



## Quarks for World's Fair Park

### Tiny Particle: Big Conference

March 26, 2009

UT physicists are helping organize an international conference that looks to pump \$1.5 million into Knoxville's economy while paying homage to the tiniest component of all matter, the quark.

Quark Matter 2009 (QM09): the 21st International Conference on Ultrarelativistic Nucleus-Nucleus Collisions, is set for March 30th through April 4 at the Knoxville Convention Center, next to World's Fair Park. [Oak Ridge National Laboratory](#) is the host for the meeting.

Professor Soren Sorensen, head of the UT Department of Physics and Astronomy, is a nuclear physicist and part of the local organizing committee for the conference, which is poised to bring considerable business to East Tennessee. Estimating conference fees, rentals, catering, and participant spending, "I would assume that the total impact is on the order of \$1.5 million pumped into the local economy," he said.

More than 600 scientists from all over the world are expected at QM2009. Organizers have reviewed more than 400 submitted abstracts and set a program of talks and poster presentations, all featuring the quark, considered the building block of all matter.

Until the mid 20th Century, scientists believed that protons, neutrons, and electrons were as subatomic as particles could go. Working independently, physicists Murray Gell-Mann and George Zweig discovered in 1964 that the blueprint for matter included a still smaller particle, the "quark," a name Gell-Mann plucked from a line in James Joyce's *Finnegan's Wake*: "Three quarks for Muster Mark."

Quark matter was part of the Big Bang and can still be found in neutron stars. By colliding heavy ions at nearly the speed of light (ultrarelativistic), scientists can free quarks and the subatomic particles that hold them together, called gluons. Studying their properties provides a glimpse into the first few seconds of the universe and can reveal information about atoms and their constituents. The many scientists interested in this work have gathered nearly every year since 1979 to compare notes and consider new theories and experiments.

"At the moment, (quarks) are, to the best of our knowledge, the most fundamental particles that we can deal with," Sorensen said. "So in that sense they are at the bottom of what we call the quantum ladder. Ninety-nine point five percent of normal mass—99.5% of everything we see on Earth—is made out of quarks, deep down.

"In the U.S., I would say roughly a third of all nuclear physicists are in this field," he said. "This is the major conference if you work in (quark matter). If you have been working on the Brookhaven Accelerator, if you have been working on the heavy ion program in Geneva, and now the heavy ion program at LHC (Large Hadron Collider), then this is the conference."

The meeting organizers have purposely designed a program that focuses attention on the most substantial and thought-provoking ideas in quark matter to set the stage for future work.

"The emphasis in this conference is to summarize and understand where the field stands before the LHC machine will have its first results in a couple of years, which will open up a new frontier," Sorensen explained.

That new frontier will be explored in large part by scientists who are at present just beginning their careers, a fact the QM09 organizers have taken into account. Sorensen estimates that about one-third of the conference participants will be students. A one-day student school is scheduled for March 29, prior to the official conference start, and a career forum is slated for Monday evening, March 30.

"Student Day will provide a general overview of the whole field in very simple terms so that first and second year graduate students can understand it," he said.

Student participation is important, Sorensen explained, for several reasons.

"Many of the parallel talks will be given by the young people," he said. "It will be students within the last one or two years before graduation; it will be the post-docs, and so on. Coming to a conference like this gives them a unique opportunity for presenting their work and getting themselves and their work known to the community. A Quark Matter talk can make a career.

"It's also a wonderful job market," he added. "This is the way for the senior physicists to try to find out who is close to graduation who could be their next post-doc. And then of course it's very important for the students to learn something. It's a way for them to get out from in front of an oscilloscope or the computer terminal to come and listen to all the many things that are going on; not just at their level—sub, sub, subfield—but in our whole field."

In fact, one reason that he and other nuclear physicists lobbied to host the meeting in the United States was to ensure that U.S. graduate students had the opportunity to attend.

"It looked at one point like there would be a whole generation of young people who would not be able to go to Quark Matter," Sorensen said. "It's so expensive to send students to Hungary, or to China, or to India, that in general there are not many American students going to the conference."

With ORNL hosting the 2009 meeting, the Department of Energy was "quite supportive in providing substantial funds, specifically for young people," he said. "I have personally handed out financial support to close to 200 students."

Other QM09 sponsors are the American Physical Society/Physical Review, Elsevier, the International Union of Pure and Applied Physics, the ExtreMe Matter Institute at GSI, CERN, Brookhaven National Laboratory, and Los Alamos National Laboratory. The UT College of Arts and Sciences has also made possible the performance of the play "[Copenhagen](#)" for conference participants.

Along with UT; Vanderbilt, Duke, Florida State, North Carolina State, and Georgia State universities are all part of the organizational team. The local organizing committee is chaired by Glenn Young, Director of the ORNL Physics Division and a UT physics graduate. Vicki Greene of Vanderbilt, a 1984 math and physics graduate, is in charge of conference events. Physics faculty members Yuri Efremenko and Ken Read are also involved with conference planning.