

## Preface

The neutrino is now considered the most important subject for research in the fields of cosmic ray physics and high-energy astrophysics. It is well known that this particle plays an essential role in these research fields. Thus it seems appropriate and even urgent to review the current state of research on the neutrino as an “elementary” particle and its related problems now being found in cosmic ray and astrophysics.

Historically, the concept of the neutrino was the brain-child of Pauli in 1931, in his attempts to interpret the beta-decay process. Since its existence was shown experimentally by Reines and Cowan in 1953, this strange, weak-interacting particle seems to have been playing a very crucial role in the progress of high-energy physics and astrophysics. Based on his review of the recent progress in both fields of physics, the editor seriously considered compiling a book about neutrinos in cosmic ray physics and high-energy astrophysics, and decided that this book might be dedicated to Professor Saburo Miyake for his great contributions to neutrino research using the techniques for cosmic ray research.

In the community of researchers on cosmic ray physics and related fields, Professor Miyake has been well known for his major contributions to the research on high energy muons and neutrinos. Most of his experimental work was done underground, here and abroad. In particular, his collaborative work at the Kolar Gold Field with many colleagues of the Tata Institute of Fundamental Research in Bombay is especially well known.

In Japan, since the Institute for Cosmic Ray Research, University of Tokyo was established in 1973 with Professor Miyake as the director, he led the research groups in that institute, who were mainly engaged in experimental work on high-energy muon and neutrino interactions by studying high-energy secondary cosmic ray particles. It may be noted that, without his extensive and creative effort, this institute would have never become renowned worldwide for many excellent and successful results in cosmic ray and high-energy physics.

In order to appreciate such important contributions of his for more than thirty years, I, as the editor, took the initiative to ask many of his colleagues and friends whether they would write articles on neutrinos in cosmic ray physics and astrophysics, since I thought that their contributions to these fields were indispensable to their rapid progress. All of the articles in this book are thus written by scientists who are now playing major roles in these fields of research. I, therefore, believe they are very informative and coincide with the interest and research of most readers, both

students and researchers, since their contents are updated and cover the most recent results of current research.

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