T 63: Invited Overview Talks IV

Time: Thursday 11:00–12:30 Location: AudiMax

Invited Overview Talk T 63.1 Thu 11:00 AudiMax

Binary Black Hole Populations: Scientific Perspectives for the Einstein Telescope — •Michela Mapelli — Institut für Theoretische Astrophysik, Zentrum für Astronomie, Universität Heidelberg, Heidelberg, Germany

The fourth gravitational-wave transient catalog contains more than 200 binary compact-object merger candidates, the vast majority of which involve black holes. These data represent a genuine revolution in black hole science. In this talk, I will focus on the implications of these new observations for our understanding of the astrophysical formation of such systems across cosmic time. I will discuss the challenges of explaining the inferred black hole merger-rate density and of accounting for the most massive systems detected so far – with masses inside or above the pair-instability mass gap. In the second part of the talk, I will briefly touch upon the scientific prospects of next-generation detectors. The Einstein Telescope is expected to observe binary black hole mergers out to redshift $z \sim 100$. Together with LISA, it will open up the opportunity for multi-band gravitational-wave astronomy and will probe the largely uncharted territory of intermediate-mass black holes.

Invited Overview Talk T 63.2 Thu 11:30 AudiMax

JUNO's First Light: High-Precision Reactor Neutrino Oscillations — •Michael Wurm for the JUNO-Collaboration — Johannes Gutenberg-Universität Mainz, Germany

The JUNO experiment in southern China is designed for a high-precision measurement of reactor antineutrino oscillations. With a 20-kiloton liquid scintillator target and 17,600 20-inch photomultiplier tubes, JUNO is the largest detector of its kind and is expected to achieve an exceptional energy resolution of about 3 % at 1 MeV. Located 55 km from the Taishan and Yangjiang nuclear power plants, JUNO is located at the first solar oscillation maximum, enabling precise measurements of the oscillation pattern and sensitivity to the neutrino mass ordering. This configuration also provides outstanding sensitivity to the solar oscillation parameters, θ_{12} and Δm^2_{12}.

JUNO began operations in August 2025. Following a brief calibration phase, 59 days of stable data-taking were analyzed to deliver the first oscillation results, improving the uncertainties on the solar oscillation parameters by a factor of 1.6 relative to the combination of all previous measurements.

Having demonstrated performance consistent with and in some cases exceeding design specifications, JUNO will continue data collection to accumulate the statistics required for a definitive determination of the neutrino mass ordering. In parallel, its unprecedented size makes JUNO a powerful observatory for astrophysical neutrinos, particularly those from the Sun and core-collapse supernovae.

Invited Overview Talk T 63.3 Thu 12:00 AudiMax

Flavour physics at the precision frontier: recent highlights from the LHCb and Belle II experiments — •Evelina Gersabeck — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Gustav-Mie-Haus 02 025, Hermann-Herder-Straße 3b, D-79085 Freiburg im Breisgau

Quark flavour physics focuses on precision tests of the Standard Model and searches for hints of physics beyond the Standard Model by looking for deviations from SM predictions in measured branching fractions, angular observables, matter-antimatter asymmetries etc. The two leading flavour physics experiments, Belle II, located at KEK in Tsukuba, Japan, and LHCb at the LHC, CERN, Switzerland, are actively recording unprecedented amounts of data. In this talk I will discuss recent results from Belle II and LHCb, their complementarity and aspects of possible collaboration.