Cosmic Ray Propagation Through Turbulent Magnetic Fields

Eliza Switalska

Submitted in fulfilment of the requirements for the degree of Master of Science

School of Chemistry and Physics
(Faculty of Sciences)

The University of Adelaide

September 2006

CONTENTS

Abstract

This study begins with an overview of cosmic ray literature in relation to the origin and propagation of high-energy particles in extragalactic space. It follows with a review of recent methods used in the observation and measurement of extragalactic magnetic fields and describe the radio astronomy techniques used. The later chapters describe computer simulations, which were used for producing turbulent magnetic field models and then follow on to show how these can be used to estimate the probable turbulent scales of such fields. These models are then applied to data from an actual galaxy cluster, where the turbulence spectrum of the Abell galaxy cluster (using data from a recent observational study of A3667) is estimated. The final part of this thesis is concerned with the study of cosmic ray propagation within such turbulent magnetic fields. This is achieved by altering the turbulent scale-lengths and observing the behaviour of cosmic rays within, both large ans small-scale magnetic fields, thereby giving an indication as to the actual paths they may follow in space and consequently providing some clues as to their origins.