SPheno 3.0, latest developments

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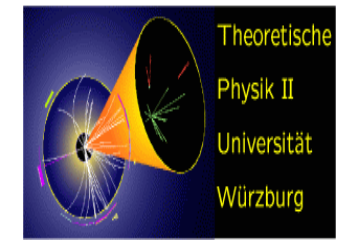
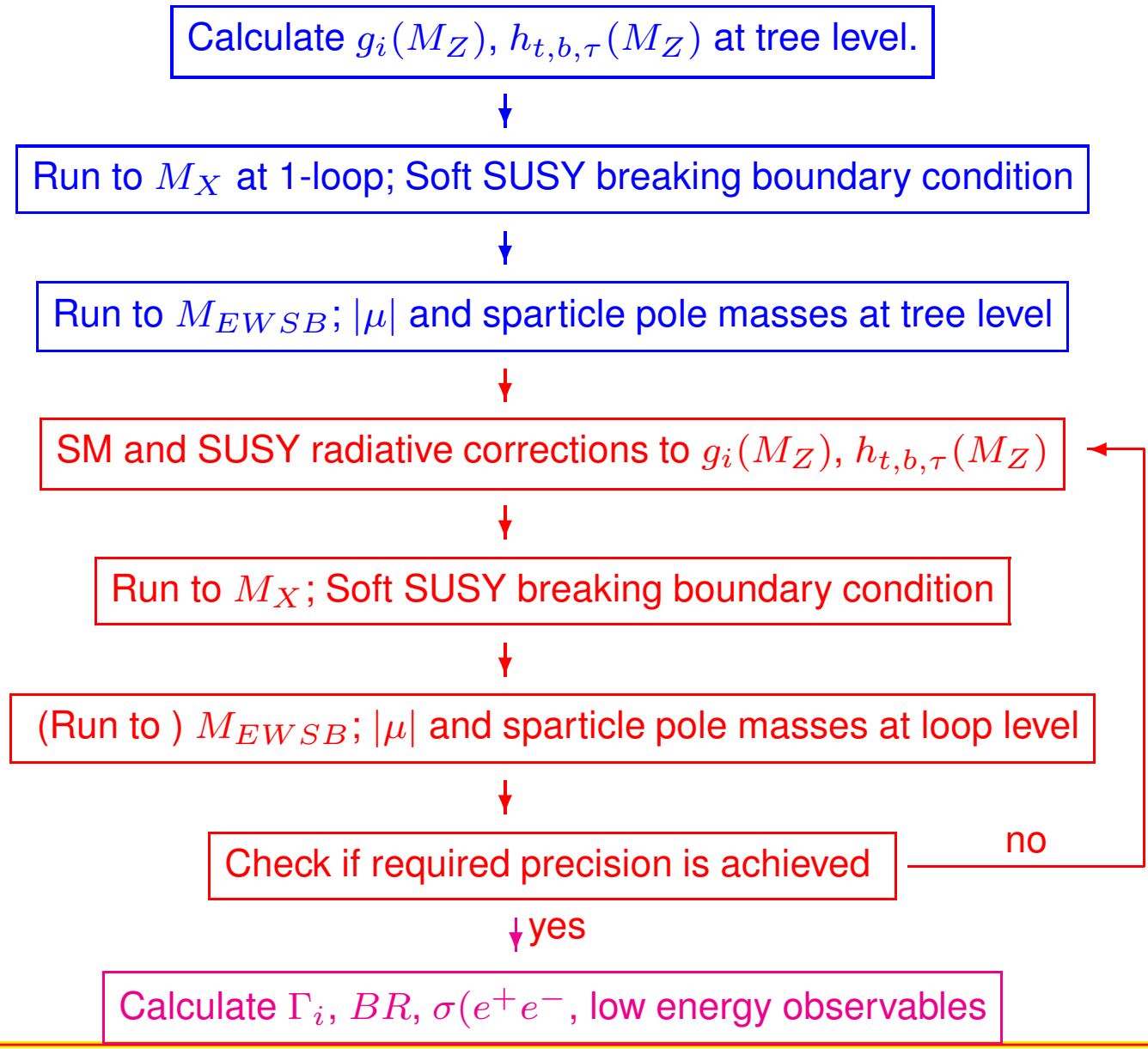


Overview

- General scheme
- MSSM implementation
- NMSSM
- R-parity

SPheno is available at:
`www.physik.uni-wuerzburg.de/~porod/SPheno.html`

SPheno, general scheme



SPheno, version 3.0beta, MSSM

- complete 2-loop SUSY RGEs
- complete 1-loop SUSY masses + 2-loop Higgs masses + μ at 2-loop
- includes complete flavour structure of the MSSM in RGEs and 1-loop masses
- includes CP phases in RGEs and 1-loop masses but for the mixing of (h^0, H^0) with A^0
- all 2-body decays of SUSY and Higgs particles at tree-level, but running couplings
- all 3-body decay modes of $\tilde{\chi}_k^0$, $\tilde{\chi}_j^\pm$, $\tilde{g}$, $\tilde{t}_1$ + some 3-body decays of sleptons relevant for GMSB
  + decays into gravitino in case of GMSB models
- SUSY and Higgs production in e^+e^- annihilation

SPheno, version 3.0beta, MSSM

Models, input via SLHA 2 (arXiv:0801.0045)

- MSSM at M_{EWSB}
- mSUGRA, GMSB, AMSB, string inspired scenarions
- mSUGRA with seesaw I or seesaw II
- at M_{GUT}: specification of all SUSY parameters is possible

low energy observables

- $b \to s\gamma$, $b \to s l^+ l^-, s\nu\nu$, $B_s \to \mu^+\mu^-$ $B_u \to \tau\nu$, $\Delta M_{B_{d,s}}$
- ρ-parameter at 1-loop level
- a_e, a_μ, a_τ, d_e, d_μ, d_τ
- $\mu \to e\gamma$, $\tau \to e\gamma$, $\tau \to \mu\gamma$, $\mu \to 3e$, $\tau \to 3e$, $\tau \to 3\mu$, $Z \to e\mu$, $Z \to e\tau$, $Z \to \tau\mu$

SPheno, version 3.0beta, MSSM

in near future

- d_n, $K \to \pi\nu\nu$, $K_L \to \mu^+\mu^-$, ϵ_K
- theoretical uncertainties on masses via remaining scale dependence, take e.g. values $M_i(M_{EWSB}/2)$ and $M_i(2M_{EWSB})$
  but two problems:
  - these values are not necessarily min and max
  - SLHA allows to fix M_{EWSB}, uncertainties depend on this parameter
- dominant 2-loop contributions to ρ-parameter
- documentation

SPheno, version 3.0beta, NMSSM

- RGEs at 1-loop for gauge and Yukawa couplings
- tree level masses for SUSY particles, 1-loop effective potential for Higgs masses (alternative: calculate spectrum with NMHDECAY)
- all 2-body decays of SUSY and Higgs particles at tree-level, but running couplings
- all 3-body decay modes of $\tilde{\chi}_k^0$, $\tilde{\chi}_j^{\pm}$, $\tilde{g}$
- of SUSY and Higgs production in e^+e^- annihilation

near future

- complete set of RGEs at 2-loop level
- B-physics observables, ρ-parameter, rare lepton decays
- documentation

at the scale of 1-2 years

- SUSY masses at 1-loop level, complete 1-loop Higgs masses + leading 2-loop contributions

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SPheno, version 3.0beta, R-parity

- models: bilinear model ϵ_i (e.g. hep-ph/0011248), $\mu\nu$SSM (arXiv:0903.3596)
- RGEs at 1-loop for gauge and Yukawa couplings
- tree level masses for SUSY particles, dominant 1-loop effective potential for Higgs masses
- all 2-body decays of SUSY and Higgs particles at tree-level, but running couplings
- all 3-body decay modes of $\tilde{\chi}_k^0$, $\tilde{\chi}_j^\pm$, $\tilde{g}$
- of SUSY and Higgs production in e^+e^- annihilation

near future

- complete set of RGEs at 2-loop level
- B-physics observables, ρ-parameter, rare lepton decays
- λ_{ijk}, λ'_{ijk}, spontaneous R-parity violation
- documentation

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SPheno 3.0beta, comments

- it is only a beta-version due to missing documentation
- several of the near future plans are currently running projects
- interface to Prospino planned to include LHC processes