Doctoral Thesis Summary

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Title :
" Chargino search with the DELPHI detector at LEP at energies E_{cm} = 130 – 172 GeV "

The goal of this work is the search for charginos using the data collected with the DELPHI detector at LEP during the years 1995 – 1996 at energies E_{cm} = 130.4, 136.3, 161.4 and 172.4 GeV. A total integrated luminosity of 25.7 pb^{-1} was analyzed. In this thesis report the methods used and the results obtained in the search for charginos were described.

The study was carried out within the theoretical framework of the Minimal Standard Supersymmetric Model, assuming R–parity conservation and in two different scenarios, namely: when the lightest supersymmetric particle (LSP) is the first neutralino or the sneutrino – "Neutralino LSP Scenario"– and when the LSP is the gravitino –"Gravitino LSP Scenario"–. Grand Unification was assumed as well, so that the following relation between the gaugino masses holds: $M_1 = \frac{5}{3}\tan^2\theta_W \cdot M_2 \simeq 0.5 \cdot M_2$.

A total of five chargino candidate events pass the selection cuts devised for the study of the "Neutralino LSP Scenario" in all the energy range analyzed (E_{cm} = 130.4 – 172.4 GeV), while no event is selected by the "Gravitino LSP Scenario" criteria. In both cases, this is compatible with the background estimated by Monte Carlo.

Assuming that the $\tilde{\chi}_1^0$ is stable, the 95 % C.L. lower limit on the chargino mass in the *non-degenerate* case ($\Delta M = m_{\tilde{\chi}_1^\pm} - m_{\tilde{\chi}_1^0} > 10$ GeV/c^2) is $m_{\tilde{\chi}_1^\pm} > 67.8$ GeV/c^2 for a light sneutrino (41 GeV/$c^2 < m_{\tilde{\nu}} < 100$ GeV/c^2) and between $m_{\tilde{\chi}_1^\pm} > 84.3$ GeV/c^2 (if the chargino is gaugino) and the kinematic limit (if the chargino is higgsino) for a heavy sneutrino ($m_{\tilde{\nu}} > 300$ GeV/c^2). In the *degenerate* case ($\Delta M = 5$ GeV/c^2) the limit is $m_{\tilde{\chi}_1^\pm} > 80.3$ GeV/c^2, independently of the sneutrino mass.

These experimental results have been translated into exclusion regions in the MSSM parameter space and the values of the lower limit on the chargino mass as a function of the parameters M_2 and μ for different values of $tan\beta$ have been estimated.

Combining the above results with those from the search for neutralinos in *LEP–I* for the case of a stable $\tilde{\chi}_1^0$ and a heavy sneutrino, a lower limit on the mass of the first neutralino as a function of $tan\beta$ has been found. An absolute lower limit of $m_{\tilde{\chi}_1^0}^{\min} > 24.9$ GeV/c^2 is obtained for $tan\beta = 1$.