# XXVII$^{th}$ International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2019)
# Final Report

Supersymmetry (SUSY) is one of most elegant extensions of the Standard Model (SM) and explains the puzzles of the SM by providing a candidate to explain the dark matter content of the universe, allowing scientists to understand the origin of the electroweak scale requiring the top mass to be around 170 GeV and leading to the unification of forces at a grand unified scale. Further the minimal supersymmetric standard model (MSSM) predicts the Higgs boson mass to be less than 135 GeV. The discovery of the Higgs Boson with mass around 125 GeV at the LHC has provided a major support to SUSY ideas.

Searches for SUSY are ongoing at the Large Hadron Collider (LHC). Direct and indirect dark matter experiments are searching for a particle dark matter candidate which arises most naturally in SUSY models. Proton decay predicted by SUSY grand unified theories is being searched for at deep underground experiments.

In addition, recent advances in neutrino and dark matter physics, observational astrophysics, precision cosmology and the promising new window into the cosmos opened by the direct detection of gravitational waves, have brought new ideas on the potential connections between new fundamental particles and our understanding of their impact on the early universe and its evolution. At present, the major questions include: Is SUSY still the best candidate for models beyond the SM? Do we have any well motivated alternative to SUSY? Have we exhausted all possibilities to search for new physics at high and low energy scales?

XXVIIth International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2019), hosted by Texas A&M University – Corpus Christi during May 20-24, 2019, provided a unique venue to discus and understand the status of SUSY, connection between particle physics and cosmology, supersymmetry and its alternative, Higgs sector, neutrino sector, flavor sector, dark matter, electroweak phase transition, astroparticle physics, gravitational waves and string theory. Discussion of results from the LHC, recent neutrino experiments and observations, direct and indirect dark matter detection experiments, detection of gravitational waves, data from particle colliders, as well as measurements of the CMB and Large Scale Structure were an integral part of SUSY 2019. To ensure the younger participants will benefit from the conference the most, the conference was preceded by the 4 day long pre-SUSY summer school for graduate students and postdocs. The invited speakers were leading scientists in the fields of SUSY interest. The school took place on Texas A&M University – Corpus Christi campus during the week prior the SUSY 2019 conference (May 15 – 18, 2019).

Since its inception in 1993, SUSY has become one of the most important and widely attended international meetings in high energy physics, devoted to new ideas in fundamental particle physics.

SUSY 2019 brought together approximately 250 scientists, theorists, phenomenologists, experimentalists and cosmologists, (including over 60 graduate students and 70 postdocs)

representing 22 nations: Australia, Belgium, Canada, Chile, China, Colombia, France, Germany, India, Italy, Japan, Mexico, Peru, Portugal, Romania, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom and United States. SUSY 2019 provided a stimulating venue for the exchange of scientific ideas among experts in dark matter, neutrino physics, particle physics, astrophysics and cosmology.

The following scientific topics were delivered during SUSY 2019 in form of 44 plenary talks and over 200 parallel talks:

- Supersymmetry: Models, Phenomenology and Experimental Results
- Unification of Forces
- Electroweak, Top and Higgs Physics
- Precision Calculations and MC tools
- BSM in Flavor Physics
- Neutrino Masses: Models and Phenomenology
- Cosmology and Gravitational Waves
- Dark Matter, Astroparticle Physics
- Formal Field Theory and Strings
- Alternatives to Supersymmetry
- Quantum Information: Machine Learning/Big Data

The conference abstracts and power point presentations for the talks and discussions can be found on the SUSY website: https://indico.cern.ch/event/746178/abstracts/ (abstracts), https://indico.cern.ch/event/746178/contributions/ (PPTs).

28 talks were given during the pre-SUSY program related to the following topics:

- Neutrino Physics
- Big Data
- Collider Physics & SUSY
- String Phenomenology
- Cosmology
- Dark Matter
- SUSY Models and Phenomenology

The Pre-SUSY presentations are posted on https://indico.cern.ch/event/746207/contributions/.