

論文の内容の要旨

論文題目

Search for Long-lived Chargino with Anomaly-Mediated Supersymmetry Breaking Scenarios in pp Collisions at $\sqrt{s} = 7$ TeV
(LHC7TeV データを用いた長寿命荷電粒子の探索)

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A search for long-lived charginos in anomaly-mediated supersymmetry breaking (AMSB) models is performed using 4.7 fb^{-1} data of pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector. In the AMSB models, the wino is the lightest gaugino and the lightest chargino and neutralino (as the lightest supersymmetric particle) are dominantly composed of the charged and neutral winos, respectively. Furthermore, the masses of the charged and neutral winos are highly degenerate, which results in a significant lifetime of the chargino. The lightest chargino decays into a neutralino and a soft charged pion. Due to the mass degeneracy, the momentum of the pion originating from the chargino decay is too soft to be reconstructed in collider experiments. The neutralino escapes detection; therefore, the decaying chargino could be identified as a high momentum track breaking up in the tracking volume (disappearing track).

In this dissertation, a method for detecting such chargino tracks is newly developed. The transition radiation tracker (TRT) employed as one of the ATLAS inner detectors, consisting of a lot of drift tubes, is used for the identification of the disappearing track. A large number of associated hits in the TRT detector for the stable charged particles while a smaller number is expected for decaying charginos. By requiring a small number of TRT hits along a track, the chargino track is discriminated to the track of the SM particles.

After the application of selection requirements, three hundred and four candidate tracks remain. The background and signal yields are determined by an unbinned maximum likelihood fit on the p_T of the tracks. The p_T spectrum of the candidate tracks is consistent with the background-only hypothesis and no excess of data is found.

New constraints on the chargino properties and the AMSB model parameters are then set. A chargino having a lifetime of 1 ns is excluded up to a chargino mass is less than

120 GeV in the region $m_{3/2} > 2000$ GeV at 95% Confidence Level (CL). For a chargino having a lifetime of 0.3 ns a constraint of a chargino mass > 100 GeV in the region $m_{3/2} > 2000$ GeV is set at 95% CL.