T 76: Invited Overview Talks 5

Time: Thursday 9:00–10:30 Location: Geb. 30.95: Audimax

Invited Overview Talk T 76.1 Thu 9:00 Geb. 30.95: Audimax

Origin of heavy elements: r-process in neutron star mergers and core-collapse supernovae — •Almudena Arcones — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstr. 2, Darmstadt 64289, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstr. 1, Darmstadt 64291, Germany

Our understanding of the origin of heavy elements by the r-process has made great progress in the last years. In addition to the gravitational wave and kilonova observations for GW170817, there have been major advances in the hydrodynamical simulations of neutron star mergers and core-collapse supernovae, in the microphysics included in those simulations (neutrinos and high density equation of state), in galactic chemical evolution models, in observations of old stars in our galaxy and in dwarf galaxies. This talk will report on recent breakthroughs in understanding the extreme environments in which the formation of the heavy elements occurs, as well as open questions regarding the astrophysics and nuclear physics involved.

Invited Overview Talk T 76.2 Thu 9:30 Geb. 30.95: Audimax

Radio Detection of Neutrinos — •Anna Nelles — Erlangen Centre for Astroparticle Physics (ECAP), Friedrich-Alexander-Universität Erlangen-Nürnberg, 91058 Erlangen, Germany — Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

Optical neutrino telescopes, in particular IceCube, have truly started the field of neutrino astronomy. However, in order to pursue higher neutrino energies, those that are expected to be directly related to ultra-high energy cosmic rays, other methods are needed. This talk will introduce radio detection as promising route to discovery of EeV neutrinos. I will highlight the global experimental landscape, but focus on the Radio Neutrino Observatory Greenland (RNO-G) that is currently under construction.

Invited Overview Talk T 76.3 Thu 10:00 Geb. 30.95: Audimax

High precision gravitational wave physics from quantum field theory — •Jan Plefka — Humboldt-Universität zu Berlin, Berlin, Germany

Predicting the outcome of scattering processes of elementary particles in colliders is the central achievement of relativistic quantum field theory applied to the fundamental (non-gravitational) interactions of nature. While the gravitational interactions are too minuscule to be observed in the microcosm, they dominate the interactions at large scales. As such the inspiral and merger of black holes and neutron stars in our universe are now routinely observed by gravitational wave detectors. The need for high precision theory predictions of the emitted gravitational waveforms has opened a new window for the application of perturbative quantum field theory techniques to the domain of classical gravity. In this talk I will show how observables in the classical scattering of black holes and neutron stars can be efficiently computed in a perturbative expansion using a world-line quantum field theory; thereby combining state-of-the-art Feynman integration technology with perturbative quantum gravity. Here, the black holes or neutron stars are modelled as point particles in an effective field theory sense. Fascinatingly, the intrinsic spin of the black holes may be captured by a supersymmetric extension of the world-line theory, enabling the computation of the far field wave-form including spin and tidal effects to highest precision.