Low Energy Cosmic Ray Anisotropies Observed using the Pierre Auger Observatory

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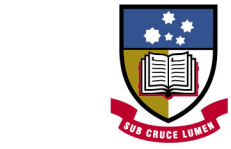
Doctor of Philosophy



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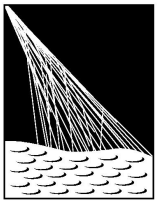

PIERRE AUGER OBSERVATORY

School of Chemistry & Physics

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Abstract

The Pierre Auger Observatory is a hybrid cosmic ray detector located in the high plains of Argentina. It comprises an array of water-Cherenkov stations overlooked by four fluorescence detector sites and was designed and built for the purpose of studying ultra-high energy cosmic rays ($>10^{18}$ eV). Due to the distribution of cosmic ray energies following a power law, in the process of studying these high energy events, the observatory also collects vast amounts of data on lower energy cosmic ray events. The low solar activity of the 2006 to 2009 period presents an opportunity to study the behaviour of the very low cosmic ray flux which would otherwise be overwhelmed by the solar wind during more active periods.

This research aims to investigate the anisotropy in the low energy cosmic ray flux in the southern hemisphere using the calibration data for the Pierre Auger Observatory's surface detector. The energy ranges accessible via these calibration data were determined via numerical simulation of both air shower propagation through the atmosphere as well as the surface detector response to the surface particles, and were found to be of the order of 100 GeV. Following corrections to remove atmospheric and other spurious effects, investigations into the anisotropy present in the data were performed in both solar and sidereal time, spanning periods of both low and high solar activity.

Declaration of Originality

I, Kerridwen Bette Barber, certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university of other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future be used as a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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