close enough to Sgr A* to have orbital timescales of ~years or faster. The conventional explanation for this is that strong scattering in the ISM broadens pulsed radio signals in time, to the point that they become undetectable; observing at higher frequencies reduces this effect, but the steep spectrum of most radio pulsars means the signals also become much fainter. The 2013 discovery of the magnetar J1745-2900 only 0.1 pc in projection from Sgr A* challenged this viewpoint, leading to some claims of a "missing pulsar" problem. However even with the reduced scattering strength inferred from this source, no existing radio telescopes have yet had the sensitivity to detect faint millisecond pulsars (MSPs) at the Galactic center.The proposed next-generation Very Large Array (ngVLA) will have nearly an order of magnitude more sensitivity than any current telescope in the ~5--30 GHz range that is expected to be the sweet spot for detection of pulsars -- including MSPs -- at the Galactic center. In this presentation we will outline the motivations, current knowledge, and predictions for a pulsar search in the Galactic center using the ngVLA, one of the key science goals for the instrument.

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361.25 - ngVLA Key Science Goal 5

Understanding the Formation and Evolution of Black Holes in the Era of Multi-Messenger Astronomy(T. Joseph W Lazio)

The next-generation Very Large Array (ngVLA) will be a powerful telescope for finding and studying black holes across the entire mass range. High-resolution imaging abilities will allow the separation of low-luminosity black holes in the local Universe from background sources, thereby providing critical constraints on the mass function, formation, and growth of black holes. Its combination of sensitivity and angular resolution will provide new constraints on the physics of black hole accretion and jet formation. Combined with facilities across the spectrum and gravitational wave observatories, the ngVLA will provide crucial constraints on the interaction of black holes with their environments, with specific implications for the relationship between evolution of galaxies and the emission of gravitational waves from in-spiraling supermassive black holes and potential implications for stellar mass and intermediate mass black holes. The ngVLA will identify the radio counterparts to transient sources discovered by electromagnetic, gravitational wave, and neutrino observatories, and its high-resolution, fast-mapping capabilities will make it the preferred instrument to pinpoint electromagnetic counterparts to events such as supermassive black hole mergers.The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc. Part of this research was carriedout at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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361.26 - VLBA Observations of the Structure and Motions of the Inner Parsec of the M87 Jet(Robert Craig Walker)

Walker et al (2018, Ap.J. 855, 128) reported results from Very LongBaseline Array (VLBA) observations of M87 at 43 GHz which includeintensive monitoring in 2007 and 2008 plus 17 years of roughly annualobservations, for a total of 50 individual observations. The resultsfrom that study are reviewed in this poster. The central radio sourcein M87 provides the best opportunity to study jet formation because ithas a large angular size for the gravitational radius of the blackhole and has a bright jet that is well resolved by VLBI observations.The 43 GHz VLBA observations have a resolution of about 0.21 x 0.43milli-arcseconds (mas) which is about 30 by 60 Schwarzchild radii (Rs)for D = 16.7 Mpc and Mbh = 6.1 X 109 Msun. Our high-dynamic-rangeimages clearly show the wide-opening-angle structure of the jet andshow the counter-jet. The jet and counter-jet are nearly symmetric inthe inner 1.5 milli-arcseconds (0.12 pc in projection) with both beingedge brightened. Both show deviations from parabolic shape in theform of an initial rapid expansion in width and subsequent contractionfollowed by further rapid expansion and, beyond the visiblecounter-jet, subsequent collimation. Proper motions andcounter-jet/jet intensity ratios both indicate acceleration fromapparent speeds of less than about 0.5c to greater than about 2c inthe inner about 2 mas (0.16 pc or 240 Rs in projection) and suggest ahelical flow. The jet displays a sideways shift with an approximately8 to 10 year quasi-periodicity. The shift propagates outwardsnon-ballistically and significantly more slowly than the flow speedrevealed by the fastest moving components. Polarization data show asystematic structure with magnetic field vectors that suggest atoroidal field close to the core.

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