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Dynamic Universe: from FAST to Cosmic Antennae (CA)

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Human's perception and philosophy of the cosmos depend on our collective sensors. Modern optical sky surveys in the 20th century gave rise to the
concept of dynamic Universe, the forefront of which currently is situated in radio bands and manifests itself as fast radio bursts (FRB). The discovery of FRBs was awarded the 2023 Shaw prize in astronomy. We built the largest radio telescope, namely, the Five-hundred-meter Aperture Spherical radio Telescope (FAST), which has been leading the field of characterizing repeating FRBs ever since its inception in 2020.

With close to 100 FAST-based papers on FRBs, including 5 on Nature and 2 on Science, we started to establish an evolutionary picture for FRBs. With compact objects being the leading candidate engine of FRBs, the utter lack of short-time-scale periodicity present a major mystery regarding FRBs' origin. Recently, we invented the Pincus-Lyapunov diagram to help ascertain the stochastic nature of FRBs. The P-L diagram quantify FRBs to be less chaotic than Earthquakes, but way more random, akin to a Brownian motion on the energy-time bi-variate space. This stochastic behavior presumably reflects the young ages of FRBs. To help systematically localize and discovery multi-band counterparts, we are building a next generation FRB machine, namely Cosmic Antennae (CA), the aim of which is to increase the discovery rate by orders of magnitude over all current radio telescopes.

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Session Classification: Astronomical Observations with Light, X-Ray, Gamma-Ray, and Cosmic-Ray

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