The new CONUS project aiming to detect coherent neutrino scattering for the first time, with first results expected after a few months of data taking.

The conclusion of the H.E.S.S. legacy survey of the Galactic plane, resulting in a catalogue of 78 very-high-energy gamma-ray sources as well as new results on individual sources, such as the identification of the Galactic Centre as a cosmic PeVatron accelerator and the first observation of particles escaping from the acceleration zone of a supernova remnant.

Key steps towards the realization of the CTA as a next-generation gamma-ray observatory were also made, including the foundation of the CTAO Observatory GmbH with Werner Hofmann as founding director, decisions on the CTA array site locations, and the successful testing of camera prototypes for the small-size and the medium-size CTA telescopes.

Key results in the area of “Quantum Dynamics of Atoms and Molecules” include:
- The most accurate value for the mass of the electron and the most stringent test of CPT symmetry in the baryonic sector with protons and antiprotons using high-precision Penning-trap measurements combined with, among others, state-of-the-art bound-state quantum-electrodynamics calculations.
- Photodissociation of an internally cold beam of CH⁺ ions in the cryogenic storage ring CSR demonstrating its unique performance with respect to the storage of cold molecular and cluster ion beams.
- The theoretical description and experimental realisation of tunable subluminal pulse propagation and phase detection of X-ray light employing interactions with nuclei embedded in thin-film cavities.
- The development of the concept of a vacuum collider via laser guided re-collisions of electron-positron pairs and of the theory for laser-generated intense gamma rays and neutral matter-antimatter plasmas.
- Highly charged ions (HCI) trapped at low temperatures by sympathetic laser cooling in Coulomb ion crystals for future high-precision spectroscopy and fundamental physics tests.
- The invention and experimental implementation of an ultrafast phase- and amplitude-control and time-gating scheme based on strong laser fields, enabling the time-resolved observation of a Fano resonance, the reconstruction of laser-driven quantum dynamics, and XUV/X-ray frequency combs.

In recognition of these achievements, members of the institute were awarded many prizes and other distinctions. I would like to emphasise that this success would not be possible without the excellent workshops and the support of the different service groups as well as by the administration. I would like to thank all members of the institute, in particular our junior scientists, and partners at universities and outside research institutions for their collaboration, support and enthusiasm.

The following chapters of the report address the areas of “1 Crossroads of Particle Physics and Astrophysics”, “2 Quantum Dynamics of Atoms and Molecules”, and “3 Service Units, Facts and Figures”. Lists of publications, theses, invited talks, teaching activities, organized conferences, and institutional collaborations are provided online.