

## Education and Public Outreach of the Pierre Auger Observatory

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**Abstract.** The Auger collaboration's broad mission in the areas of education, outreach and public relations is coordinated in a separate subtask of the experiment. Its goals are to encourage and support a wide range of education and outreach efforts which link schools and the public with the Auger scientists and the science of cosmic rays, particle physics, and associated technologies. The northern and southern hemisphere sites and the collaborating institutes in 19 countries offer extremely diverse settings for education and outreach projects. The collaboration's impact in Mendoza Province, Argentina, initiated with a series of public talks and visits to schools and universities, is discussed. The Visitor and Education Center at the southern Auger Center Building is also described. In addition, progress on establishing high-school based networks of cosmic-ray detectors at numerous sites in North America and abroad will be reported.

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### 1 Introduction

The goals of the Education, Outreach, and Public Relations task in the Auger Observatory include:

- Use of the Auger Observatory and its international collaboration of scientists and educators as vehicles to enhance scientific literacy and technology skills in the regions of the northern and southern hemisphere sites and internationally.
- Increase public awareness and public support for basic research in physics, astrophysics, and all areas of science.
- Encourage and support a wide range of education and outreach projects which link schools, community groups, and the public with the scientists and the science of the Auger Observatory.

- Provide both technical and non-technical information on the Auger project (from its goals to its scientific results) to a wide range of audiences, which include students, the general public, government officials and scientific colleagues. Modes of information dissemination include public and technical talks, press kits and releases, and educational materials available in several media formats – audiovisual, print, electronic – and in several languages.
- Recruit and encourage the participation of groups underrepresented in science in Auger Observatory outreach and education activities.

An Education/Outreach Working Group consisting of at least one representative from each of the 19 collaborating countries has been established. This report summarizes a number of ongoing education/outreach efforts in the vicinity of the southern hemisphere site in Argentina, lists a sample of related activities, and describes future plans.

### 2 Education and Outreach Impact in Argentina

To date, the Auger collaboration has had the greatest impact in the municipality of Malargüe (population 18,000), Mendoza Province, with efforts concentrated during week-long collaboration meetings. The mere presence, in the restaurants, hotels, and streets of Malargüe, of over 100 physicists from around the world is quite noticeable in this remote town. Our varied interactions with Malargüe residents, from students to adults, reveal that there is substantial public interest in the Auger Observatory, its participating scientists, and its impact in the region. Education and outreach activities have been arranged in collaboration with the Malargüe Office of Tourism and its dedicated staff, the Municipal Schools Office and the Press Office. These offices have facilitated a smooth and positive integration of the Observatory into the local culture.

## 2.1 Activities in April 2000

Outreach activities in Malargüe started in earnest during the April 2000 Auger collaboration meeting when a series of 4 public lectures drew over 700 visitors which included primary and secondary school students, teachers, families, businessmen, and local officials. Presentations by Auger collaborators were given in Spanish or English and introduced the public to the Auger Observatory, its scientific goals, and its widely-distributed array of detectors in a level-appropriate manner. A non-technical Auger information brochure in Spanish was distributed during each lecture. Following each presentation, many audience members posed insightful questions ranging from “Why did you pick the Malargüe region to perform the experiment?” to “How does the Auger Observatory benefit humanity?” A common theme in many questions concerned the environmental impact of placing 1600 detector tanks in the Malargüe region – their visual impact, their safety, their longevity. At these lectures, several local teachers extended invitations to Auger scientists to visit their schools to provide further information and hold discussions with their students.

Two Auger collaborators were also interviewed on Malargüe’s radio station for an hour-long broadcast. This transmission was aimed at the rural population who could not attend the public lectures in town, and a general overview of the Auger Observatory was presented in simple language.

Well-attended lectures were also given at the Technological University in nearby San Rafael, one for the general public and several short technical presentations for instructors and students.

Co-spokespersons A. Watson and J. Cronin were named honorary overseers of the Municipal English Academy and have paid visits to the school during each collaboration meeting for informal discussions with students.

## 2.2 Activities in November 2000 / May 2001

The November 2000 collaboration meeting was scheduled to overlap with the 50<sup>th</sup> anniversary celebration of the founding of Malargüe. Identified by a 4 meter long banner, the collaboration marched in an anniversary parade along the town’s main street, sandwiched between a local school for flamenco dance and a school for gymnastics. This was followed by a formal dedication ceremony to open the newly-completed Auger Assembly Building. In attendance were the mayor of Malargüe, the governor of Mendoza Province, plus other representatives from the provincial government, military, and clergy. This was followed by a catered Open House which drew over 1000 Malargüe residents. The walls of the central hall of the Assembly Building were lined with large posters, provided by several Auger collaborators, explaining various aspects of the Auger Observatory and cosmic-ray physics. During the Open House, many Auger scientists were on hand to discuss the project with townspeople in a one-on-one fashion.

During the November 2000 and May 2001 collaboration

meetings, several Auger scientists visited individual school classes to present elementary physics lectures or hold informal discussions. Both Spanish and English speakers were involved. The English speakers were especially welcome at Malargüe’s two English language schools – the Municipal English Academy and the English Cultural Institute.

Outreach activities extended beyond the science of cosmic rays during the May 2001 collaboration meeting. The wife of one collaborator is a professional ballet dancer who was a guest teacher at two Malargüe ballet schools during the week. Over 100 young ballet students were delighted by her classes.

Newspapers in Mendoza Province and Buenos Aires carry frequent reports on Auger meetings and milestones achieved by the experiment.

## 2.3 The Visitor and Education Center at the Southern Hemisphere Site

The Visitor and Education Center in Malargüe is being designed to occupy a one-story high, 10m × 12m enclosed space at the entrance of the Auger Center Building. This building is presently under construction with a completion date in July 2001. A dedication ceremony and open house are planned for November 2001.

The Visitor Center will serve as a first stop on a tour of the Auger campus and other facilities in the field (surface detectors, fluorescence detectors, communications towers), but it will also provide a self-contained visitor experience. Although there will be permanent fixtures and posters on the walls of the Visitor Center, the space and its exhibits will be flexible enough to accommodate (a) individuals, families, or small groups walking through the area on their own and (b) groups of up to 25 (school classes, for example) who can be seated to view a video presentation or a live lecture/discussion led a physicist or public-relations guide. Lectures to larger audiences are foreseen to occur in the nearby Malargüe Conference Center which has large auditorium spaces and is used for Auger collaboration meetings.

Exhibits being considered and developed for the Visitor Center include

- A series of professionally produced, framed posters, with Spanish and English text, covering the following range of topics: history of cosmic ray research and its important players, images of possible sources of cosmic rays (colliding galaxies, active galactic nuclei, ...), artist’s rendering of air shower formation in the atmosphere (showing final state particles detected by surface detectors and light detected by fluorescence detectors), photographs of Auger installations in the field, information on the Auger collaboration (world map with participating countries and institutions), and images of particle detectors used in other environments (other cosmic ray experiments, accelerator experiments, medical applications). The wall space will be able to accommodate the mounting of alternate exhibits – student drawings of cosmic rays and Auger detectors, professional artist

exhibits illustrating cosmic rays and astrophysical objects.

- A scale model of the Auger detector array, with other landmarks – roads, towns, geographic features – mounted on a low table, with LEDs indicating surface detector positions. This exhibit is foreseen to evolve with the installation of the array, showing the fraction of the array which has been installed to date. Clusters of detector LEDs struck by extended air showers, using either simulated or real data, can be flashed using a PC-driven LED controller.
- Visual (spark chamber) or audible (Geiger counter) demonstrations of cosmic ray detection.
- A large LED-display scoreboard showing accumulated online statistics, highest-energy event recorded, etc., from Auger data.
- Audio/visual equipment to project a professionally produced video on the Auger Observatory, its science and scientists.

#### 2.4 Mendoza's *Eureka* Interactive Science Museum

The Education/Outreach task is collaborating with a superb, multidisciplinary science museum and park named *Eureka* in the city of Mendoza, the provincial capital, to install Auger-related exhibits. Auger collaborators at Mendoza's Technological University (UTN Mendoza) serve as liaisons to the *Eureka* staff. Over the upcoming year, planned exhibits include posters similar to those in the Auger Visitor Center in Malargüe, interactive PC-based displays to visualize the development of extended air showers and their detection, full-scale models of a surface detector tank and a fluorescence detector located in the museum's outdoor exploration park.

#### 2.5 Partnership with Lincoln International School in Buenos Aires

The Auger collaboration has established a partnership with the Lincoln International School in a suburb, La Lucila, of Buenos Aires. This English language high school has a diverse international student body. During day-long visits by G. Snow in April 2000 and by J. Cronin in April 2001, general talks on the Auger Observatory were presented to large assemblies of students. An enthusiastic physics teacher at the school plans to contribute to the experiment through independent student projects which may entail visits to the Malargüe site.

#### 2.6 Scholarships to Michigan Technical University

Auger collaborators from Michigan Technological University (MTU), with the enthusiastic support from the University administration, have initiated a scholarship program for high school students from Malargüe. The scholarship supports one student per year for a four-year course of study

which leads to a bachelors degree. It covers all local costs – tuition, room & board, fees, and other expenses. An additional student is chosen each year, so after the pipeline fills, four students may be simultaneously supported. School officials in Malargüe are entrusted with the selection of each year's candidate. To ensure the success, the student must demonstrate English proficiency on a standardized exam before enrolling and must maintain above-average performance in his/her courses to retain the scholarship. The Auger collaboration views this unique educational tie to Malargüe as a model for other collaborating institutions to follow.

### 3 Selected Related Education/Outreach Activities

#### 3.1 The Coalition for National Science Funding Exhibition

On June 13, 2001, the Auger collaboration will mount an exhibit at the Coalition for National Science Funding Exhibition in the Rayburn Office Building of the U.S. House of Representatives in Washington, DC. Thirty one research and education projects or organizations will be on hand to introduce members of Congress and their science staff members to the wide spectrum of programs supported by the U.S. National Science Foundation. The Auger exhibit will feature colorful posters documenting the installation of the Engineering Array at the southern site, displays of detector hardware components, and Auger information packets to leave with exhibit visitors. Members of Congress from states with Auger collaborating institutions will be informed how their support of basic research benefits researchers, students, and others in their constituencies.

#### 3.2 Distributed High-School Networks of Extended Cosmic-Ray Air Shower Detectors

In the U.S., Canada, and Europe, a number of university groups, some collaborating in the Auger Observatory, have launched efforts to enlist high schools in their vicinities in the study of extended cosmic-ray air showers. Groups of high school teams construct, install, and operate school-based detectors under the guidance of university faculty and students. The stand-alone experiment at each school is an array of detectors in weather-proof enclosures on the school roof, with a GPS receiver providing a time stamp for cosmic-ray events. The detectors are connected to triggering electronics and a data-aquisition personal computer inside the building. Students share data via the Internet to search for time coincidences with other sites, both locally and across large distances. Several of these efforts plan to exchange and compare data with the Auger Observatory.

A description of one high-school effort based at the University of Nebraska can be found in this ICRC 2001 proceedings: "The Cosmic Ray Observatory Project – a Statewide Education and Outreach Experiment in Nebraska, USA" by D. Claes, V. Mariupolskaya, and G. Snow. A more detailed description with links to similar efforts at other locations can

be found in the American Physical Society, Spring 2001, Forum on Education electronic newsletter [1]. The above partnerships between university researchers and local schools serve as models for expansion to Auger collaborating institutions around the world.

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#### 4 References

1. "Cosmic Rays Through The Heartland", D. Claes and G. Snow, Spring 2001 APS Forum on Education electronic newsletter, <http://www.aps.org/units/fed/spring2001/pdf/crop1.pdf>.