AIP Matters

Tuesday, January 18, 2011

Director's Matters

By H. Frederick Dylla, Executive Director & CEO

Rutherford's nuclear world

History provides teaching moments for many fields of study. For the sciences, I have found that exploring how a major discovery played out, with its usual fits and starts, is an enjoyable and satisfying learning experience. Eureka moments are hard won. Subsequently written textbook entries for a discovery often lay out the minimal logical path from stated problem to found solution. Such methodical reconstructions, however, strip away the real-life pain and reward and make the path less interesting to me.

I had the opportunity at last week's AAPT winter meeting to put one of the most important discoveries in physics in its historical context. This year is the centenary of Ernest Rutherford's discovery of the atom's nucleus, a structure much smaller than an atom itself (by nearly a factor of 10,000), but nevertheless containing nearly all the atomic mass. Even to a bright elementary student, none of this is surprising today. But in the early 1900s the discovery was profound. Very little was known about the atom except for its approximate size and that it contained a negatively charged particle we now call the electron.

From the left, historians John Rigden (AIP, retired), Roger Stuewer (Univ. of MN), and Tony French (MIT) with Fred Dylla and AAPT President David Cook.

Rutherford's discovery of the nucleus was conducted over a five-year period that began in 1908 when his students Hans Geiger and Ernest Marsden started measuring the trajectories of alpha particles emanating from a natural radioactive source directed onto a thin foil of gold. As the researchers expected, most of the particles traversed the foil with only a small deflection from their forward path. To the experimenters' and Rutherford's surprise, however, a few were deflected through large angles. After puzzling for about a year over how this could

happen, Rutherford suggested that a massive, charged body lay deep within the atom. His analysis of the experiment has held up to this day, though he and his students were careful to do many follow-up experiments before they declared success.

The Large Hadron Collider is the largest and most powerful particle accelerator on Earth. (Credit: CERN)

Rutherford and his students are credited with two milestone developments that the physics community will memorialize in 2011: the discovery of the atomic nucleus and the invention of the particle scattering experiment. Particle scattering remains, a century later, the primary means of investigating the subatomic world. Rutherford's work launched the fields of nuclear physics and later particle physics, which have given us our basic understanding of the structure of the universe from subatomic to cosmic dimensions.

In the spring AIP's Center for History of Physics will be introducing a new educational web exhibit entitled “Rutherford’s Nuclear World” to commemorate Rutherford's key experiments a century ago and his legacy a century hence. For a preview of some of the material in the exhibit, you can view two presentations given at last week's AAPT meeting. My presentation, “A Million Volts in a Soapbox,” focused on Rutherford and the accelerator; History Center director Greg Good’s talk, “Rutherford's Geophysicists,” was part of the Rutherford commemorative session that appealed to physics teachers and history buffs alike.

Fred

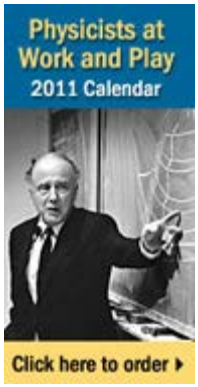
PRC MATTERS

Orville Butler and Zaiqing Feng of the Institute for History of Natural Sciences, Chinese Academy of Sciences.

Telling the story of industrial R&D in the US

Orville Butler, historian of the History Center’s History of Physics Entrepreneurship study, recently visited the cities of Beijing, Xi’an, and Nanchang, China. Enlisting the help of Xingtao Ai, chief representative of AIP's Beijing office, Butler was able to address students and scholars at the Institute for History of Natural Sciences, Chinese Academy of Sciences and at Nanchang University. Butler’s presentation, “Evolution of

Industrial R&D and Physics-Based Technology Transfer in the US since World War II," incorporated findings from the History of Physicists in Industry study and a current project to examine entrepreneurship, both from AIP's History Center.



Still need a calendar for 2011?

The Emilio Segrè Visual Archives 2011 "Physicists at Work and Play" calendar features some of the most interesting historical photos from their collection. Both sizes (11" x 17" and 13.5" x 19") are still available; proceeds benefit the Archives.

Please pass the word along to your colleagues in the community.

AROUND AIP

Green tip

Investigate your utility company's reward programs for conserving energy. As an example, Baltimore Gas and Electric Company (BGE) and Pepco will install either a programmable thermostat or outside switch on your heat pump. When energy demand reaches a peak, the company sends a signal, cycling your compressor to conserve energy. Customers are rewarded with an incentive credit.

WHAT'S HAPPENING THIS WEEK

Friday, January 21

- *Physics Today* Advisory Committee meeting (College Park, MD)

We invite your feedback to this newsletter via email to aipmatters@aip.org.

For past issues of this newsletter, visit the AIP Matters archives.