URSI GASS 2023, Sapporo, Japan,19 – 26 August 2023

The Giant Radio Array for Neutrino Detection

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The Giant Radio Array for Neutrino Detection (GRAND) is designed to detect ultra-high-energy neutrinos, cosmic rays(CR) and gamma-rays using radio antennas. GRAND will contain 200,000 antennas and cover a huge area of 200,000 km^2 split into several sub-arrays spread worldwide. The detection strategy of GRAND is to detect the coherent radio emission (in the 50-200 MHz range) generated by the extensive air showers (with energis above 10^{17}eV) induced in the atmosphere or in the mountains by the cosmic particles. According to dedicated simulations, GRAND will reach unprecedented sensitivity to neutrinos of astrophysical origin with energies above 10^{17} eV. GRAND has sub-degree angular resolution which will make it possible to hunt for point sources and possibly launch neutrino astronomy era. This, combined with the large instantaneous field of view expected from the location of the sub-arrays in different continents and hemispheres, will make GRAND a key instrument in the future multi-messenger transient astronomy, during which the century-old mystery of the nature and origin of the particles with highest energy in the universe may be solved.

The GRANDProto300 (GP300) array is a pathfinder for GRAND project. The array is composed of 300 antennas, will start in 2023 in a radio-quiet area of ~300 km^2 near Dunhuang (~1100 m a.s.l.) in China. As a testbed, the GP300 array is expected to become the pioneer of autonomous radio detection technology, including the recognition and reconstruction of almost horizontal CR air shower. In addition, the GP300 array has a distinct advantage in studying the transition between Galactic and extragalactic origins of cosmic rays, due to its large effective area and the precise measurements of both energy and mass composition for CRs with energies ranging from 30 PeV to 1 EeV. Using the GP300 array we will also study the potential sensitivity for radio transients (such as Giant Radio Pulses and Fast Radio Bursts) in the 50-200 MHz range.