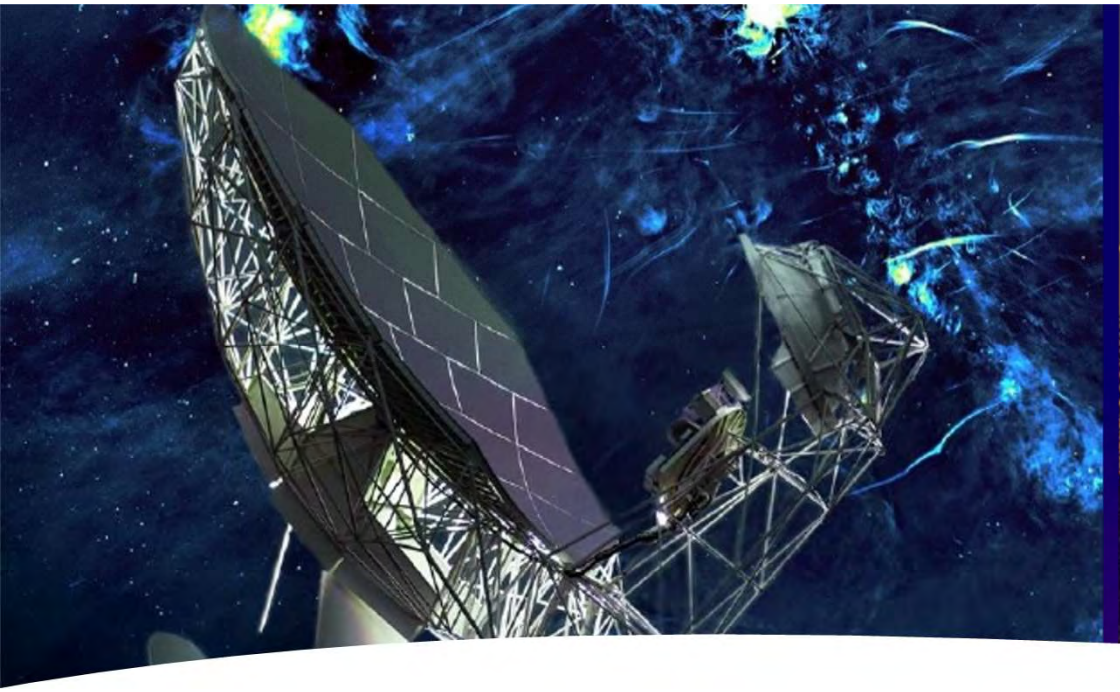
- **The Challenge:** Processing ~700 PB/year of global data products
- **Korea's Pledge (2025):** Submitted commitment for **1.5 FTE**, **0.16 PB** storage, and **0.04 PFLOPS** compute initially
- **Infrastructure:**
  - Tiered Storage (NVMe for hot data, Ceph for cold data)
  - Connectivity: **400GbE** upgrade to KREONET completed (Nov 2025)
- **Readiness:** Active participation in global "TEAL" workflow development

SKA and Global VLBI

- **SKA-VLBI:** Integrating SKA as a phased array into global VLBI networks
- **Low-VLBI Proposal:** Constructing SKA-Low compatible stations in Korea
- **Scientific Gain:** Creates a **~8,000 km North-South baseline** with Australia
- **Result:** Drastic improvement in **uv-coverage** (filling the gap) and imaging quality for southern sky sources









Conclusion & Future Outlook

- **Membership:** Targeting "In-principle Approval" at **Council Meeting 17 (March 2026)**
- **Industrial Return: "SKA Industry Day"** scheduled for early 2026 to connect Korean manufacturers with SKAO procurement
- **Workforce:** Training the next generation via university consortiums (UNIST-led, KAIST, Sejong, KHU, CNU, Chosun, Yonsei, …)
- **Closing:** Korea is ready to contribute to and lead in the SKA era