Renormalisation of the NMSSM in SloopS

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Outline

- NMSSM
- SloopS
- Renormalisation
- Phenomenological applications

NMSSM

- MSSM + a new Higgs gauge singlet chiral superfield
- Solves the μ-problem by generating this parameter dynamically

$$\mu \hat{H}_u . \hat{H}_d \longrightarrow \lambda \hat{S} \hat{H}_u . \hat{H}_d$$

- Extended Higgs sector :
  - 3 CP-even Higgs bosons h_1,h_2,h_3
  - 2 Pseudoscalars A_1, A_2
  - 2 charged Higgs bosons $H^{\pm}$
- h_1 or h_2 could be the one observed at LHC
- Easier to get a SM-like 125 GeV Higgs boson

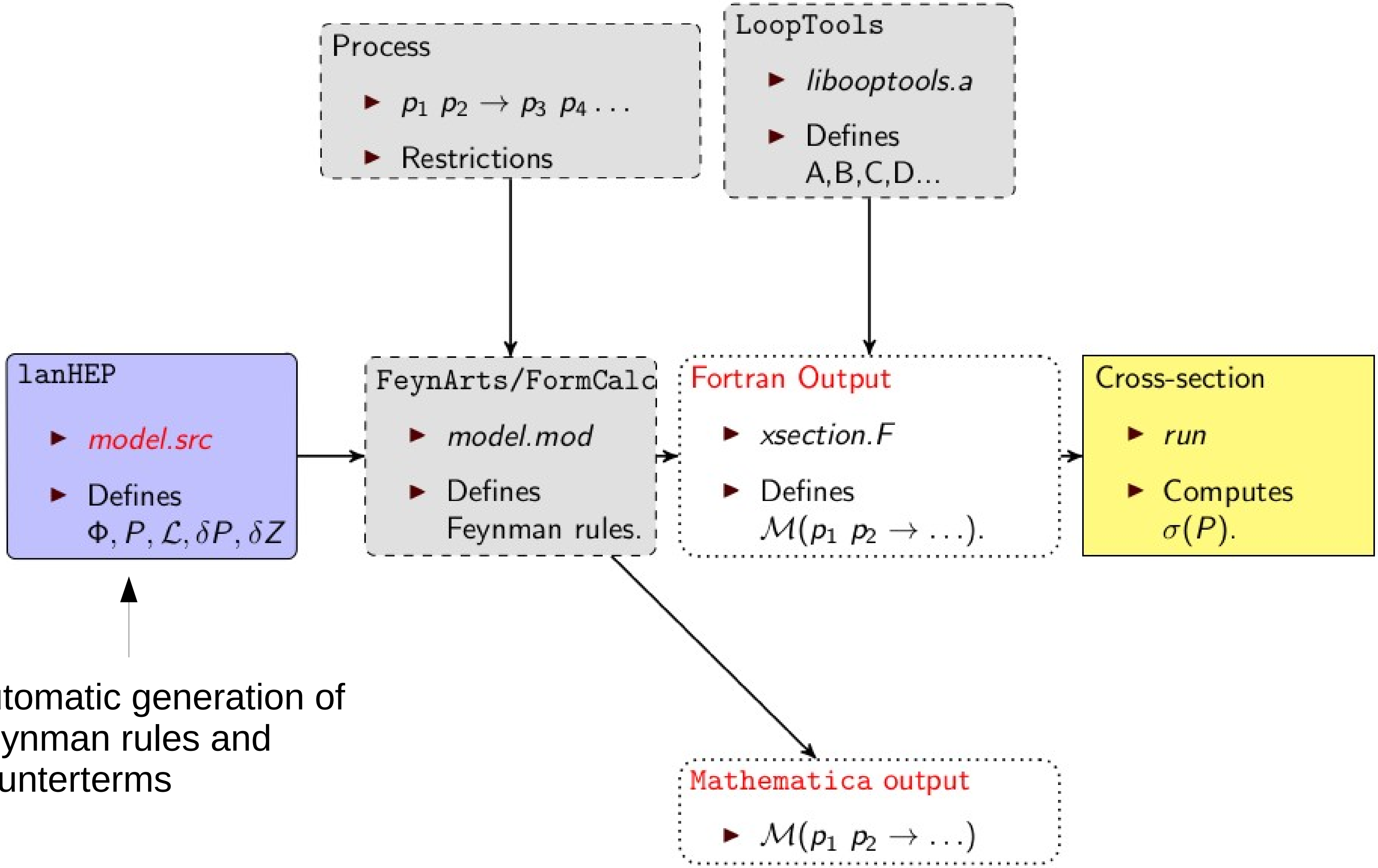
$$m_h^2 = m_{h,MSSM}^2 + \lambda^2 v^2 \sin^2(2\beta)$$

- Propose new scenarios to account for Dark Matter compared to the MSSM

SloopS

- An automatic code for the calculation of cross sections at one loop in SUSY (Boudjema, Baro, Semenov, Chalons)
- Full renormalisation of electroweak sector of MSSM performed in the OS-scheme
- Full renormalisation of NMSSM (this talk)

SloopS



Automatic generation of Feynman rules and counterterms

Renormalisation of the NMSSM

Charginos (over $M_2, \mu, \tan(\beta)$) — Higgs (over $\tan(\beta), \lambda, \kappa, A_\lambda, A_\kappa, m_{H_d}, m_{H_u}, m_{H_s}$)

- $M_1, M_2, \mu, \tan(\beta), \lambda, \kappa, A_\lambda, A_\kappa, m_{H_d}, m_{H_u}, m_{H_s}$

Neutralinos (under $M_1, M_2, \mu, \tan(\beta), \lambda, \kappa$)

$$\tan(\beta) = \frac{v_u}{v_d}$$

- $\tan(\beta)$ links together all sectors : OS-scheme complicated !
- Solution : take a DR condition for $\tan(\beta)$ to decouple sectors :
  - μ, M_2 from the 2 charginos
  - M_1, λ, κ from 3 neutralinos
  - A_λ, A_κ, from 2 pseudoscalars
  - m_{H_d}, m_{H_u}, m_{H_s} from minimization equations of Higgs potential

Renormalisation of the NMSSM

- Achievements :
  - Complete renormalisation of gauge, (s)fermions, chargino, neutralino sectors.
  - Any one-loop decay widths in these sectors can be calculated.
- Work in progress :
  - Implementation of the Higgs sector.

Phenomenological applications

- Computation of radiative corrections to some physical observables :
  - Precise calculation of Dark Matter relic density. For example in the annihilation of 2 singlinos.
  - Interplay of NMSSM scenarios with dark matter and collider observables