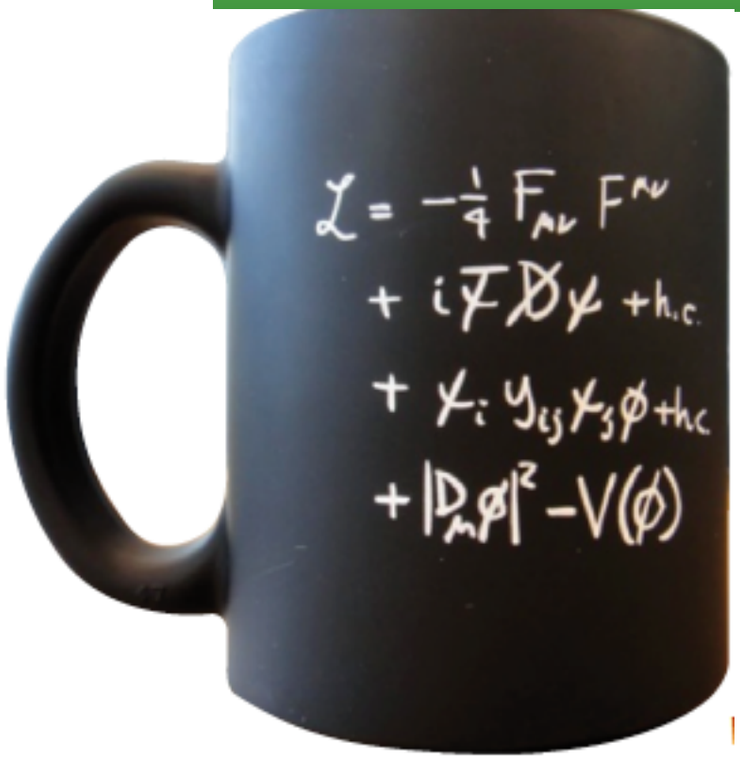
Tools and Monte Carlo 11

Kentarou Mawatari

Lagrangian (TH) ⇔ Data (EXP)

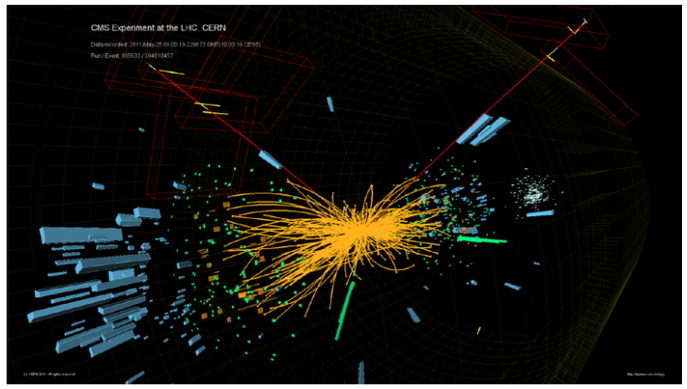


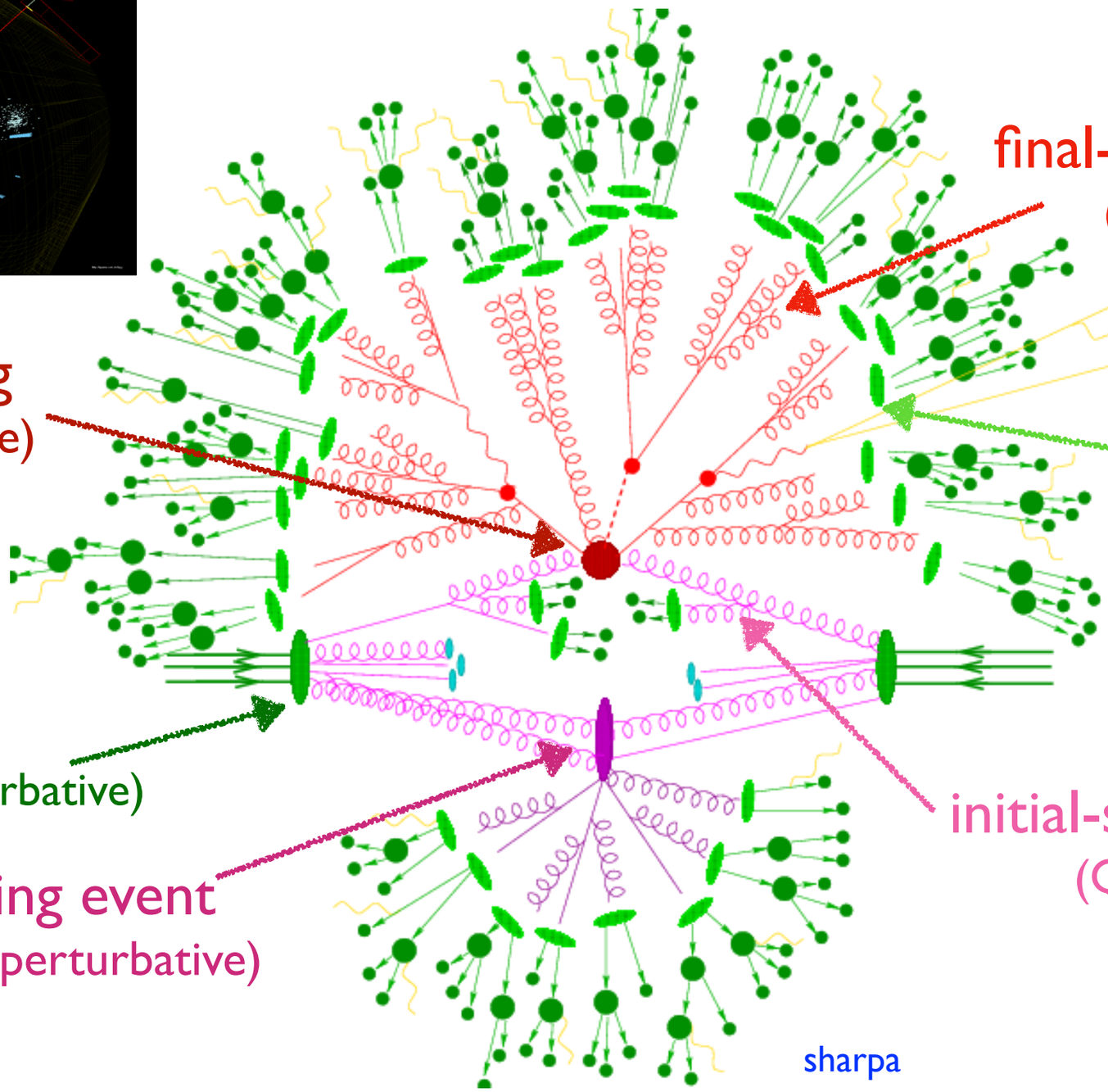
simulation tools

prediction

interpretation

Monte Carlo generator representation





hard scattering
((B)SM; perturbative)

final-state parton shower
(QCD; perturbative)

hadronization
(QCD; non-perturbative)

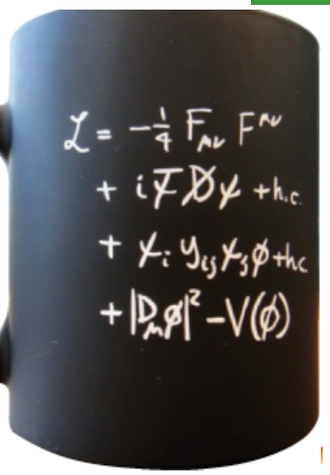
proton
(QCD; non-perturbative)

underlying event
(QCD; non-perturbative)

initial-state parton shower
(QCD; perturbative)

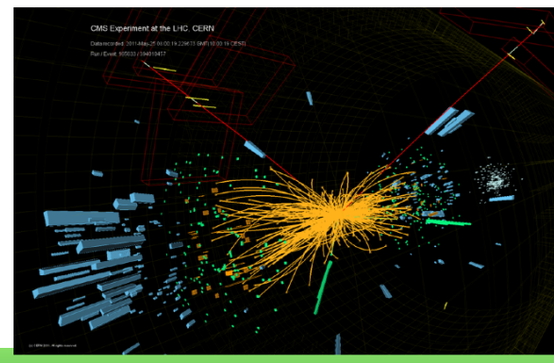
sharpa

BSM workflow after LHC

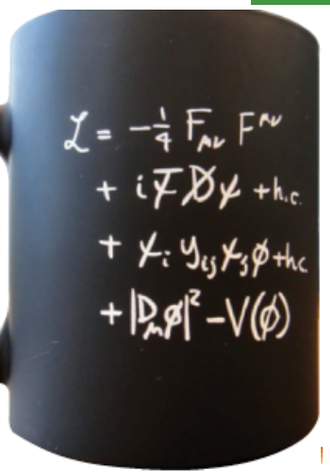


- take a BSM model (symmetry, particle contents,…), i.e. Lagrangian
  - derive the Feynman rules — Model providers
    - draw Feynman diagrams for interesting any processes
      - compute the amplitude (squared) — Matrix-element generators
        - generate events
          - parton-shower/hadronisation — Shower MC
          - detector simulation — Detector simulation tools
          - analysis — Analysis tools

DM physics tool
DM annihilation
(relic, indirect detection)
DM-N cross section
(direct detection)

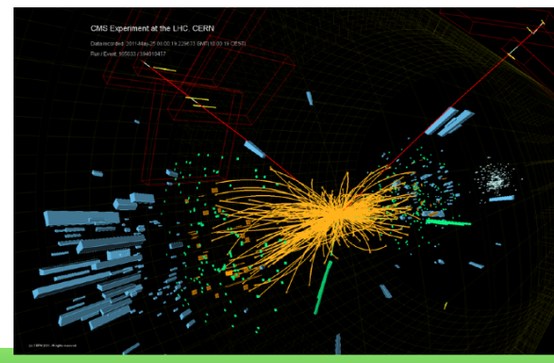


BSM workflow after LHC

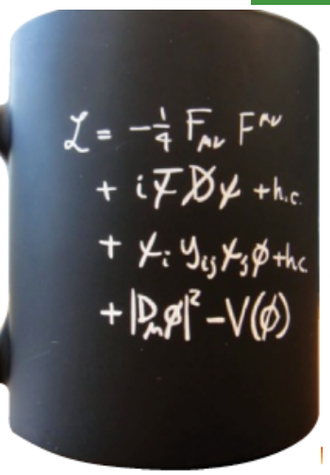


- take a BSM model (symmetry, particle contents,…), i.e. Lagrangian
  - derive the Feynman rules — FeynRules
    - draw Feynman diagrams for interesting any processes
    - compute the amplitude (squared) — MadGraph5_aMC@NLO
      - generate events
        - parton-shower/hadronisation — Pythia8
        - detector simulation — Delphes
        - analysis — MadAnalysyi5

MadDM
MicrOMEGAs



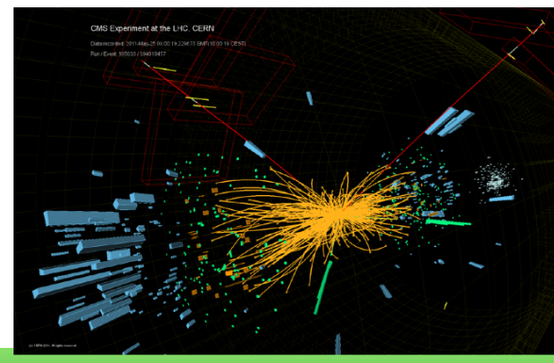
BSM workflow after LHC



at NLO

- take a BSM model (symmetry, particle contents,…), i.e. Lagrangian
  - derive the Feynman rules — FeynRules+NLOCT
    - draw Feynman diagrams for interesting any processes
      - compute the amplitude (squared) — MadGraph5_aMC@NLO
        - generate events
          - parton-shower/hadronisation — Pythia8
            - detector simulation — Delphes
              - analysis — MadAnalsysi5

MadDM
MicrOMEGAs

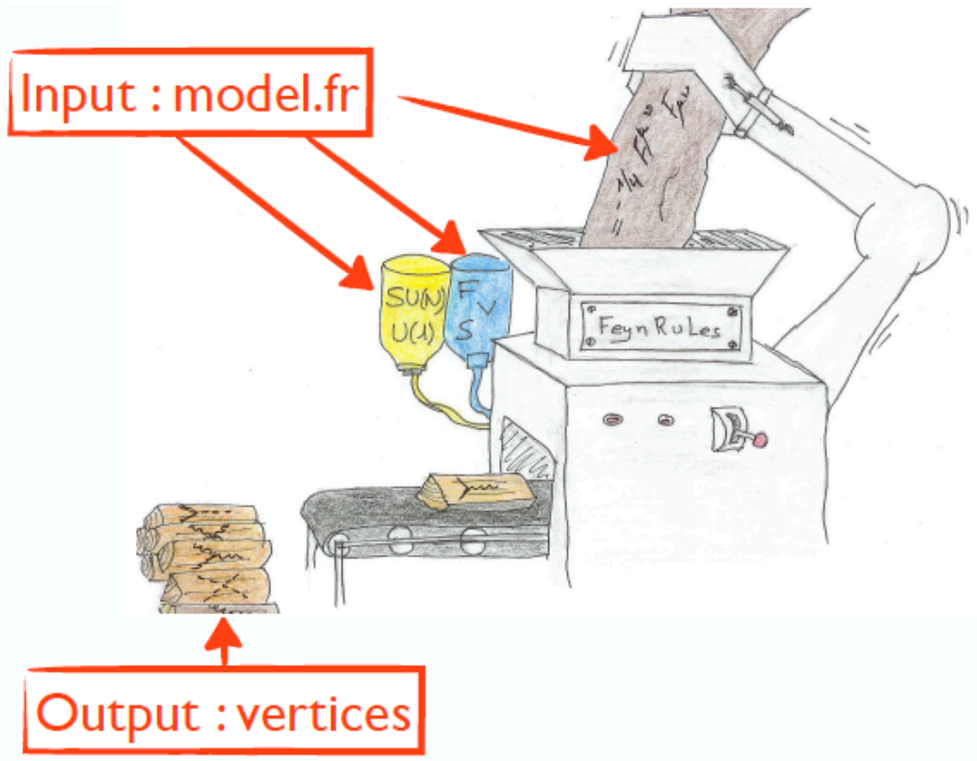


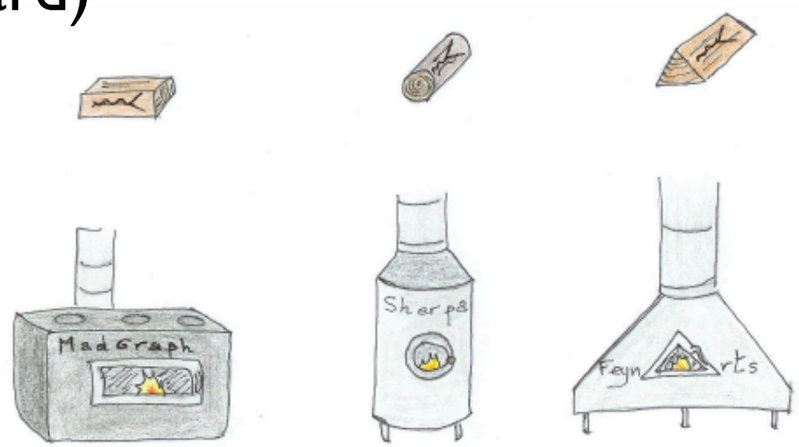
https://feynrules.irmp.ucl.ac.be

FeynRules in a nutshell

Alloul, Christensen, Degrande, Duhr, Fuks [1310.1921, CPC]
Degrande [1406.3030, CPC]

- a mathematica package that allows to
  - calculate Feynman rules for any QFT models, i.e. Lagrangians
  - output them to various event generators (CalcHEP, FeynArts, MG5aMC, Sherpa, Whizard)





FeynRules outputs can be used directly by event generators

UFO : output with the full information used by several generators

C. Degrande

* Universal FeynRules Output
Degrande et al. [1108.2040, CPC]

BSM models in the FeynRules model database

feynrules.irmp.ucl.ac.be/wiki/ModelDatabaseMainPage

FeynRules model database

This page contains a collection of models that are already implemented in FeynRules. For each model, a complete model-file is available, containing all the information that is needed, as well as the Lagrangian, as well as the references to the papers were this Lagrangian was taken from. All model-files can be freely downloaded and changed, serving like this as the starting point for building new models. A TeX-file for each model containing a summary of the Feynman Rules produced by FeynRules is also available.

The Standard model model-file is already included in the distribution of the FeynRules, but it can also be downloaded independently from the corresponding link below.

We encourage model builders writing a FeynRules implementation of their model to make their model file(s) public in the FeynRules model database, in order to make them useful to a community as wide as possible. For further information on how to make your model implementation public via the FeynRules model database, please send an email to

- neil@...
- celine.degrande@...
- claude.duhr@...
- benjamin.fuks@...

Available models

Standard Model	The SM implementation of FeynRules, included into the distribution of the FeynRules package.
Simple extensions of the SM	Several models based on the SM that include one or more additional particles, like a 4th generation, a second Higgs doublet or additional colored scalars.
Supersymmetric Models	Various supersymmetric extensions of the SM, including the MSSM, the NMSSM and many more.
Extra-dimensional Models	Extensions of the SM including KK excitations of the SM particles.
Strongly coupled and effective field theories	Including Technicolor, Little Higgs, as well as SM higher-dimensional operators, vector-like quarks.
Miscellaneous	
NLO	Models ready for NLO computations

feynrules.irmp.ucl.ac.be/wiki/EffectiveModels

Strongly-coupled models and effective field theories

Model	Short Description	Contact	Status
Axion-Like Particles	Effective Theories for a light Axion-Like Particle	I. Brivio	**Available**
Anomalous Gauge Boson Couplings	Model including anomalous couplings among gauge bosons	O.J.P. Eboli, M.C. Gonzalez-Garcia	**Available**
BSM Characterisation	The SM EFT Lagrangian in the mass basis	B. Fuks, K. Mawatari	**Available**
Complete top-quark EFT implementation	A complete top-quark EFT implementation	G. Durieux and C. Zhang	**Available**
Chiral perturbation theory	The effective Lagrangian describing the low-energy interaction of mesons.	C. Degrande	**Available**
EFT mass basis	The SM EFT Lagrangian in the mass basis	B. Fuks, K. Mawatari	**Available**
Effective theory for 4 top production	Dimension-six operators invariant under the SM symmetries affecting 4 top interactions	C.Degrande	**Available**
Effective theory for weak gauge boson production	Dimension-six operators invariant under the SM symmetries affecting triple gauge boson interactions	C.Degrande	**Available**
Effective top-Higgs interactions	Dimension 6 Higgs-top interactions.	E. Salvioni and J. Dror	**Available**
FCNC Higgs interactions	The SM		
FCNC Top interactions	The SM interacti		
HiggsCharacterisation	The mod resonan		
Higgs Effective Lagrangian	Higgs ef		
Higgs effective theory	An add-on for the SM implementation containing the dimension 5 gluon fusion operator.	C. Duhr	**Available**
Mimimal Higgsless Model (3-Site Model)	A higgsless model, including new heavy fermions and a Z' and a W' boson.	N. Christensen	**Available**
nTGC Effective theory	dimension-8 operators invariant under the SM symmetries affecting neutral triple gauge boson couplings	C. Degrande	**Available**
Strongly Interacting Light Higgs	A model including higher-dimensional SM operators to describe strongly coupled theories of EWSB.	C. Degrande	**Available**
Technicolor	The Minimal Walking Technicolor Model	M. Järvinen, T. Hapola, E. Del Nobile, C. Pica	**Available**
TFCNC	The SM, plus FCNC top interactions.	M. Buchkremer, G. Cacciapaglia, A. Deandrea, L. Panizzi	**Available**
The SMEFT in the Warsaw basis	Standard Model Effective Field Theory	I. Brivio, Y. Jiang, M. Trott,	**Available**
Top Effective theory	Higher-dimensional operators invariant under the SM symmetries affecting top production and decay	C. Degrande	**Available**
Top Effective theory for FCNC	Dimension-six operators invariant under the SM symmetries affecting top FCNC	C.Degrande, G. Durieux, F. Maltoni, C. Zhang	**Available**

To download models in the FR repository:

MG5_aMC> display modellist

https://launchpad.net/mg5amcnlo

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MadGraph5_aMC@NLO

Overview | Code | Bugs | Blueprints | Translations | Answers

Registered 2009-09-15 by Michel Herquet

MadGraph5_aMC@NLO is a framework that aims at providing all the elements necessary for SM and BSM phenomenology, such as the computations of cross sections, the generation of hard events and their matching with event generators, and the use of a variety of tools relevant to event manipulation and analysis. Processes can be simulated to LO accuracy for any user-defined Lagrangian, an the NLO accuracy in the case of models that support this kind of calculations -- prominent among these are QCD and EW corrections to SM processes. Matrix elements at the tree- and one-loop-level can also be obtained.

MadGraph5_aMC@NLO is the new version of both MadGraph5 and aMC@NLO that unifies the LO and NLO lines of development of automated tools within the MadGraph family. It therefore supersedes all the MadGraph5 1.5.x versions and all the beta versions of aMC@NLO.

The standard reference for the use of the code is: J. Alwall et al, "The automated computation of tree-level and next-to-leading order differential cross sections, and their matching to parton shower simulations", arXiv:1405.0301 [hep-ph]. In addition to that, computations in mixed-coupling expansions and/or of NLO corrections in theories other than QCD (eg NLO EW) require the citation of: R. Frederix et al, "The automation of next-to-leading order electroweak calculations", arXiv:1804.10017 [hep-ph]. A more complete

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Latest version is 2.6.x

MG5_aMC_v2.6.2.tar.gz

MG5_aMC_v3....beta.tar.gz

released on 2017-08-15

All downloads

https://answers.launchpad.net/mg5amcnlo/+addquest

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MadGraph5_aMC@NLO

Overview Code Bugs Blueprints Translations **Answers**

Ask a question

These other questions seem similar to yours. You may want to take a look at them.

263917: bwcutoff in top pair gluon gluon/ e+ e- production and decay (Answered)
posted on 2015-03-20 in MadGraph5_aMC@NLO

244869: e- e+ interactions (Solved)
posted on 2014-03-03 in MadGraph5_aMC@NLO

227310: ISR/FSR for e+ e- interactions (Answered)
posted on 2013-04-23 in MadGraph5_aMC@NLO

647442: Including ISR In Collisions (Solved)
posted on 2017-07-11 in MadGraph5_aMC@NLO

224726: PhotonFlux subprocess (Answered)
posted on 2013-03-20 in MadGraph5_aMC@NLO

218770: 2>1 process issue? (Answered)
posted on 2013-01-09 in MadGraph5_aMC@NLO

One can directly communicate with the developers via Launchpad (ask questions, report bugs, etc).

If you did not find your problem in these existing FAQs or questions, enter the details of your problem to alert the MadGraph5_aMC@NLO support community, so they can help you resolve the issue.

Change your preferred languages to modify the list of languages available for writing the question.

Language:

English (en) *

The language in which this question is written. The languages marked with a star (*) are the languages spoken by at least one answer contact in the community.

Summary:

e+e- linear collider top

A one-line summary of the issue or problem.

Conte, Fuks, Serret [1206.1599]

Conte, Dumont, Fuks, Wymant [1405.3982]

Dumont, Fuks, Kraml, Bein, Chalons, Conte, Kulkarni, Sengupta, Wymant [1407.3278]

Canonical Group Ltd launchpad.net/madanalysis5

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MadAnalysis 5

Overview | Code | Bugs | Blueprints | Translations | Answers

Registered 2013-04-13 by Eric Conte

MadAnalysis 5 is a new framework for phenomenological investigations at particle colliders. Based on a C++ kernel, this program allows to efficiently perform, in a straightforward and user-friendly fashion, sophisticated physics analyses of event files such as those generated by a large class of Monte Carlo event generators.

MadAnalysis 5 has been recently extended to allow for the recasting of existing LHC analyses. These features are available from version 1.1.12 onwards (currently available as beta version). For documentation on the MA5 PAD (public analysis database) and on instructions to implement new analyses, see http://madanalysis.irmp.ucl.ac.be/wiki/PublicAnalysisDatabase

The latest stable version of the MadAnalysis 5 package can be obtained in two ways:
- directly from the Bazaar versioning system by typing in a shell:
  bzr branch lp:madanalysis5
- as a tar-ball (to be downloaded from the right of this page).

More information on the program can be found on the wiki http://madanalysis.irmp.ucl.ac.be

If you use MadAnalysis 5, please cite
1. E. Conte, B. Fuks and G. Serret,
   Comput. Phys. Commun. 184 (2013) 222
   http://arxiv.org/abs/1206.1599

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Latest version is v1.3

MadAnalysis5_v1.3.tar.gz

released on 2016-03-01

All downloads

MadDM1: Backovic, Kong, McCaskey [1308.4955]
MadDM2: Backovic, Kong, Martini, Mattelaer, Mohlabeng [1505.04190]
MadDM3: Ambrogi, Arina, Backovic, Heisig, Maltoni, Mantani, Mattelaer, Mohlabeng [1804.00044]

https://launchpad.net/maddm

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MadDM

Overview | Code | Bugs | Blueprints | Translations | Answers

Registered 2014-03-27 by Mihailo Backovic

ATTENTION: MadDM is now a plugin for MadGraph 5. In order to install it and run it, start madgraph and type

install maddm

in the command line. Then exit and start maddm with ./maddm.py.

M5G_aMC@NLO v.2.6.2 is required to be able to run MadDM v.3.0.

MadDM v.3.0 is a numerical tool to compute dark matter relic abundance, dark matter nucleus scattering rates and dark matter indirect detection predictions in a generic model. The code is based on the existing MadGraph 5 architecture and as such is easily integrable into any MadGraph collider study. A simple Python interface offers a level of user-friendliness characteristic of MadGraph 5 without sacrificing functionality.

MadDM is able to calculate the dark matter relic abundance in models which include a multi-component dark sector, resonance annihilation channels and co-annihilations.

The direct detection module of the MadDM code calculates spin independent / spin dependent dark matter-nucleon cross sections and differential recoil rates as a function of recoil energy, angle and time. The code provides a simplified simulation of detector effects for a wide range of target materials and volumes.

The indirect detection module of the MadDM code computes the velocity averaged cross-section for dark matter particles annihilating into n final state particles. It further provides the energy spectra of photons, neutrinos and cosmic-rays generated by these final states after decaying, showering and hadronization. It automatically computes the flux of prompt neutrinos and gamma rays at detection while it provides a user friendly interface with the numerical DRAGON code for obtaining the flux of cosmic rays at Earth. It also provides a user friendly interface with the nested sampling PyMultiNest algorithm for efficient sampling of the model parameter space and allows as well to test the model against the Fermi-LAT dwarf spheroidal galaxy likelihood.

MadDM v1

MadDM v2

MadDM v3

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Downloads

Latest version is maddmv3.0

MadDM_v3.0.beta.tar.gz

released on 2018-03-29

All downloads

Announcements

MadDM v.3.0 beta released on 2018-04-03
We are pleased to release the v.3.0 of the MadDM code, which is now a MG5_aMC...

Update for MadDM v.2.0 released on 2015-06-29