Computer tools in particle physics

- Lecture 2 : MicrOmegas -

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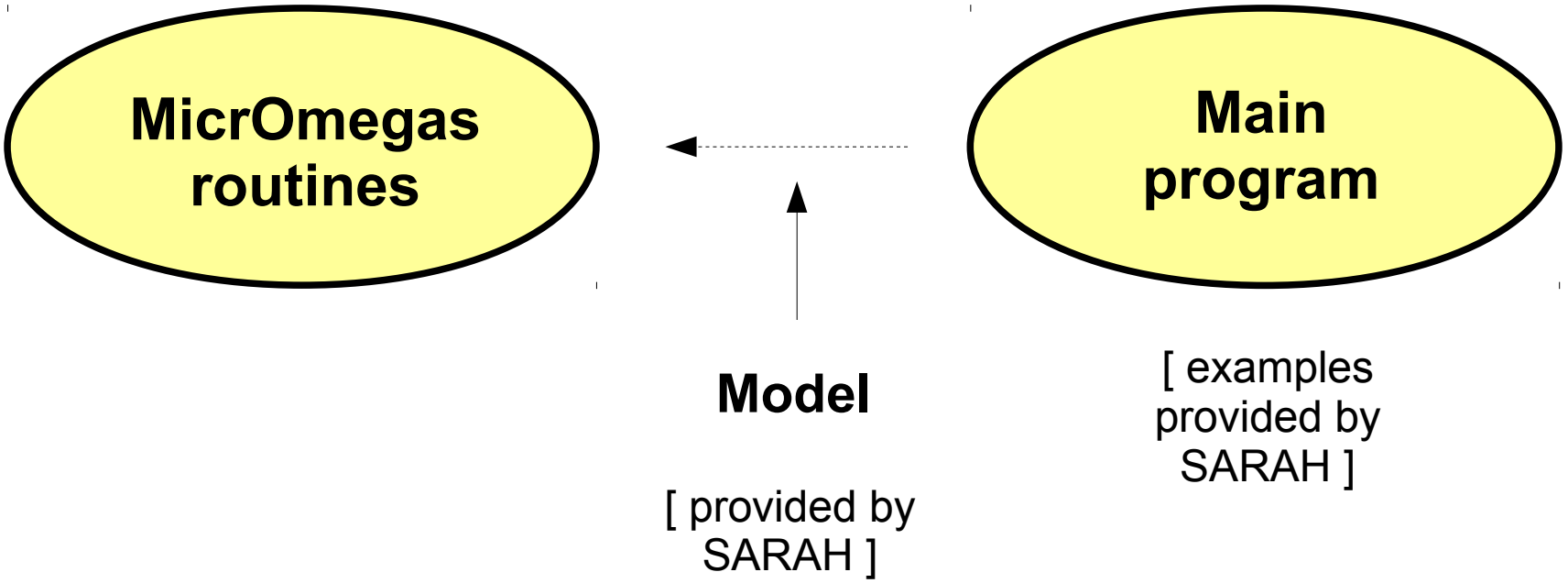
MicrOmegas

MicrOmegas [Bélanger, Boudjema, Pukhov, Semenov]

- **Name of the tool:** `MicrOmegas`
- **Authors:** Genevive Blanger, Fawzi Boudjema, Alexander Pukhov and Andrei Semenov (micromegas@lapth.cnrs.fr)
- **Type of code:** `C` and `Fortran`
- **Website:** https://lapth.cnrs.fr/micromegas/

MicrOmegas

MicrOmegas [Bélanger, Boudjema, Pukhov, Semenov]



MicrOmegas

MicrOmegas [Bélanger, Boudjema, Pukhov, Semenov]

- Dark matter relic density ($\Omega_{DM}h^2$)
- Direct detection rates
- Indirect detection rates

Chuck Norris fact of the day

Chuck Norris lost his virginity before his dad

Dark matter in the scotogenic model

The lightest particle charged under Z_2 is stable: dark matter candidate

Fermion Dark Matter: N_1

- It can only be produced via Yukawa interactions
- Potential problems with lepton flavor violation: is it compatible with the current bounds?

Scalar Dark Matter: the lightest neutral η scalar, η_R or η_I

- It also has gauge interactions
- Not correlated to lepton flavor violation

Scotogenic: benchmark point

BS1 benchmark point

$$\lambda_1 = 0.25 \qquad \lambda_2 = 0.5 \qquad \lambda_3 = 0.5$$
$$\lambda_4 = -0.5 \qquad \lambda_5 = 8 \cdot 10^{-11} \qquad m_\eta^2 = 1.85 \cdot 10^5\,\mathrm{GeV}^2$$

$$M_N = \begin{pmatrix} 345\,\mathrm{GeV} & 0 & 0 \\ 0 & 4800\,\mathrm{GeV} & 0 \\ 0 & 0 & 6800\,\mathrm{GeV} \end{pmatrix}$$

$$Y_N = \begin{pmatrix} 0.0172495 & 0.300325 & 0.558132 \\ -0.891595 & 1.00089 & 0.744033 \\ -1.39359 & 0.207173 & 0.253824 \end{pmatrix}$$