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UCSB Physics Professor Takes High Position with International Superconducting Project

A physics professor at the University of California, Santa Barbara has been named deputy physics coordinator for a major international project that will attempt to understand the fundamental forces of nature. Called the Compact Muon Solenoid (CMS) and located in Switzerland, the project may be the largest international scientific collaboration that the world has ever known. It is based at the European Organization for Nuclear Research, or CERN.

Professor Joseph Incandela will work with CMS physics coordinator, Paris Sphicas, of the University of Athens and CERN, to coordinate the physics research of 2,030 physicists from 38 countries and 174 institutions for a two year period. UC Santa Barbara has played one of the largest roles of any university group involved in the project.

The CMS experiment incorporates the largest superconducting solenoidal magnet in the world. A significant portion of the device was constructed at UCSB, and the university has a team of physicists, engineers, and technicians in place at CERN who are helping to prepare for the start-up phase of the project.

The scientists hope to answer some of the basic questions of physics with the underground experiments at the Large Hadron Collider (LHC), an accelerator that

occupies a space larger than the Geneva airport and is positioned under the border between Switzerland and France.

CMS is one of two sister particle detectors that are positioned inside the LHC, which forms a 17 mile circle underground. Incandela went to CERN recently for the lowering of the CMS magnet into place 350 feet below ground, an event that attracted over 30 television and radio news crews from around the world. The device weighed as much as five jumbo jets.

He explained that the center of mass collision energy will be 14 trillion electronic volts in the LHC. The beams of energy will be thinner than a human hair. "We will be able to probe a critical range of energy where we believe important clues must exist about the real nature of forces and particles in our universe," said Incandela. "This is a very exciting time for elementary particle physics; the experiments will have a major impact on physics."

Incandela will move to CERN this summer and the experiments are expected to begin pilot operation before the end of the year. Incandela is working with UCSB physics professors Claudio Campagnari, David Stuart, and Jeffrey Richman. UCSB's Vice Chancellor for Research, Michael Witherell, also a physicist, is involved as well. He was one of the first to use silicon to detect particles. Witherell is the former director of Fermilab, a key player in the U.S. effort.

"The UCSB physicists working on CMS are faced with an opportunity that comes along once every 20 years, the chance to make revolutionary discoveries about the nature of matter, space, and time," said Witherell. "For us, the startup of the Large Hadron Collider will be like the launching of the Hubble Space Telescope."

At UCSB, Campagnari and Incandela oversaw the building of high precision particle tracking devices made of silicon, a project that took place on the fifth floor of Broida Hall and involved physicists and technicians, as well as graduate and undergraduate students. The devices built on campus consisted of 2.6 million channels of electronics, the largest portion of the particle tracking system for this experiment that was constructed in one location. This component is considered crucial to the physics of the CMS experiment.

Incandela said that construction was very stressful and that he felt 10 years younger once the units were completed and placed in the CMS detector. He explained that he worried about everything, including earthquakes, that might ruin the detectors

before they were completed and shipped out. He said the physics position he holds now with CMS is much less stressful, even though he receives about 100 emails per day relating to the project. "I can get up in the middle of the night and there is always someone to talk with who is working on the project," he said. Incandela will retain his position as professor of physics at UCSB and will take graduate students and post-doctoral fellows to Europe to work on the research.

The experiments will collide protons with protons at extremely high energies, thus converting kinetic energy into energy that can create new particles. "The experiment will reach extremely high temperatures that have not existed since the big bang," he said. "The particles we hope to create were abundant at that point. This experiment could see evidence for the Higgs, the particle that causes other particles to have mass, or for dark matter. These are a couple of many, many possibilities of what we may see."

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.