

A banner for the Space VLBI 2020 conference. The background is a dark, swirling pattern of orange and red, resembling a galaxy or a nebula. In the center, there is a bright, glowing ring of light, possibly representing a black hole or a similar astronomical phenomenon. The text is overlaid on this background.

Space VLBI 2020:
Science and Technology Futures

JANUARY 28-30, 2020

CHARLOTTESVILLE, VA USA

Poster Presentation Abstracts

Bjorn Emonts (National Radio Astronomy Observatory)

Sophie Lebowitz (Ohio State University)

Matthew Lehnert (Institute Astrophysique de Paris)

Guillaume Drouart (Curtin University/ICRAR)

Carlos De Breuck (European Southern Observatory)

Topic: Science Goals

ALMA Zooming in on the Dragonfly Galaxy

The Atacama Large Millimeter/submillimeter Array (ALMA) is giving us an unprecedented view of the gas, dust, and AGN activity in distant galaxies. We present ALMA observations of the Dragonfly Galaxy, a hyper-luminous infrared radio galaxy at redshift 2, with a resolution of ~ 30 milli-arcseconds (~ 250 pc). These ALMA results reveal that the high starburst activity in the Dragonfly Galaxy is the result of a merger between two disk galaxies, which gravitational effects displace a large amount of cold gas across the system. Complementary observations taken with the highest frequency receiver of the Karl G. Jansky Very Large Array (VLA) at a resolution of 100 milli-arcsecond reveal a hot-spot in the radio jet at the location where it hits the disk of the merging companion galaxy. Thanks to the high spatial resolution of our observations, our ALMA and VLA data challenge common beliefs regarding gas outflow as well as the nature of high-redshift radio galaxies. Our results show the promise of ALMA and a Next-Generation Very Large Array (ngVLA) in studying the evolution of galaxies and AGN in the Early Universe.

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Glen Langston (National Science Foundation)

Anthony Minter (Green Bank Observatory)

Larry D'Addario (National Radio Astronomy Observatory)

Topic: Other

Spacecraft Tracking Station Design and Implementation

We reminisce over our experiences with Space VLBI Tracking Station Design and Implementation. We note the care needed to enable extreme frequency stability required and precision needed in accounting for system component time delays.

Matthew Lister (Purdue University)

Topic: Science Goals

AGN Jets at High Resolution: The MOJAVE VLBA Program

MOJAVE is a long term program to investigate the kinematics and polarization properties of powerful parsec-scale jets associated with active galactic nuclei (AGN). Starting with the 2 cm Survey in 1995 and full polarization observations in 2002, we currently image ~100 AGN regularly with the VLBA at 15GHz. In August 2019 we began observing 25 of these AGN monthly at 15, 22, and 43 GHz. We seek to better understand rapid changes in the jet magnetic field structure using linear polarization, rotation measure, and spectral index time-lapse movies. In our most recent kinematics analysis, we tracked 1744 individual bright features in 382 jets over at least 5 epochs. A majority of the best-sampled jet features showed accelerated motion, and the fastest speeds are found only in AGNs of the low-synchrotron peak(LSP) class. Although most features within a jet typically have speeds within 40% of a characteristic value, we identified 55 slow pattern speed features, nearly all of which lie within 4 pc (100 pc deprojected) of the jet core. With few exceptions, the cores with median brightness temperatures below 5×10^{10} K are predominantly associated with slow ($<2c$) apparent speed jets. Our Monte Carlo simulations suggest a typical intrinsic (unbeamed) T_b value of $(4.6 \pm 0.5) \times 10^{10}$ K for the jet cores in their median state. Using data from MOJAVE, U Michigan, and Owens Valley 40m monitoring programs, we have constructed a complete flux density-limited AGN sample above 1.5 Jy at 15 GHz. The sample is well fit by a parent jet population having a simple unbeamed power-law luminosity function incorporating pure luminosity evolution and a Lorentz factor distribution ranging from 1.25 to 50 with a power law slope -1.4 ± 0.2 . The parent jets of the brightest radio quasars have a space density of 261 ± 19 Gpc⁻³ and unbeamed 15 GHz luminosities above $10^{24.5}$ W/Hz, comparable with the properties of FR II radio galaxies.

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George Moellenbrock (NRAO)

Edward Fomalont (NRAO)

William Dent (ALMA)

Topic: Calibration techniques

Calibration of Space VLBI Orbit Position Errors Using Multiple Calibrators

Phase-referencing in Space VLBI observations at radio and millimeter/sub-millimeter wavelengths will likely be limited by errors in the time-dependent position assumed for the orbiting antenna(s). We propose a calibration technique that uses multiple calibrators within a relatively modest angular separation from the science target to model the orbit position error and estimate an effective differential geometric phase screen among them and covering the science target field. Sufficiently flexible and rapid slewing is needed for the orbiting antennas to permit visiting multiple calibrators before the position error changes significantly. By improving the accuracy of otherwise traditional phase-referencing, this technique will optimize astrometric and imaging sensitivity at the extreme resolution of space VLBI. Variations of this multi-calibrator technique are also under consideration for calibrating stand-alone ALMA observations on long baselines at frequencies greater than 250 GHz, where phase calibration transfer errors appear to be dominated by systematic errors in the vertical components of antenna position solutions that originate in the tropospheric path calibration.