

Physics Department Senior Design Project Proposal

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(Name, phone, email)

Project Title: Simulation of the wireless sensor network to be used in the northern Pierre Auger Observatory.

Project Type: [] Team; Number of students: [X] Honors

Objective

(What is the science and/or engineering in this project?)

The goal of the Pierre Auger Observatory is the study of the highest energy cosmic rays. This can only be done with a very large array of detectors spanning an area of several thousands of square kilometers. Following the construction of Auger South in Argentina, the plan is now to develop the northern site to be located in south-east Colorado.

The design of a reliable (and fast) communication system between the detectors, spread over such a large area, and the data collection point is paramount for the success of the future array. In this context, CSM is responsible for designing a realistic model of the wireless sensor network, which is due to be implemented for the northern site. The model is based on placing the cosmic-ray detectors in the digital elevation map of the area where the array will be deployed and finding out whether, for a given mast height, the antenna placed on a given pair of cosmic-ray detectors see each other, i.e. the line of sight is not intercepted by the variations of elevation along its path. This needs to be done through a computer program, as we need to test the communication of as many as 4400 detectors.

Prior Background

(What is the history of your involvement with this topic, including previous student projects?)

This project is a continuation of a successful senior design done last year. Quite a bit of software is already written. Last year's senior design student presented his results in May at the Auger Collaboration meeting in Lamar, CO.

Student Expectations

(What do you anticipate the student(s) will be able to accomplish during the academic year?)

Strong C/C++ experience is required for this project. The student is expected to cleanup the existing code and "bring it to the next level". This includes the implementation of a genetic algorithm to optimally pick the mast height needed on each tank, and possibly to add a realistic wave propagation model (single-edge diffraction) to go beyond the line-of-sight approach.

Supervision Plan

(Who will be directly interacting with the student(s), you, a post-doc, grad students, or others?)

By myself.

Resources

(What equipment, algorithms, and facilities are available, and what will be assembled as part of the project?)

Access to a computer in the Auger lab.

Technical References

(Identify a few key starting points for the student(s); journal citations, prior reports, instruction manuals, etc.)

See <http://www.auger.org> for a description of the Auger observatory and its goals. The previous senior design report will be available as reference and starting point of the work to be done.