Search for Ultra High Energy Radiation from Astrophysical Sources

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Summary

This thesis presents results of searches made with the Buckland Park and SUGAR data sets for Ultra High Energy $\gamma$-ray emission from certain astrophysical objects. The origin of cosmic radiation at Ultra High Energies remains largely unresolved, and investigations into $\gamma$-ray emission from such objects may provide an insight to possible origins of cosmic rays.

The first chapter of the thesis briefly reviews the current status of properties of the cosmic ray flux such as the observed spectrum, composition and anisotropy, followed by a discussion of the field of Ultra High Energy $\gamma$-ray astronomy including aspects of possible acceleration mechanisms, attenuation in the interstellar medium and the status of observations from other groups.

The initiation and development of Extensive Air Showers, as well as detection of cosmic ray and $\gamma$-ray showers in particular the muon content of Ultra High Energy and Extremely High Energy showers is discussed in Chapter 2.

Chapter 3 describes the Buckland Park Extensive Air Shower Array, the various components of the array as well as the techniques used for analysing data. Included in the discussion are the improvements made by the author to the array and data analysis with emphasis on methods for shower front curvature correction to the data and methods for determining the angular resolution of the array. The improvements to the arrays performance made by the author are shown to be consistent with expectation.

A brief discussion of the SUGAR array parameters is made in Chapter 4. The techniques for the analysis of data in searches for Ultra High Energy emission together with the results are presented in Chapter 5. Included is a summary of observations for each object. The final chapter summaries the results presented in this thesis.
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