

# **Orbital VLBI at Arecibo**



**Chris Salter & Tapasi Ghosh**  
**(Arecibo)**

# VLBI Capability at AO Post-Gregorian Upgrade (1997)

- Sky coverage,  $0^\circ < \text{Dec} < +37^\circ$ , with tracking time from 1 hr to 2.75 hr.
- A rubidium frequency standard.
- Frequency coverage up to C-band (4-6 GHz).
- Frequency agility, with the ability to change frequency band (and hence receiver) in less than 5 minutes.
- Great sensitivity: SEFD = 2.5 Jy at 1.6 GHz, a VERY IMPORTANT selling point for collaborations with small antennas in space.

# Collaboration with VSOP/HALCA

Leonid Gurvits spent an extended spell in Arecibo (1991-93), and he appreciated the value the 305-m dish could have for OVLBI. He opened negotiations with Wayne Canon of Space Geodynamics Laboratory (SGL) of the Institute for Space and Terrestrial Science (ISTS), Toronto, Canada, for the loan of an S2 VLBI recorder, so AO could participate in the VSOP mission.

The S2 recorder was installed successfully by mid-1997.

In short order this also led to the generous loan of;

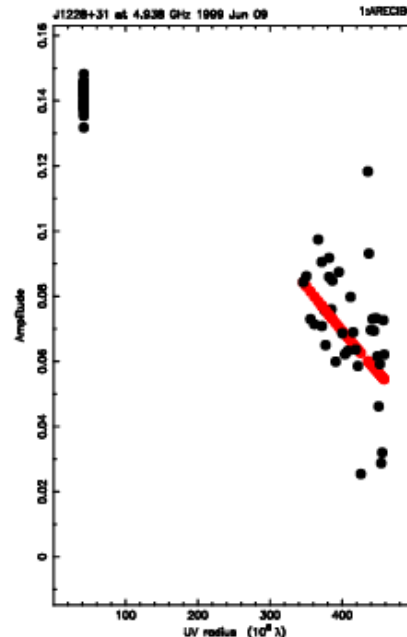
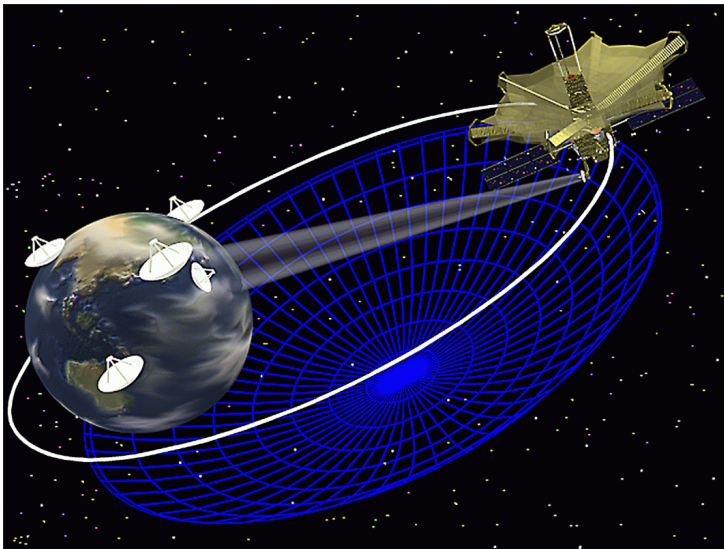
- A H-maser on (very) extended loan from JPL.
- A phase-cal unit from Haystack Obs.
- Field System startup/support from Ed Himwich.



# Arecibo and HALCA/VSOP

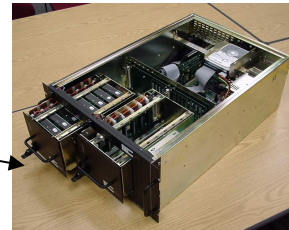
Between mid-1997 and 2001, Arecibo participated in 44 observation with HALCA/VSOP. Of these, 20 formed the  $\lambda 6$ -cm "Deep Interferometric VSOP—Arecibo Survey (DIVAS)": P.I.'s Hirabayashi & Edwards.

VSOP Apogee  $\sim 1.7$  Earth Diameters, Dish Diameter = 8 m,  
Orbital period = 6.3 hr



# VLBI Developments 2001–2020

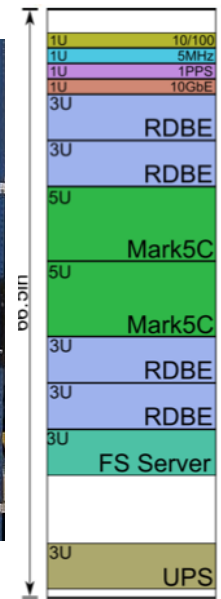
- Purchase of a VLBA4 Data Acquisition Rack, (later supplemented by RDBE digital VLBI back-ends.)
- Purchase of a Mk-IV tape recorder, enabled up to 1-Gbps recording. From 2004, disk-based Mk-5 recorders were deployed, with a Mk-6 installed just before the 305-m collapse.
- Purchase of a brand-new H-maser.
- AO participated regularly in Global, EVN, and HSA runs at 327 MHz, L-, C- and X-band. It also took part in transatlantic e-EVN VLBI.



VLBA4 + Mk5a



RDBEs

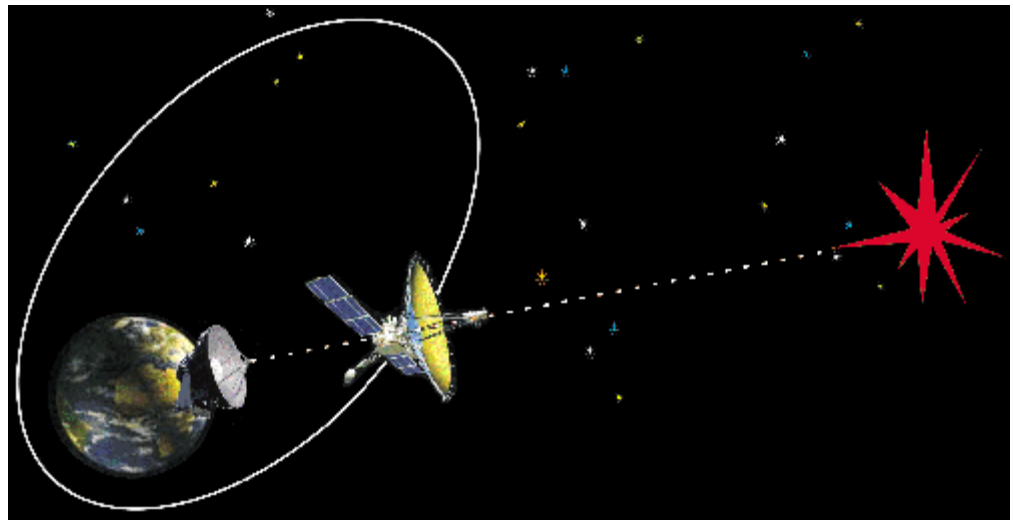




# Collaboration with RadioAstron

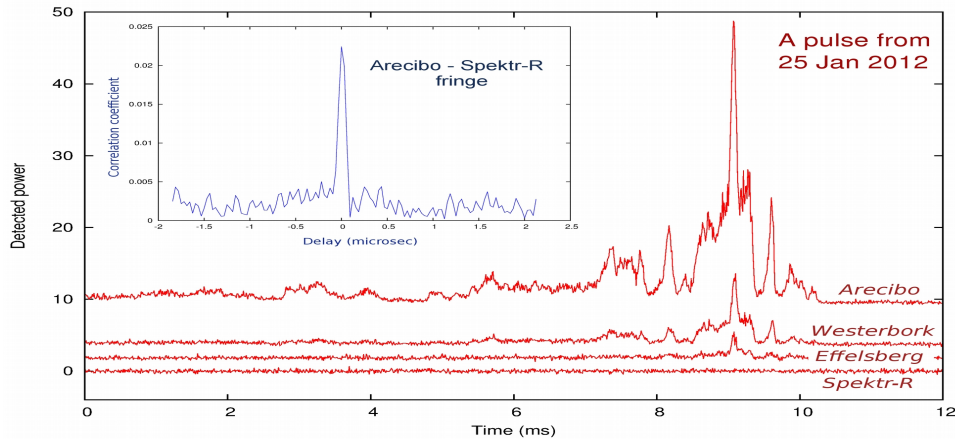
Between early 2012 and late 2018, AO participated in over 450 observations with the Russian RadioAstron orbital 10-m telescope. After an observing session, the recorded data were usually transferred to the relevant correlator station via the internet.

A highly elliptical orbit of period  $\sim 8.6$  days gave baselines up to 28 earth diameters. AO took part in RadioAstron runs at 327 MHz, L- and C-band, observing both compact AGNs and pulsars.

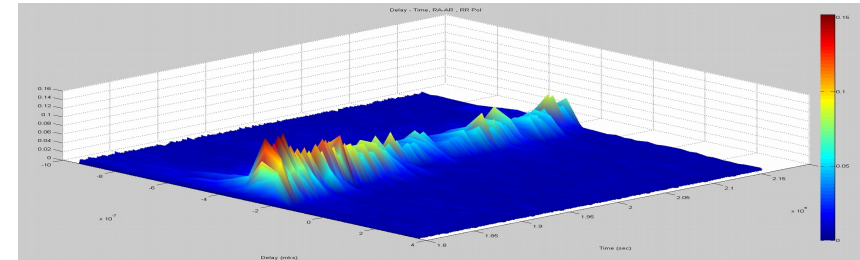


# A Couple of Examples

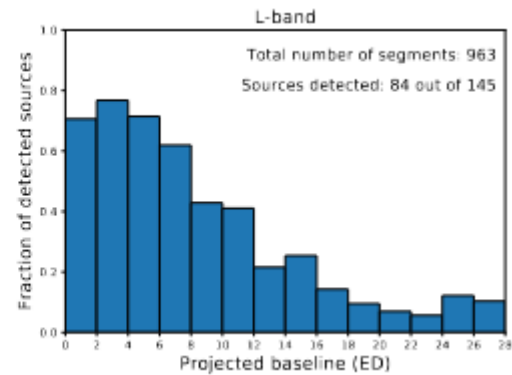
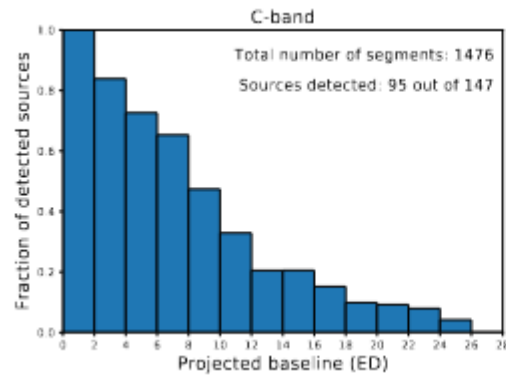
RadioAstron observations at 92 cm of the pulsar B0950+08  
220 000 km projected baseline



Courtesy: Yuri Kovalev



RadioAstron  
AGN Survey



(Kovalev *et al.*, 2020)

# Leonid González in Wonderland

