0.1 Both Beams polarised required: Determination of selectron quantum numbers

Supersymmetry is one of the most motivated possibilities for NP. However, even its minimal version, the MSSM, leads to about 105 new free parameters. At the LC one has to determine the Susy parameters as model independent as possible, as well as to prove the underlying Susy assumptions, e.g. that the Susy particles have to carry the same quantum numbers (with the exception of the spin) as their SM partners.

E.g. Susy transformations associate chiral (anti)fermions to scalars $e^-_{L,R} \leftrightarrow \tilde{e}^-_{L,R}$ but $e^+_{L,R} \leftrightarrow \tilde{e}^+_{R,L}$. In order to prove this association the use of both beam polarized is necessary [2]. The process $e^+e^- \to \tilde{e}^+\tilde{e}^-$ occurs via γ and Z exchange in the s–channel and via neutralino $\tilde{\chi}^0_i$ exchange in the t–channel. The association can be directly tested only in the t–channel and the use of polarized beams serves to separate this channel. We demonstrate this by isolation of the pair $\tilde{e}^+_R\tilde{e}^-_L$ by the LL configuration of the initial beams in an example where the selectron masses are close together, $m_{\tilde{e}_L} = 200$ GeV, $m_{\tilde{e}_R} = 190$ GeV, so that $\tilde{e}_L$, $\tilde{e}_R$ decay via the same decay channels, see Fig. 1a. The other Susy parameters are taken from the reference scenario SPS1a [1]. With $P_{e^-} = -80\%$, $P_{e^+} = 0\%$ the pairs $\sigma(\tilde{e}^+_R\tilde{e}^-_L) = 102\ fb$ and $\sigma(\tilde{e}^+_L\tilde{e}^-_L) = 108\ fb$ are close together. This will nearly not be changed even if $P_{e^-} = -100\%$ were available, which would result in $\sigma(\tilde{e}^+_R\tilde{e}^-_L) = 113\ fb$ and $\sigma(\tilde{e}^+_L\tilde{e}^-_L) = 119\ fb$!

However, if we use polarized positrons a separation of the wanted pair $\tilde{e}^+_R\tilde{e}^-_L$ with the test of the chiral quantum number might be possible: $P_{e^-} = -80\%$, $P_{e^+} = -40\%$ result in $\sigma(\tilde{e}^+_R\tilde{e}^-_L) = 143\ fb$ and $\sigma(\tilde{e}^+_L\tilde{e}^-_L) = 66\ fb$ and with $P_{e^-} = -80\%$, $P_{e^+} = -60\%$ even $\sigma(\tilde{e}^+_R\tilde{e}^-_L) = 163\ fb$, $\sigma(\tilde{e}^+_R\tilde{e}^-_R) = 49\ fb$ and $\sigma(\tilde{e}^+_L\tilde{e}^-_L) = 44\ fb$ are obtained, see Fig. 1.

References

[1] B. C. Allanach *et al.*, in *Proc. of the APS/DPF/DPB Summer Study on the Future of Particle Physics (Snowmass 2001)* ed. N. Graf, Eur. Phys. J. C **25** (2002) 113 [eConf **C010630** (2001) P125] [hep-ph/0202233].

[2] C. Blochinger, H. Fraas, G. Moortgat-Pick and W. Porod, Eur. Phys. J. C **24** (2002) 297 [hep-ph/0201282].

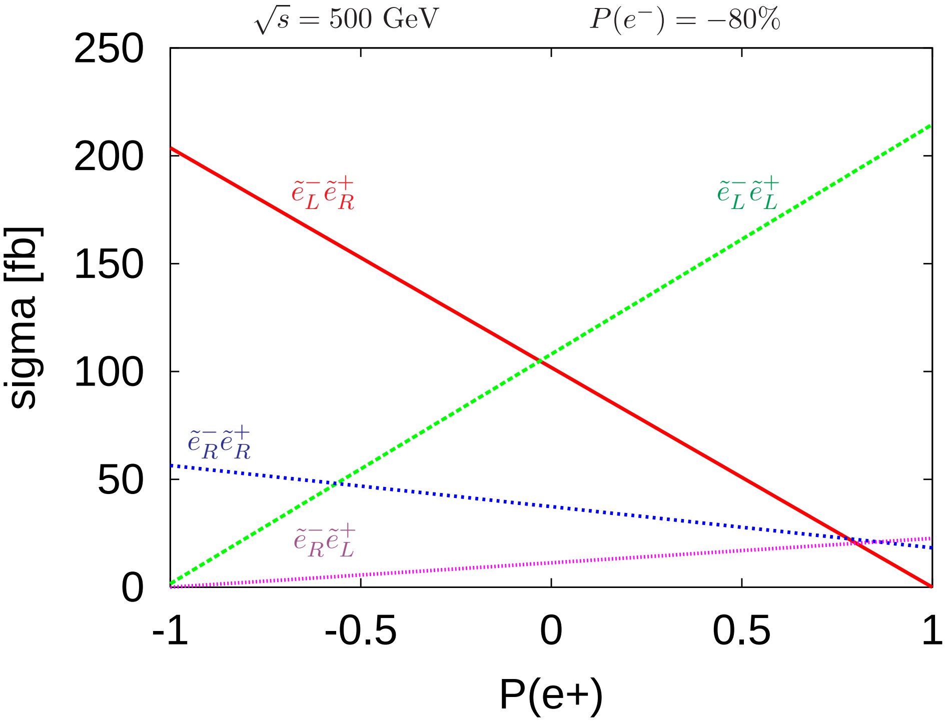

Figure 1: a) Separation of the selectron pair $\tilde{e}_L^- \tilde{e}_R^+$ in $e^+e^- \to \tilde{e}_{L,R}^+ \tilde{e}_{L,R}^-$ with longitudinally polarized beams in order to test the association of chiral quantum numbers to scalar fermions in Susy transformations;