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Space Low-Frequency Radio Observatory (SLFRO)

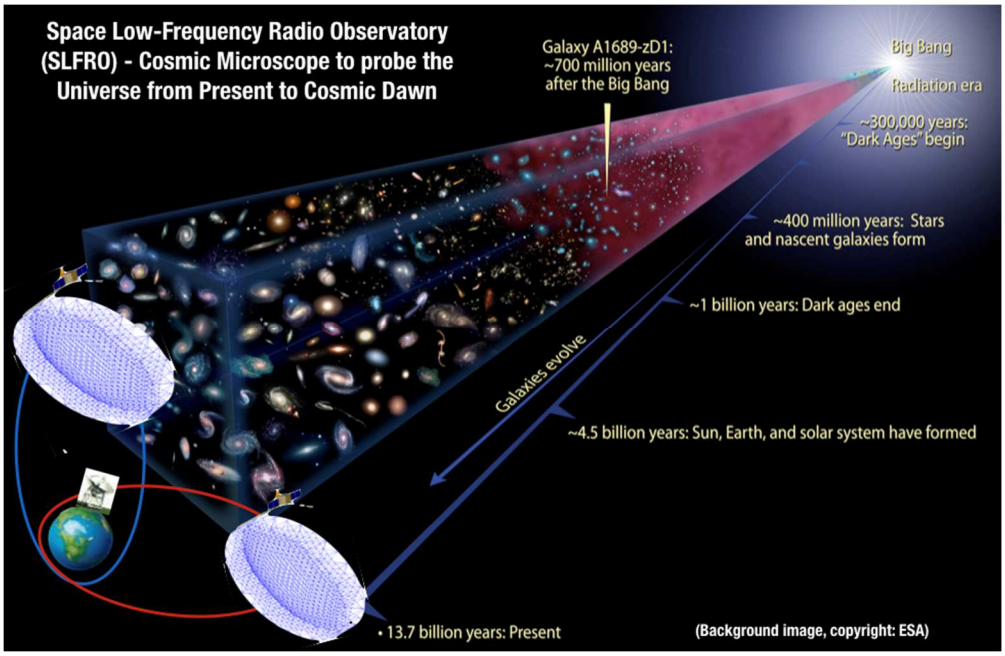
- Cosmic Microscope to probe the Universe from Present to Cosmic Dawn

Tao An[(1)] on behalf of the project team

(1) Shanghai Astronomical Observatory, China; e-mail: antao@shao.ac.cn

A space-based radio astronomical programme proposal, named as the Space Low-Frequency Radio Observatory (SLFRO) aiming at imaging the fine structure of compact cosmic objects such as black hole, pulsar and so on. The mission plans to launch two 30meter-diameter radio telescope into a 2,000km x 100,000km elliptical orbit. The operational frequency ranges from 0.03 to 1.67 GHz, supporting broad science areas. The two telescopes can work in flexibly diverse modes: (1) each telescope can observe in single dish mode, monitoring the burst radio sky, triggering the following-up very long baseline interferometry (VLBI) observations; (2) two telescopes form the space VLBI baseline enabling detection the fringes from the compact flaring sources and accurate determination of the position; and (3) combining the space- and ground-based VLBI telescopes to acquire high dynamic range images with unprecedented high resolutions (0.4 mas at 1.67 GHz and 20 mas at 30 MHz). The SLFRO offers astronomers an unique opportunity to conduct advanced science frontiers. The scientific objectives include: probing the AGN activity back to the Epoch of Reionization and Cosmic Dawn era, and unveiling the evolutionary history of the Universe; searching for binary (and triple) supermassive black holes to constrain the properties of low-frequency gravitational wave, galaxy merger and the co-evolution of black holes and their host galaxies in cosmological scale; monitoring the radio bursts from exoplanets and fast radio bursts, gamma-ray bursts, then supplying precise localization at mas level.

Compared with previous space VLBI programme, the baseline sensitivity of SLFRO increases by a factor of 10 or higher owing to the newly constructed giant ground telescopes, e.g., Chinese Five-hundred-meter Aperture Spherical radio Telescope (FAST) 500m and Square Kilometre Array phase 1, and the resolution is 10 times higher than ground-only VLBI network. The combination of two space telescopes significantly improves the (u-v) coverage on space-ground baselines, and thus increases the image performance greatly. SLFRO expects to detect the weak and compact population of Galactic (e.g., radio stars) and extragalactic radio sources which are not well known yet. The space VLBI at the 30-300MHz frequency range opens a new electromagnetic window to observe the radio emission from Jovian-type exoplanets, marking an important step in exoplanet studies.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Galaxy A1689-zD1: ~700 million years after the Big Bang
Big Bang
Radiation era
~300,000 years: "Dark Ages" begin
~400 million years: Stars and nascent galaxies form
~1 billion years: Dark ages end
Galaxies evolve
~4.5 billion years: Sun, Earth, and solar system have formed
• 13.7 billion years: Present
(Background image, copyright: ESA)