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More information on Pierre Auger Cosmic Ray Observatory, including visual overview and interview with Nobel Laureate James Cronin: http://www.auger.org/

Pierre Auger Observatory Images: http://www.auger.org/observatory/2004.html

For Immediate Release

Pierre Auger Observatory Celebrates Progress on Detector Array and Presents First Science Results

MALARGÜE, Argentina **--** Scientists of the Pierre Auger Observatory, a project to discover the origins of rare and mysterious ultra-high energy cosmic rays, began a celebration today (10 November) in Malargüe, Argentina, to mark the progress on installation of the Observatory's detectors on the Argentina Pampas, and the presentation of the first physics results.

"These highest-energy cosmic rays are messengers from the extreme universe. They represent a great opportunity for discoveries," said Nobel Prize winner James Cronin, of the University of Chicago, who conceived the Auger experiment together with Alan Watson of the University of Leeds (UK). Watson added: "How does nature create the conditions to accelerate a tiny particle to such an energy? Tracking these ultrahigh-energy particles back to their sources will answer that question."

The opening symposium included presentations on the origins of the project, the construction, and the first science results. Guided tours of the Observatory will be given on Friday, 11 November. Events conclude on Saturday, 12 November, with a science fair featuring participants from local schools.

"It is a great pleasure for the Atomic Energy Commission of Argentina to participate in the celebration of the Pierre Auger Project in Malargüe," said Dr. Cristina Combiaggio, Director of *Centro Atomico Constituyentes* of CNEA *(Comision Nacional de Energia Atomica).* "We are very proud of having been able to collaborate with the Project from the very beginning, assuming its leadership in our country, and we commit ourselves to continue providing support."

The Observatory collaboration includes more than 370 scientists and engineers from 60 institutions in 16 countries, and the construction cost of approximately $50 million (US) has been shared by the participating countries. The international funding agencies are listed below.

Commenting on the experiment's progress, the Chief Executive of the UK's Particle Physics and Astronomy Research Council [PPARC], Prof. Keith Mason, said: "The Pierre Auger Observatory is a remarkable example of international collaboration, and I am particularly proud that the UK was involved at its inception and that our scientists continue to play a key role in this project."

Dr. Roberto Petronzio, President of Italy's *Istituto Nazionale di Fisica Nucleare* (INFN), said the Auger experiment "represents an important scientific engagement for INFN, which participates with researchers in eight different areas of focus. The collaboration is the widest in the field of cosmic ray physics and is aimed at clarifying the origins of the most energetic particles streaking across the universe. The Pierre Auger Observatory represents, in addition, an important project for the scientific development of Latin America."

The Pierre Auger Observatory is trying to solve the mystery of the origins of extremely rare ultra-high-energy cosmic rays – charged particles showering the earth at energies above 10^{19} electron volts, about 10 million times higher than the the energy of the world's highest-energy particle accelerator, the Tevatron at Fermilab. To witness these extremely rare events, the observatory is constructing an array of 1600 detectors spread over 3000 square kilometers in Argentina's Mendoza Province, just east of the Andes Mountains. Each detector contains 3000 gallons of ultra-pure, de-ionized water. These "Cerenkov detectors" discern the presence of charged particles by measuring the Cerenkov radiation, or electromagnetic shock waves, produced when the particles move through the water faster than the speed of light in the water. The effect is analogous to shock waves generated in the atmosphere by planes flying at supersonic speeds. Information from the detectors is transmitted by solar-powered cellular phone technology.

The detector array covers an area approximately the size of the state of Rhode Island in the United States. Surrounding the array is a set of 24 telescopes which, on clear moonless nights, observe the ultraviolet fluorescence produced as cosmic ray shower particles travel through the atmosphere. While a northern hemisphere site has not yet been funded, the collaboration is working to establish a northern hemisphere partner of the southern observatory, likely to be based in southeastern Colorado in the US. With observatories in both hemispheres, the Auger collaboration will have the opportunity to view cosmic rays across the entire universe, from every direction.

"Once more science stands at the threshold of resolving a fundamental question that has so far eluded mankind – the source of high energy cosmic rays," said Prof. Mason. "And I look forward with great interest to Auger's quest to unravel one of Nature's most intriguing mysteries."

The first science results from the Auger Observatory include a new cosmic ray spectrum at the highest energies; the results of anisotropy and point source searches; and new limits on the photon content of the primaries, which could address several points within exotic theories of cosmic ray origin. The significance of the results:

- The Observatory charts a spectrum by measuring the observed cosmic rays as a function of energy. As the energy of the cosmic rays increases, the experiment is seeing fewer and fewer of them. Auger observes cosmic rays at energies as high as any other experiment has ever seen, if not higher, examining this high energy range for interesting phenomena -- which might or might not exist.

- Cosmic rays generally are charged particles. Lower-energy rays are greatly affected by galactic magnetic fields, taking twisted and distorted paths to earth. High-energy rays, less affected by magnetic fields, take a more direct path to earth. If experimenters see more rays from one direction than from another (anisotropy), they can refine their observations to include point source searches, tracking back fairly closely to a point source or an object in the sky.

- Scientists want to know the makeup of the primaries, the cosmic ray particles that initially strike the earth's atmosphere, creating further collisions with air moleclues that eventually produce a cascade of particles called an extensive air shower. Is the primary a proton, an atomic nucleus, or a photon? Researchers have determined experimentally that the makeup of primaries cannot exceed a specific fraction (a limit) of photons, which will eventually affect their thinking on some exotic theories of cosmic ray origins.

- These exotic theories include hypothetical objects left over from the Big Bang, called topological defects, such as "cosmic strings," "domain walls," and "monopoles." If these hypothetical phenomena existed, and then collapsed, their collapses could produce enough energy to create very high-energy cosmic rays. If so, then a certain fraction of cosmic rays would consist of photons. So far, the data is not extensive enough to prove or disprove any of these phenomena. But enlarging the data set over time will help Auger scientists narrow down the many different theories of cosmic ray origin.

The Pierre Auger Cosmic Ray Observatory is named for French scientist Pierre Victor Auger (1899-1993), who in 1938 was the first to observe the extensive air showers generated by the interaction of very-high-energy cosmic rays with the earth's atmosphere.

Fermilab, which hosts the project management office for the Pierre Auger Observatory, is a U.S. Department of Energy Office of Science national laboratory, operated under contract by Universities Research Association, Inc. DOE and NSF have designated URA as the US representative on the project's international oversight board, currently chaired by URA President Fred Bernthal.

Auger Observatory Collaborating Institutions by Country

Argentina
Instituto Balseiro, Centro Atómico Bariloche - Comisión Nacional de Energía Atómica y Universidad Nacional de Cuyo
Instituto de Astronomía y Física del Espacio - CONICET
Instituto de Física de La Plata - Universidad Nacional de la Plata y CONICET
Laboratorio TANDAR - Comisión Nacional de Energía Atómica
Universidad Tecnologica Nacional - Regionales Mendoza & San Rafael
Australia
University of Adelaide

Bolivia
Universidad Catolica de Bolivia
Universidad Mayor de San Andres
Brazil
CBPF-Centro Brasileiro de Pesquisas Fisicas
Universidade Estadual de Feira de Santana - Bahia
Universidade Estadual do Sudoeste da Bahia
Universidade Federal da Bahia
Universidade Federal do Rio de Janeiro
Universidade Federal Fluminense
Universidade de Sao Paulo
Universidade Estadual de Campinas
Czech Republic
Institute of Physics of the Academy of Sciences of the Czech Republic
Institute of Particle and Nuclear Physics, Charles University Prague
France
Institut de Physique Nucléaire,Orsay, and IN2P3-CNRS
Laboratoire de l'Accélérateur Linéaire,Orsay, and IN2P3-CNRS
Laboratoire AstroParticule et Cosmologie du Collège de France, and IN2P3-CNRS
Laboratoire de Physique Nucléaire et de Hautes Energies, Université Paris 6, and IN2P3-CNRS
Germany
Forschungszentrum Karlsruhe-Institut für Kernphysik
Forschungszentrum Karlsruhe-Institut für Prozessdatenveratbeitung und Elektronik
Max Planck-Institut für Radioastronomie and Universität Bonn associated by Forschungszentrum Karlsruhe
Institut für Kernphysik
Rheinisch-Westfälische Technische Hochschule Aachen
Universität Karlsruhe
Universität Siegen
Bergische Universität Wuppertal
Italy
Dipartimento di Fisica dell'Università and INFN, L'Aquila
Dipartimento di Fisica dell'Università and Sezione INFN, Lecce
Dipartimento di Fisica dell'Università and Sezione INFN, Milano
Dipartimento di Fisica dell'Università and Sezione INFN, Napoli
Dipartimento di Fisica dell'Università di Roma “Tor Vergata” and Sezione INFN Roma II
Dipartimento di Fisica Sperimentale dell'Università and Sezione INFN, Torino
Istituto di Fisica dello Spazio Interplanetario (INAF), Dipartimento di Fisica Generale dell'Università and Sezione INFN, Torino
Sezione INFN di Catania & Dipartimento di Fisica e Astronomia dell'Università, Catania
INFN, Laboratori Nazionali del Gran Sasso
Mexico
Benemérita Universidad Autónoma de Puebla
Centro de Investigacion y de Estudios Avanzados del IPN
Universidad Michoacana de San Nicolás de Hidalgo
Universidad Nacional Autónoma de México
Netherlands
Stichting Astronomisch Onderzoek in Nederland (ASTRON), Dwingeloo
Institute for Mathematics, Astrophysics and Particle Physics (IMAPP), Radboud Universiteit, Nijmegen
Kernfysisch Verneller Instituut (KVI), Rijksuniversiteit Groningen, Groningen
Nationaal Instituut voor Kernfysica en Hoge Energie Fysica (NIKHEF), Nijmegen
Poland
Department of Experimental Physics, University of Lodz
Institute of Nuclear Physics, Krakow
Slovenia
Nova Gorica Polytechnic
Spain
Departamento de Fisica de Particulas, Universidad de Santiago de Compostela
Universidad Complutense de Madrid
Centro de Supercomputacíon de Galicia
Universidad de Alcalá de Henares
United Kingdom
Oxford University

University of Leeds
USA
Case Western Reserve University
Clemson University
Colorado State University
Columbia University
Fermilab National Accelerator Laboratory / Argonne National Laboratory
Louisiana State University/Southern University
Michigan Technological University
Northeastern University
Ohio State University
Pennsylvania State University
University of California, Los Angeles
University of Chicago
University of Colorado
University of Minnesota
University of Nebraska
University of New Mexico
University of Utah

Auger Observatory Funding Agencies by Country

UNESCO
Argentina
La Provincia de Mendoza
Comision Nacional de Energía Atómica
Fundacion Antorchas
Australia
The Australian Research Council
Brazil
Fundacao de Amparo a Pesquisa do Estado de Sao Paulo (FAPESP)
Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq)
Financiadora de Estudos e Projetos do Ministerio dA Ciencia e Tecnologia (FINEP/MCT)
Czech Republic
Ministry of Education, Youth and Sports of the Czech Republic
France
Centre National de la Recherche Scientifique (CNRS)
Département Sciences de l'Univers (SDU-INSU/CNRS)
Département Physique Nucléaire et Corpusculaire (PNC-IN2P3/CNRS)
Conseil Régional Ile-de-France
Germany
Helmholtz-Gemeinschaft Deutscher Forschungszentren
Bundesministerium für Bildung und Forschung (BMBF), Germany
Deutsche Forschungsgemeinschaft DFG
Finanzministerium Baden-Württemberg
Ministerium für Wissenschaft und Forschung, Nordrhein Westfalen
Italy
Istituto Nazionale di Fisica Nucleare (INFN)
Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR)

Mexico
Consejo Nacional de Ciencia y Tecnología
Netherlands
Ministerie van Onderwijs, Cultuur en Wetenschap
Stichting voor Fundamenteel Onderzoek der Materie (FOM)
Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)
Poland
Ministry of Science and Information Society Technologies
Slovenia
Slovenian Research Agency
Ministry for Higher Education, Science, and Technology

Spain
Ministerio de Educacíon y Ciencia
Xunta de Galicia
FEDER funds
Consejería de Educacíon de la Comunidad de Castilla La Mancha
United Kingdom
Particle Physics and Astronomy Research Council
United States
Department of Energy
National Science Foundation
The Grainger Foundation

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