論文の内容の要旨

論文題目

Wino dark matter searches in the future

（将来実験におけるウィーノ暗黒物質の検証）

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In this thesis, we comprehensively study the future detection of the wino dark matter. While the existence of the O(1) TeV wino dark matter is strongly supported by the well-motivated high scale SUSY models, it is not clear whether the heavy wino can be discovered/excluded in the future. To test the future detectability, we robustly investigate the potential of collider search and indirect detection. For collider search, we estimate the impact of the indirect search by lepton colliders where the loop contribution of the dark matter is probed through the standard model channels. The likelihood analysis including the realistic systematic errors reveals that 1 TeV center of mass energy can probe up to 650-750 GeV wino through the channel of the standard model fermion pair production. The future sensitivity reach of the gamma-ray observation of the dwarf spheroidal galaxies is also studied. Under a realistic and conservative estimation, the limit will be expanded to 800-1000 GeV within a ten years observation. We also show the importance of the dark matter halo estimation for the dwarf galaxies. Under the precise halo estimation, the gamma-ray sensitivity line can exclude the entire wino parameter region. Finally, based on the motivation above, we test the future potential of the dark matter halo estimation by considering the future kinematical survey of the member stars of the dwarf spheroidal galaxies. Here, we clarify the hidden systematic biases in the halo estimation and

especially consider the treatment of the foreground contamination bias, which remains even for the future observation. It is found that the future observation will provide more than twice kinematical data, including less than 5 percent foreground contamination. However, the study also shows that this contamination significantly biases the halo estimation, which causes the overestimation of the gamma-ray sensitivity by factors of three. We propose a new likelihood function which include the foreground effect and show that the contamination is efficiently eliminated under the new method.