

論文の内容の要旨

論文題目: Search for Supersymmetry and Universal Extra Dimensions with
Degenerate Mass Spectrum in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV
(縮退したスペクトラムを持つ超対称性粒子や余剰次元の LHC 7 TeV データを用いた探索)

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Searching for a supersymmetry (SUSY) and extra dimensions with degenerate mass spectrum in collision at a center-of-mass energy of 7 TeV is presented. This search is based on 4.7 fb^{-1} of data collected by ATLAS experiment and Large Hadron Collider (LHC).

This analysis focuses on “degenerate model” with the mass difference of $\Delta m/m \sim 5\text{-}30\%$ where m is mass for the heaviest particle and Δm is mass difference between the mass of the initially produced colored particles and the lightest particle in the model. So far, the SUSY searches are targeting models with large mass difference as $\Delta m/m \sim 80\%$ and the analyses do not have sensitivity to such degenerate model. In this analysis, the degenerate SUSY model and universal extra dimensions (UED) model are searched for by optimizing the event selection. The UED model has a similar mass spectrum to those of SUSY models and is characterized by three parameters; compactification scale $1/R$, cut-off scale Λ and Higgs boson mass, so that the analysis for the degenerate model are optimized to both signal models.

The final state of such degenerate model is characterized by leptons and jets with low transverse momentum (soft leptons and soft jets) due to small mass difference, a large missing transverse energy from the lightest neutral particles and an additional high transverse momentum jet derived from initial state radiation. Analyses in a high transverse momentum lepton channels optimized to general SUSY models are combined with this analysis to improve the sensitivity to the degenerate models.

The results show that the observed data are consistent with the background expectations in each signal region. In absence of an excess, 95% confidence level exclusion limits are set for the simplified SUSY model and UED model. The gluino pair production of simplified SUSY model is excluded in degenerate mass region where the mass of gluino $m_{\tilde{g}}$ and the lightest SUSY particle m_{LSP} are approximately below 540 GeV and 450 GeV, respectively. The UED model is also excluded below 840 GeV in $1/R$ space with $\Delta R = 5$.