THE PIERRE AUGER OBSERVATORY DESIGN REPORT

Second Edition

The Auger Collaboration

14 March 1997

Foreword to the Revised Edition

The Auger Project is a broad-based international effort to make a detailed study of cosmic rays at the highest energies. Two established air shower detector techniques – a surface array of particle detectors coupled with an air fluorescence detector – form a powerful instrument for the proposed research. The objectives of the Auger Observatory are to measure the arrival direction, energy, and mass composition of cosmic rays above 10^{19} eV.

The Auger Project had its conception in a series of workshops in Paris (1992), Adelaide (1993), Tokyo (1993), and finally at Fermilab in 1995. The Design Group for the Auger Project, hosted by Fermilab, met from January 30 through July 31, 1995. More than 140 scientists from 17 counties attended one or more of the conferences and topical workshops. The Design Group produced a Design Report in November 1995 containing a reference design and a cost estimate for the proposed Auger Observatory.

This document is a second edition of the Auger Design Report. It contains additional and enhanced discussion of many of the topics in the first edition. The additions resulted from discussions with many interested scientists from around the world as well as formal reviews of the Auger Project by distinguished panels convened at Fermilab and in Paris.

This edition of the Report is organized as follows: Chapter 1 is an Executive Summary of the Report; Chapter 2 presents the scientific motivation together with a program of observations that would illuminate the theoretical picture; Chapter 3 contains the historical background of air shower studies, current and expected results, and the role of the Auger project; Chapter 4 describes how the parameters of high energy cosmic ray air showers are measured and interpreted; Chapter 5 gives results of a detailed simulation of the Auger detector and its expected performance; Chapters 6 through 8 describe the reference design for the detectors, communication, and data acquisition system; Chapter 9 describes the survey of candidate sites. The central station is treated in Chapter 10. The organization, cost, and schedule are outlined in Chapter 11.

Some appendices follow describing detectors that are not now included in the reference design. Appendices A and B contain a description of two additional somewhat speculative measurement techniques, air Čerenkov detectors and radio pulse detectors that may, after suitable development, be low cost and valuable additions to the measurement capability of the detector. These two detector options are not included in the reference design or cost estimates.

The Auger Collaboration membership list as of January 1997, as well as a list of other individuals who have authored parts of the Design Report, participated in the workshops, or significantly contributed to this Design Report in other ways are given in Appendix C.

This Report, the library of GAP Technical Notes, and other information on the Auger Project are available via the world wide web by accessing the Astrophysics pages at Fermilab: `http://www-td-auger.fnal.gov:82`.

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