

UT Physics and the Higgs

October 8, 2013

The Royal Swedish Academy of Sciences has awarded the Nobel Prize in physics to Peter Higgs and Francois Englert for their research on what has come to be called the Higgs field, which gives elementary particles mass.

The University of Tennessee High Energy Physics group has been part of the hunt for the Higgs boson since 2006, working with the Large Hadron Collider at CERN. The group collaborates with the international collaboration that has built and maintains the Compact Muon Solenoid, or CMS, detector.

The Large Hadron Collider is an underground, 17-mile ring that straddles the French-Swiss border and accelerates protons to enormous energies in opposite directions. Every second, protons collide head-on more than 40 million times at particular locations surrounded by layers of particle detectors. The results of these collisions can be new particles or other phenomena. With multiple layers, the CMS detector can observe these remnants and track their signatures, providing scientists with data to piece together what happened at the heart of a collision.

The group made substantial contributions to the particle tracking detectors needed to study the decay properties, particularly the angular distributions of the Higgs boson. For future applications of this device at much higher beam intensities the group studies pixelated artificial diamond detectors in the laboratory and particle beams. The detectors are radiation hard and will be used for measurements of particle trajectories in the ongoing hunt for rare signals. Any particle rate measurement with the CMS detector depends crucially on the knowledge of the overall particle production rate in proton-proton collisions. Therefore, the UT group, together with U.S. university collaborators from Rutgers, Vanderbilt, and Princeton, is implementing a new instrument based on diamond pixel detectors deep inside the CMS detector. Prototypes are tested in test beams and the installation is scheduled for next year.

UT's group has one faculty member (Stefan Spanier), two postdoctoral researchers, three graduate students, and typically two undergraduate students who participate in projects at CERN during the summer and are involved in the laboratory on campus or data analysis with computers during the semester.

See the links below for more information on the Higgs Hunt and UT's past and planned contributions.

- **Royal Swedish Academy of Sciences** (<http://www.kva.se/en/>) and the **Official Nobel Prize Website** (<http://www.nobelprize.org/>)
- **Fermilab Press Release on the Nobel Prize** (http://www.fnal.gov/pub/presspass/press_releases/2013/Nobel-Prize-Higgs-20131008.html)
- **Video from Fermilab about America's Role in the Discovery of the Higgs** (http://www.youtube.com/watch?v=P2TN1_hkz0A)
- **The Compact Muon Solenoid (CMS) Detector at the Large Hadron Collider (LHC)** (<http://home.web.cern.ch/about/experiments/cms>)
- **CERN Press Release (March 14, 2013) on the Higgs Boson** (<http://press.web.cern.ch/press-releases/2013/03/new-results-indicate-particle-discovered-cern-higgs-boson>)