High Energy Theory

Universidad de Granada

MATCHing Effective Theories Efficiently

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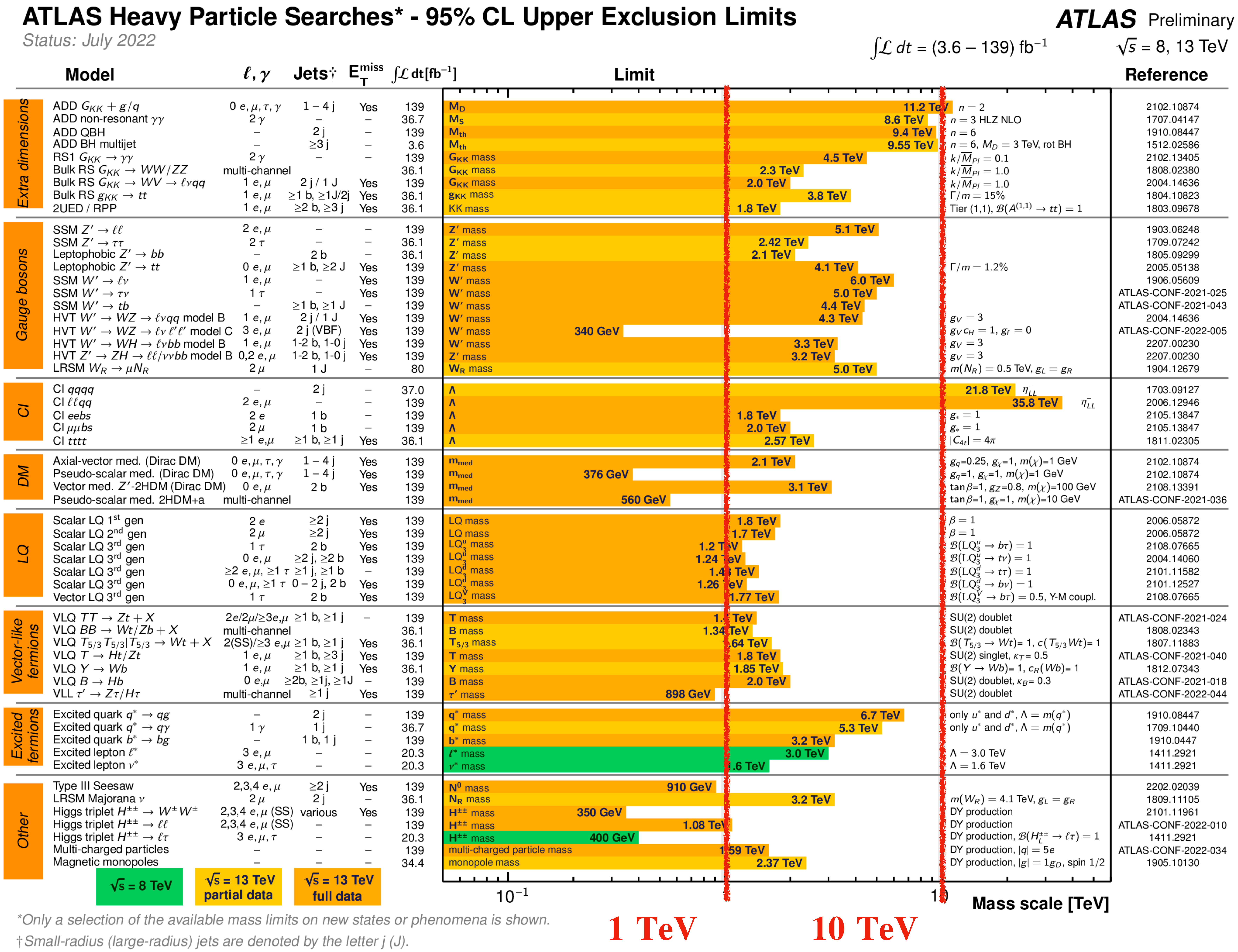
University of Granada

MATCHETE

Pushing the Limits of Theoretical Physics, MITP 10th Anniversary, 8-12 May 2023


ATLAS Heavy Particle Searches* - 95% CL Upper Exclusion Limits
Status: July 2022
ATLAS Preliminary
∫ℒ dt = (3.6 – 139) fb⁻¹
√s = 8, 13 TeV
Model | ℓ, γ | Jets† | E_T^miss | ∫ℒ dt[fb⁻¹] | Limit | Reference
Extra dimensions
ADD G_KK + g/q | 0 e, μ, τ, γ | 1 – 4 j | Yes | 139 | M_D | 11.2 TeV | n = 2 | 2102.10874
ADD non-resonant γγ | 2 γ | – | – | 36.7 | M_S | 8.6 TeV | n = 3 HLZ NLO | 1707.04147
ADD QBH | – | 2 j | – | 139 | M_th | 9.4 TeV | n = 6 | 1910.08447
ADD BH multijet | – | ≥3 j | – | 3.6 | M_th | 9.55 TeV | n = 6, M_D = 3 TeV, rot BH | 1512.02586
RS1 G_KK → γγ | 2 γ | – | – | 139 | G_KK mass | 4.5 TeV | k/M̄_Pl = 0.1 | 2102.13405
Bulk RS G_KK → WW/ZZ | multi-channel | 36.1 | G_KK mass | 2.3 TeV | k/M̄_Pl = 1.0 | 1808.02380
Bulk RS G_KK → WV → ℓνqq | 1 e, μ | 2 j / 1 J | Yes | 139 | G_KK mass | 2.0 TeV | k/M̄_Pl = 1.0 | 2004.14636
Bulk RS g_KK → tt | 1 e, μ | ≥1 b, ≥1J/2j | Yes | 36.1 | g_KK mass | 3.8 TeV | Γ/m = 15% | 1804.10823
2UED / RPP | 1 e, μ | ≥2 b, ≥3 j | Yes | 36.1 | KK mass | 1.8 TeV | Tier (1,1), ℬ(A^(1,1) → tt) = 1 | 1803.09678
Gauge bosons
SSM Z′ → ℓℓ | 2 e, μ | – | – | 139 | Z′ mass | 5.1 TeV | 1903.06248
SSM Z′ → ττ | 2 τ | – | – | 36.1 | Z′ mass | 2.42 TeV | 1709.07242
Leptophobic Z′ → bb | – | 2 b | – | 36.1 | Z′ mass | 2.1 TeV | 1805.09299
Leptophobic Z′ → tt | 0 e, μ | ≥1 b, ≥2 J | Yes | 139 | Z′ mass | 4.1 TeV | Γ/m = 1.2% | 2005.05138
SSM W′ → ℓν | 1 e, μ | – | Yes | 139 | W′ mass | 6.0 TeV | 1906.05609
SSM W′ → τν | 1 τ | – | Yes | 139 | W′ mass | 5.0 TeV | ATLAS-CONF-2021-025
SSM W′ → tb | – | ≥1 b, ≥1 J | – | 139 | W′ mass | 4.4 TeV | ATLAS-CONF-2021-043
HVT W′ → WZ → ℓνqq model B | 1 e, μ | 2 j / 1 J | Yes | 139 | W′ mass | 4.3 TeV | g_V = 3 | 2004.14636
HVT W′ → WZ → ℓνℓ′ℓ′ model C | 3 e, μ | 2 j (VBF) | Yes | 139 | W′ mass | 340 GeV | g_V c_H = 1, g_f = 0 | ATLAS-CONF-2022-005
HVT W′ → WH → ℓνbb model B | 1 e, μ | 1-2 b, 1-0 j | Yes | 139 | W′ mass | 3.3 TeV | g_V = 3 | 2207.00230
HVT Z′ → ZH → ℓℓ/ννbb model B | 0,2 e, μ | 1-2 b, 1-0 j | Yes | 139 | Z′ mass | 3.2 TeV | g_V = 3 | 2207.00230
LRSM W_R → μN_R | 2 μ | 1 J | – | 80 | W_R mass | 5.0 TeV | m(N_R) = 0.5 TeV, g_L = g_R | 1904.12679
CI
CI qqqq | – | 2 j | – | 37.0 | Λ | 21.8 TeV | η⁻_LL | 1703.09127
CI ℓℓqq | 2 e, μ | – | – | 139 | Λ | 35.8 TeV | η⁻_LL | 2006.12946
CI eebs | 2 e | 1 b | – | 139 | Λ | 1.8 TeV | g* = 1 | 2105.13847
CI μμbs | 2 μ | 1 b | – | 139 | Λ | 2.0 TeV | g* = 1 | 2105.13847
CI tttt | ≥1 e,μ | ≥1 b, ≥1 j | Yes | 36.1 | Λ | 2.57 TeV | |C_4t| = 4π | 1811.02305
DM
Axial-vector med. (Dirac DM) | 0 e, μ, τ, γ | 1 – 4 j | Yes | 139 | m_med | 2.1 TeV | g_q=0.25, g_χ=1, m(χ)=1 GeV | 2102.10874
Pseudo-scalar med. (Dirac DM) | 0 e, μ, τ, γ | 1 – 4 j | Yes | 139 | m_med | 376 GeV | g_q=1, g_χ=1, m(χ)=1 GeV | 2102.10874
Vector med. Z′-2HDM (Dirac DM) | 0 e, μ | 2 b | Yes | 139 | m_med | 3.1 TeV | tanβ=1, g_Z=0.8, m(χ)=100 GeV | 2108.13391
Pseudo-scalar med. 2HDM+a | multi-channel | 139 | m_med | 560 GeV | tanβ=1, g_χ=1, m(χ)=10 GeV | ATLAS-CONF-2021-036
LQ
Scalar LQ 1st gen | 2 e | ≥2 j | Yes | 139 | LQ mass | 1.8 TeV | β = 1 | 2006.05872
Scalar LQ 2nd gen | 2 μ | ≥2 j | Yes | 139 | LQ mass | 1.7 TeV | β = 1 | 2006.05872
Scalar LQ 3rd gen | 1 τ | 2 b | Yes | 139 | LQ₃ᵘ mass | 1.2 TeV | ℬ(LQ₃ᵘ → bτ) = 1 | 2108.07665
Scalar LQ 3rd gen | 0 e, μ | ≥2 j, ≥2 b | Yes | 139 | LQ₃ᵘ mass | 1.24 TeV | ℬ(LQ₃ᵘ → tν) = 1 | 2004.14060
Scalar LQ 3rd gen | ≥2 e, μ, ≥1 τ | ≥1 j, ≥1 b | – | 139 | LQ₃ᵈ mass | 1.43 TeV | ℬ(LQ₃ᵈ → tτ) = 1 | 2101.11582
Scalar LQ 3rd gen | 0 e, μ, ≥1 τ | 0 – 2 j, 2 b | Yes | 139 | LQ₃ᵈ mass | 1.26 TeV | ℬ(LQ₃ᵈ → bν) = 1 | 2101.12527
Vector LQ 3rd gen | 1 τ | 2 b | Yes | 139 | LQ₃ⱽ mass | 1.77 TeV | ℬ(LQ₃ⱽ → bτ) = 0.5, Y-M coupl. | 2108.07665
Vector-like fermions
VLQ TT → Zt + X | 2e/2μ/≥3e,μ | ≥1 b, ≥1 j | – | 139 | T mass | 1.4 TeV | SU(2) doublet | ATLAS-CONF-2021-024
VLQ BB → Wt/Zb + X | multi-channel | 36.1 | B mass | 1.34 TeV | SU(2) doublet | 1808.02343
VLQ T_5/3 T_5/3|T_5/3 → Wt + X | 2(SS)/≥3 e,μ | ≥1 b, ≥1 j | Yes | 36.1 | T_5/3 mass | 1.64 TeV | ℬ(T_5/3 → Wt)= 1, c(T_5/3 Wt)= 1 | 1807.11883
VLQ T → Ht/Zt | 1 e, μ | ≥1 b, ≥3 j | Yes | 139 | T mass | 1.8 TeV | SU(2) singlet, κ_T = 0.5 | ATLAS-CONF-2021-040
VLQ Y → Wb | 1 e, μ | ≥1 b, ≥1 j | Yes | 36.1 | Y mass | 1.85 TeV | ℬ(Y → Wb)= 1, c_R(Wb)= 1 | 1812.07343
VLQ B → Hb | 0 e,μ | ≥2b, ≥1j, ≥1J | – | 139 | B mass | 2.0 TeV | SU(2) doublet, κ_B= 0.3 | ATLAS-CONF-2021-018
VLL τ′ → Zτ/Hτ | multi-channel | ≥1 j | Yes | 139 | τ′ mass | 898 GeV | SU(2) doublet | ATLAS-CONF-2022-044
Excited fermions
Excited quark q* → qg | – | 2 j | – | 139 | q* mass | 6.7 TeV | only u* and d*, Λ = m(q*) | 1910.08447
Excited quark q* → qγ | 1 γ | 1 j | – | 36.7 | q* mass | 5.3 TeV | only u* and d*, Λ = m(q*) | 1709.10440
Excited quark b* → bg | – | 1 b, 1 j | – | 139 | b* mass | 3.2 TeV | 1910.0447
Excited lepton ℓ* | 3 e, μ | – | – | 20.3 | ℓ* mass | 3.0 TeV | Λ = 3.0 TeV | 1411.2921
Excited lepton ν* | 3 e, μ, τ | – | – | 20.3 | ν* mass | 1.6 TeV | Λ = 1.6 TeV | 1411.2921
Other
Type III Seesaw | 2,3,4 e, μ | ≥2 j | Yes | 139 | N⁰ mass | 910 GeV | 2202.02039
LRSM Majorana ν | 2 μ | 2 j | – | 36.1 | N_R mass | 3.2 TeV | m(W_R) = 4.1 TeV, g_L = g_R | 1809.11105
Higgs triplet H^±± → W^±W^± | 2,3,4 e, μ (SS) | various | Yes | 139 | H^±± mass | 350 GeV | DY production | 2101.11961
Higgs triplet H^±± → ℓℓ | 2,3,4 e, μ (SS) | – | – | 139 | H^±± mass | 1.08 TeV | DY production | ATLAS-CONF-2022-010
Higgs triplet H^±± → ℓτ | 3 e, μ, τ | – | – | 20.3 | H^±± mass | 400 GeV | DY production, ℬ(H_L^±± → ℓτ) = 1 | 1411.2921
Multi-charged particles | – | – | – | 139 | multi-charged particle mass | 1.59 TeV | DY production, |q| = 5e | ATLAS-CONF-2022-034
Magnetic monopoles | – | – | – | 34.4 | monopole mass | 2.37 TeV | DY production, |g| = 1g_D, spin 1/2 | 1905.10130
√s = 8 TeV
√s = 13 TeV partial data
√s = 13 TeV full data
10⁻¹
10
Mass scale [TeV]
*Only a selection of the available mass limits on new states or phenomena is shown.
†Small-radius (large-radius) jets are denoted by the letter j (J).
1 TeV
10 TeV

LHC / HL-LHC Plan

- No significant increase in the energy reach, but 20x more luminosity! Multiple ongoing low-energy experiments
- Rather than searching for resonances, we can look for the low-energy footprints of new physics

The Effective Field Theory approach

EFTs are essential to interpret experimental observations

UV physics

$$\mathscr{L}_{\rm EFT}(\eta_L) = \mathscr{L}_{d=4}(\eta_L) + \sum_{\ell=0}^{\infty}\sum_{n=5}^{\infty}\sum_{k} \frac{C_{n,k}^{(\ell)}}{(16\pi^2)^{\ell}\,\Lambda^{n-4}}\, O_{n,k}(\eta_L)$$

- Bottom → Up

  EFTs offer a model comprehensive (“model independent”) approach to study deviations form the SM, organized in a double expansion in E/Λ and loop orders.

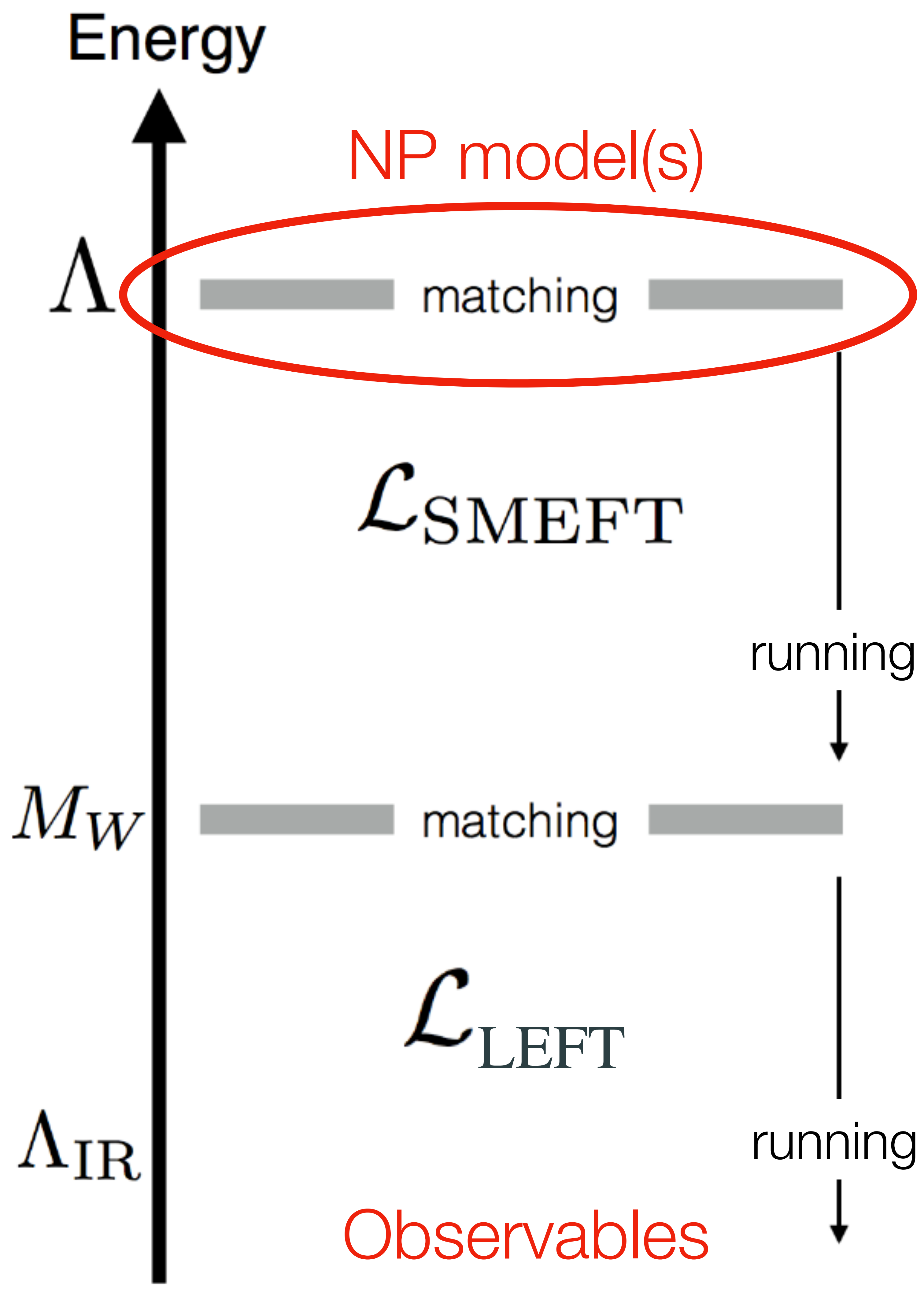
- Top → Down

  (B)SM computations of experimental observables are multi-scale problems:
  Precision requires using EFTs (RG resummation of large logs)

  Multiple BSM models share the same EFT, so many computations are reusable (“compute once for all”)

The vast landscape of BSM models and the repetitive nature of EFT computations call for automated solutions

The EFT approach: recent progress towards automation



Carmona et al. [2112.10787]

Diagrammatic matching of many NP models
(requires prior knowledge of the EFT)

[*d*-dimensional and off-shelf]

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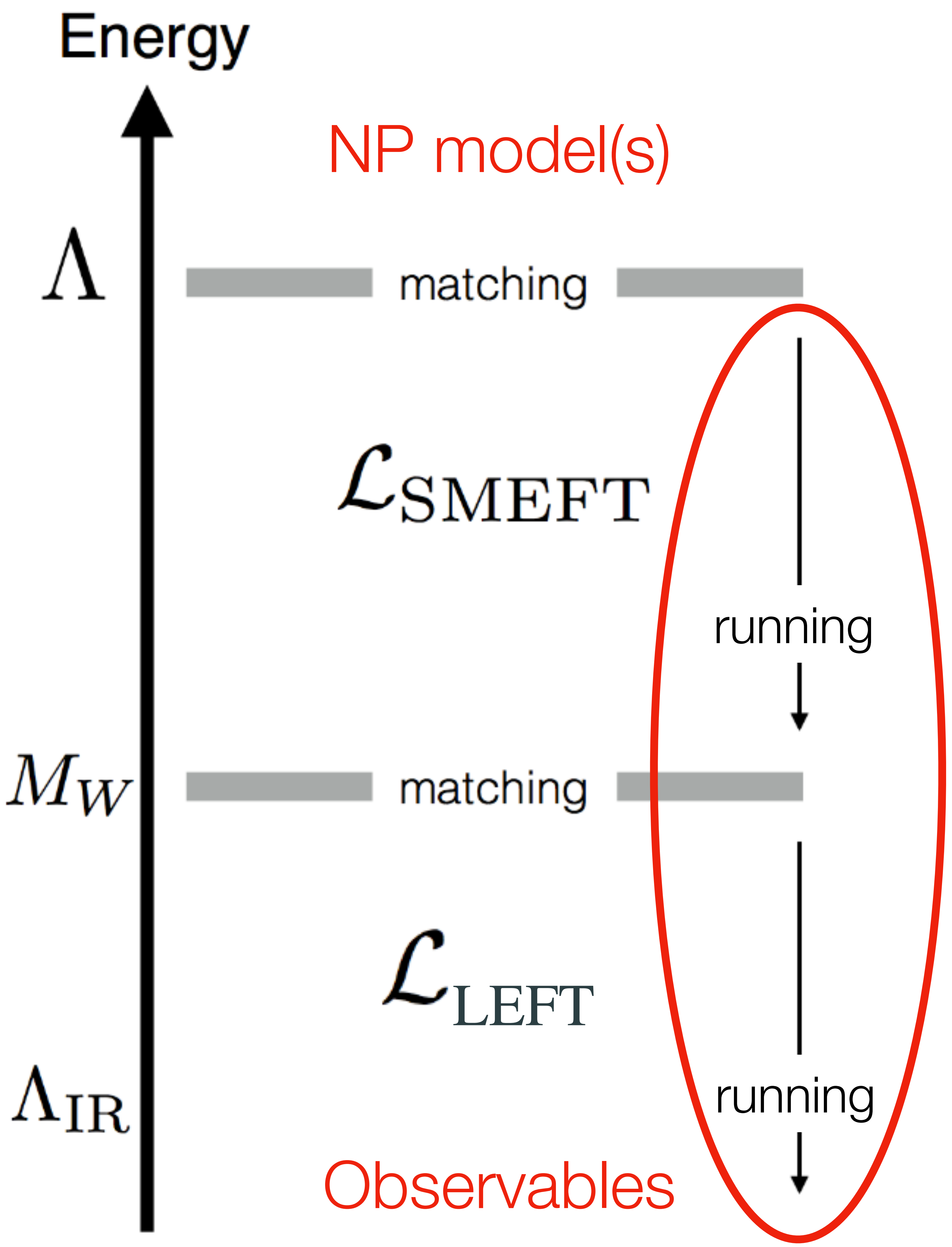

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[*d*-dimensional and off-shell]

JFM et al. [1704.04504, 2010.16341]

Aebischer, Kumar, Straub [1804.05033]

“Hard-coded” one-loop results based on:

Jenkins, Manohar, Trott [1308.2627, 1310.4838]
Alonso, Jenkins, Manohar, Trott [1312.2014]
Jenkins, Manohar, Stoffer [1709.04486]
Dekens, Stoffer [1908.05295]
Jenkins, Manohar, Stoffer [1711.05270]

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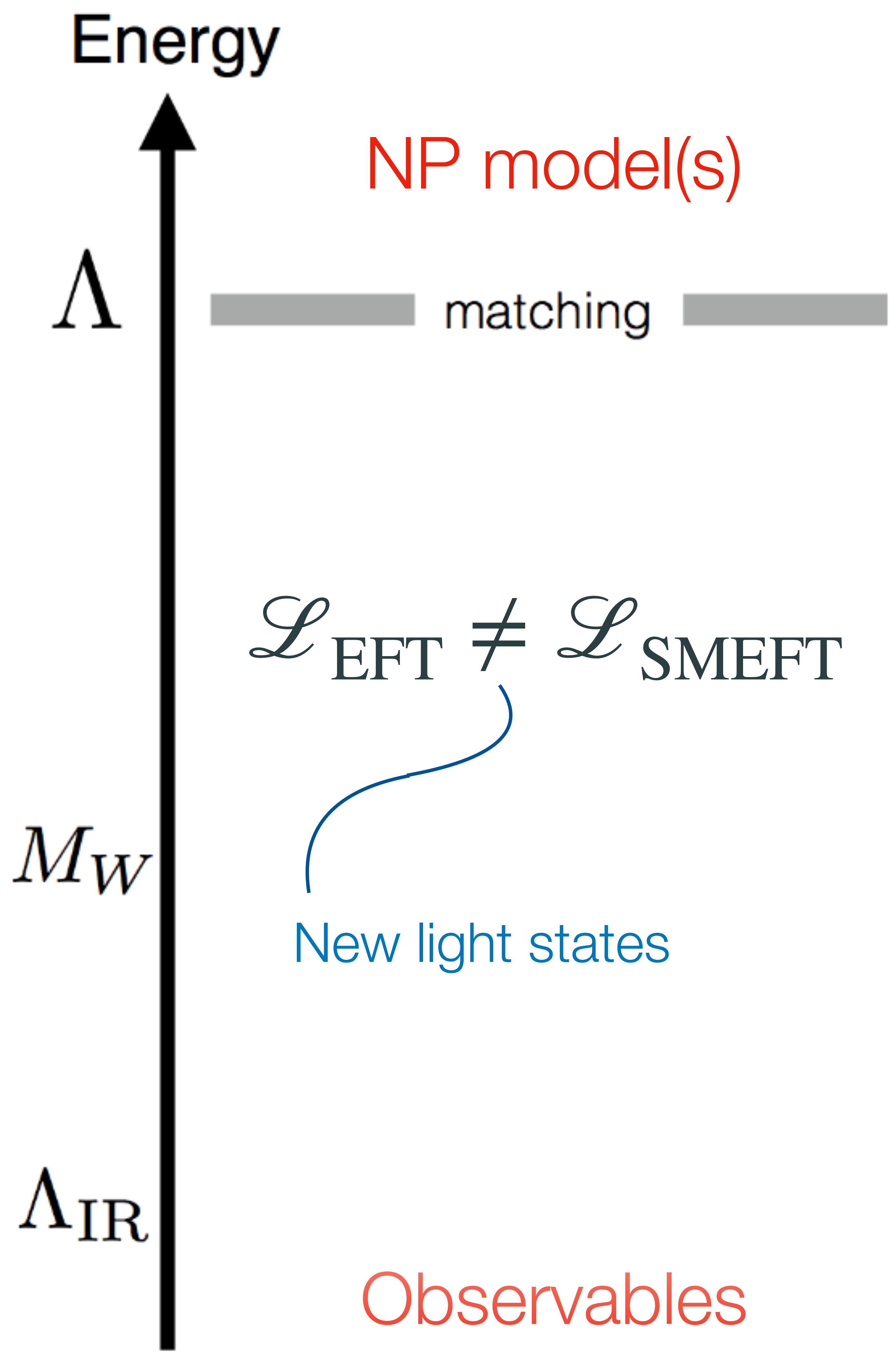

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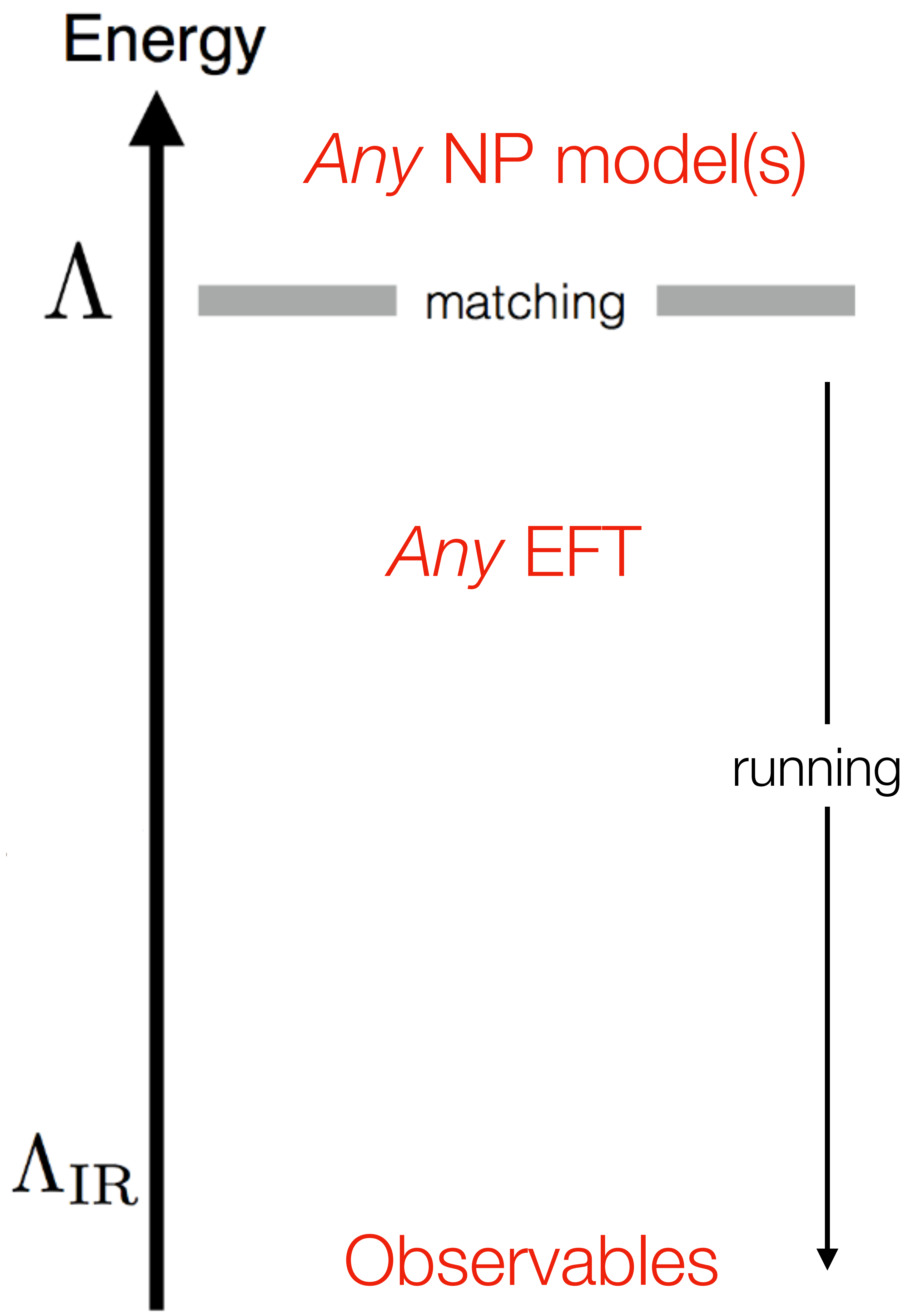
Path integral methods and Matchete

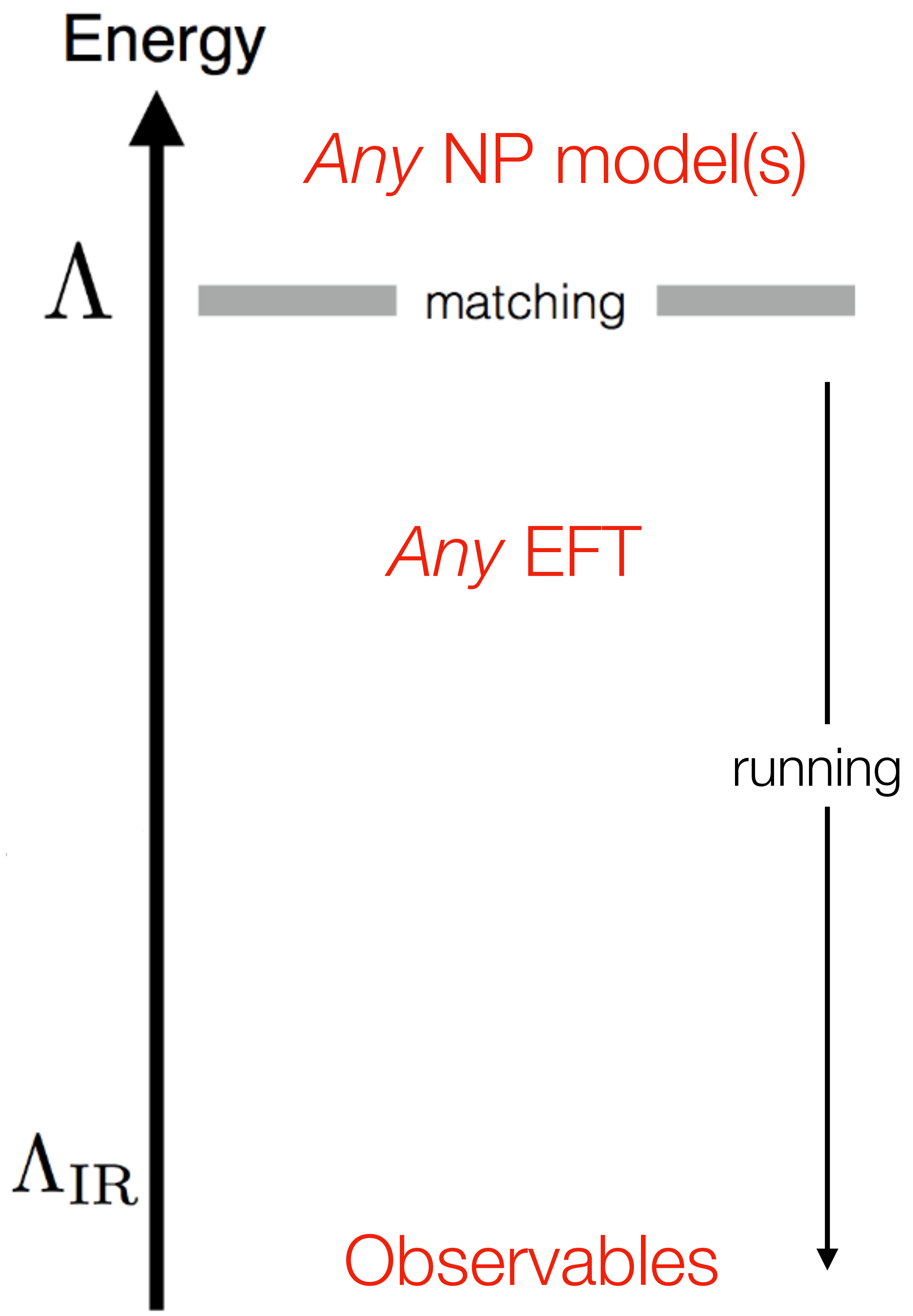


Path-integral methods for matching and running are *ideal* for this task:

- The EFT Lagrangian comes out directly as part of the procedure
  No prior knowledge of the EFT is required!

- Manifestly gauge invariant by construction
  [Gaillard '86, Chan '86, Cheyette '88]

Path integral methods and Matchete



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  [Gaillard ’86, Chan ’86, Cheyette ’88]

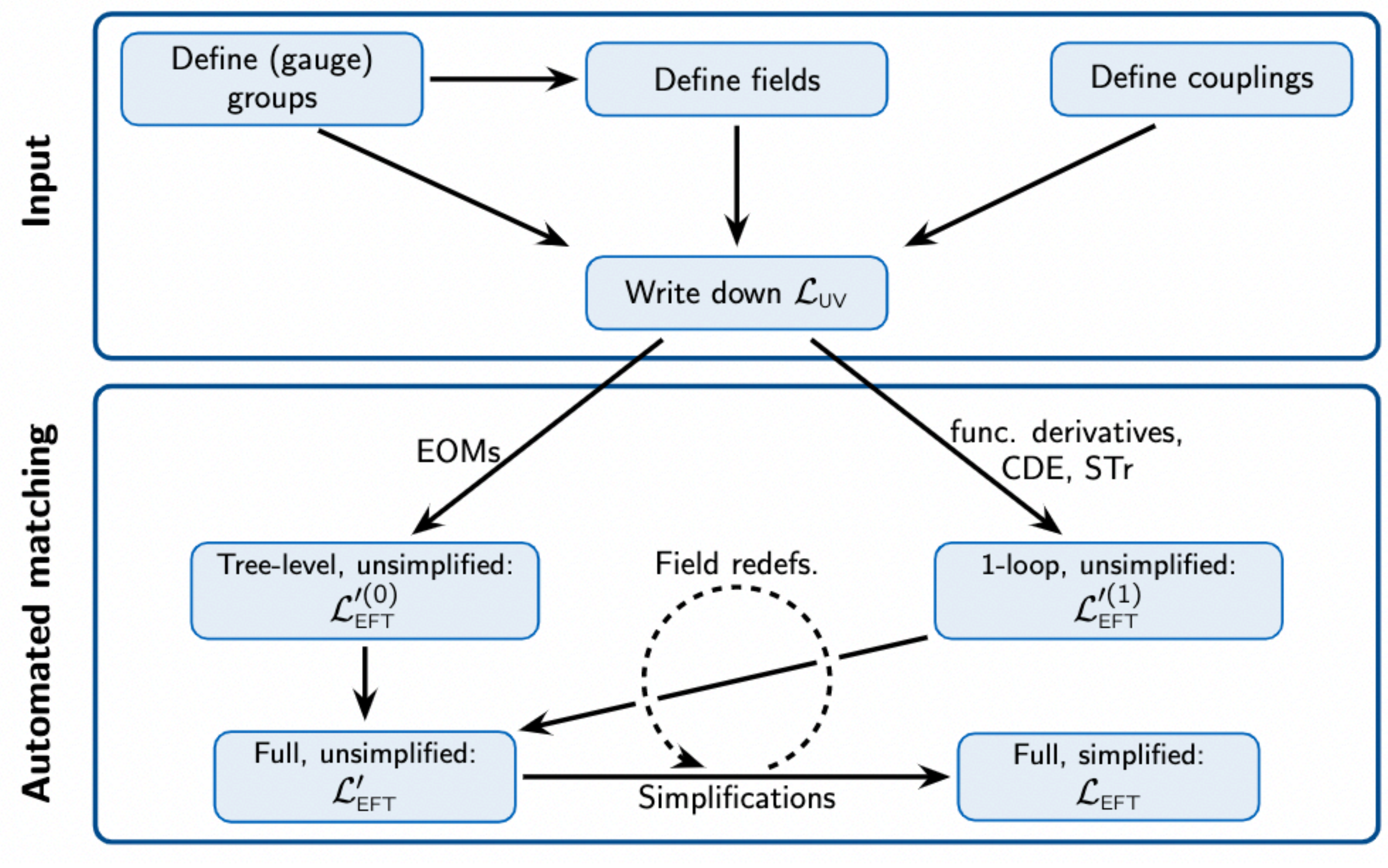
drawing by Claudia Cornella

Matchete mini-workshop
MITP, 8-12 November 2021

with M. König, J. Pagés, A. E. Thomsen, F. Wilsch

The Matchete package

MATCHETE is a Mathematica package aimed at fully automating EFT matching and RG evolution of arbitrary weakly-coupled UV theories using functional methods



[JFM, König, Pagès, Thomsen, Wilsch, 2212.04510]

Proof-of-concept version (Matchete v0.1) now publicly available:

- One-loop matching of *any* model with heavy scalars and/or fermions
- Simple and intuitive input/output
- Handles *all* group theory (any group and reps)
- Partial simplifications of the resulting EFT Lagrangian (IBP, field redefinitions,…)
- SSB and heavy vectors not yet supported
  [w.i.p with Olgoso, Santiago, Thomsen]
- Computation of the RGE not yet available

Two BSM matching examples

SM extension with a scalar SM-singlet

$$\mathscr{L}_{\rm UV} = \mathscr{L}_{\rm SM} + \frac{1}{2}(\partial_\mu S)^2 - \frac{1}{2}M^2 S^2 - \frac{\mu_S}{3!} S^3 - \frac{\lambda_S}{4!} S^4 - \frac{\lambda_{SH}}{2} (H^\dagger H) S^2 - \kappa (H^\dagger H) S \qquad \text{with } M, \kappa, \mu_S \gg v_{\rm EW}$$

Less than half a minute to compute the one-loop matching
(which was correctly determined only after several literature iterations)

[Henning, Lu, Murayama 1412.1837;
Ellis, Quevillon, You, Zhang 1706.07765;
Jiang, Craig, Li, Sutherland 1811.08878;
Haisch, Ruhdorfer, Salvioni, Venturini, Weiler 2003.05936]

SM extension with a vector-like lepton ($E \sim (\mathbf{1},\mathbf{1})_{-1}$)

$$\mathscr{L}_{\rm UV} = \mathscr{L}_{\rm SM} + i\,(\bar{E}\,\gamma_\mu D^\mu E) - m_E\,\bar{E}\,E - \left(y_E\,\ell_L H E_R + \mathrm{h.c.}\right) \qquad \text{with } M_E \gg v_{\rm EW}$$

Less than a minute to compute the one-loop matching and simplify the result
(result validated against **matchmakereft**)

Let's see how it works!

An example of Matchete in action

Matchete in action

Next is a live demonstration, see the attached Mathematica notebook

Reducing the EFT Lagrangian to its basis

$$\mathscr{L} = \frac{1}{2}(\partial_\mu\phi)^2 - \frac{1}{2}m^2\phi^2 - \frac{\lambda}{4!}\phi^4 + \frac{C_1}{\Lambda^2}\phi^6 + \frac{C_2}{\Lambda^2}\phi^3\partial^2\phi + \frac{C_3}{\Lambda^2}\phi^2(\partial_\mu\phi)^2$$

Exact simplifications (linear): IBP, Dirac and group identities, commutation relations…

$$\mathscr{L} = \frac{1}{2}(\partial_\mu\phi)^2 - \frac{1}{2}m^2\phi^2 - \frac{\lambda}{4!}\phi^4 + \frac{C_1}{\Lambda^2}\phi^6 + \frac{3C_2 - C_3}{3\Lambda^2}\phi^3\partial^2\phi$$

On-shell equivalence (non-linear): Field redefinitions (sometimes equivalent to using of EOMs)

$$\phi \to \phi + \frac{3\,C_2 - C_3}{3\,\Lambda^2}\phi^3 \qquad \left[\partial^2\phi = -\,m^2\phi - \frac{\lambda}{3!}\phi^3 + \mathcal{O}(\Lambda^{-2})\right]$$

$$\mathscr{L} \to \frac{1}{2}(\partial_\mu\phi)^2 - \frac{1}{2}m^2\phi^2 - \left(\frac{\lambda}{4!} + \frac{m^2\,(3C_2 - C_3)}{3\,\Lambda^2}\right)\phi^4 + \frac{18\,C_1 - \lambda\,(3C_2 - C_3)}{18\,\Lambda^2}\phi^6$$

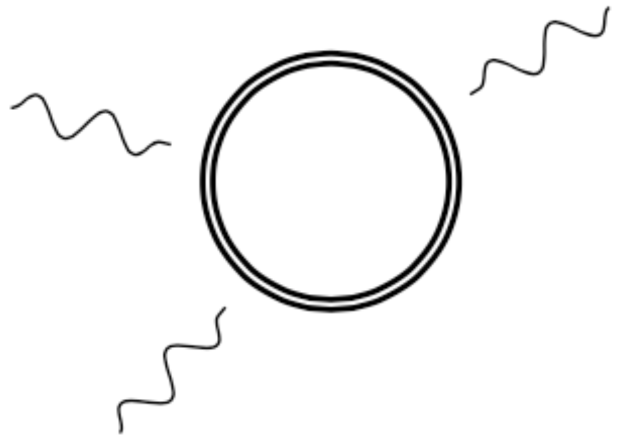
Removal of evanescent operators: Formally solved [JFM, König, Pagès, Thomsen, Wilsch, 2211.09144]

Linear simplifications

Example: Integrating out a heavy fermion in the fundamental representation of SU(3)

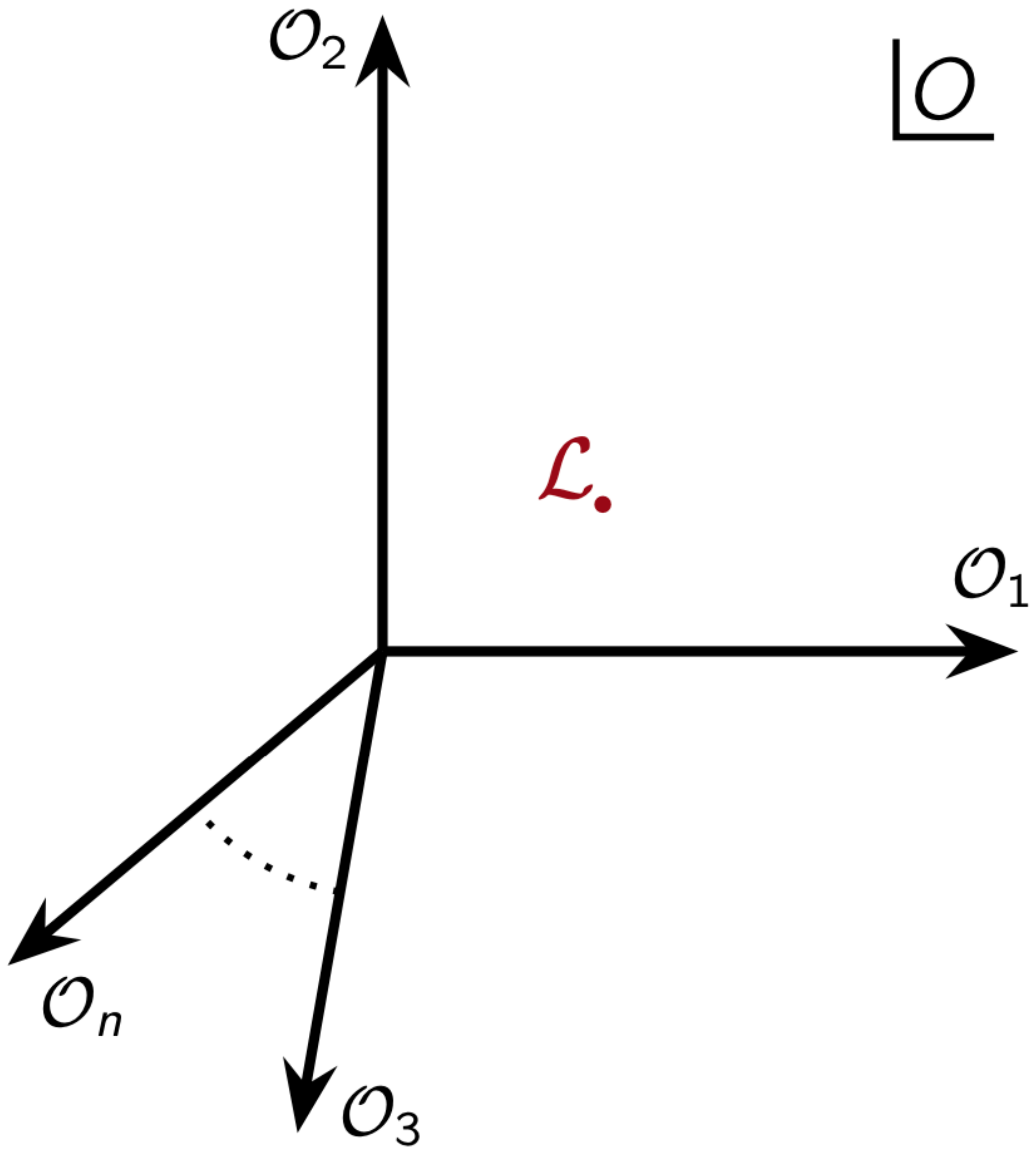
```
In[12]:= LEFT // NiceForm
Out[12]//NiceForm=
```

$$\frac{7}{540}\,\hbar\, g^2 \frac{1}{M\Psi^2}\left(D_\rho G^{\mu\nu A}\right)^2 + \frac{1}{40}\,\hbar\, g^2 \frac{1}{M\Psi^2} G^{\mu\nu A} D^2 G^{\mu\nu A} + \frac{7}{540}\,\hbar\, g^2 \frac{1}{M\Psi^2} D_\rho G^{\mu\nu A} D_\nu G^{\mu\rho A} - \frac{1}{180}\,\hbar\, g^2 \frac{1}{M\Psi^2} D_\nu G^{\mu\nu A} D_\rho G^{\mu\rho A} + \frac{1}{40}\,\hbar\, g^2 \frac{1}{M\Psi^2} G^{\mu\nu A} D_\nu D_\rho G^{\mu\rho A} + \frac{1}{40}\,\hbar\, g^2 \frac{1}{M\Psi^2} G^{\mu\nu A} D_\rho D_\nu G^{\mu\rho A} - \frac{1}{24}\,\hbar\, g^3 \frac{1}{M\Psi^2} G^{\mu\nu A} G^{\mu\rho B} G^{\nu\rho C} f^{ABC}$$



(log supertrace)

$$\mathscr{L}_{\mathrm{EFT}} = \sum_i C_i \mathcal{O}_i \in O$$



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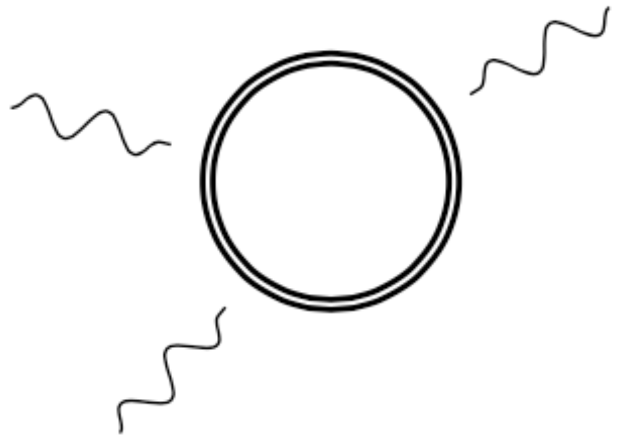
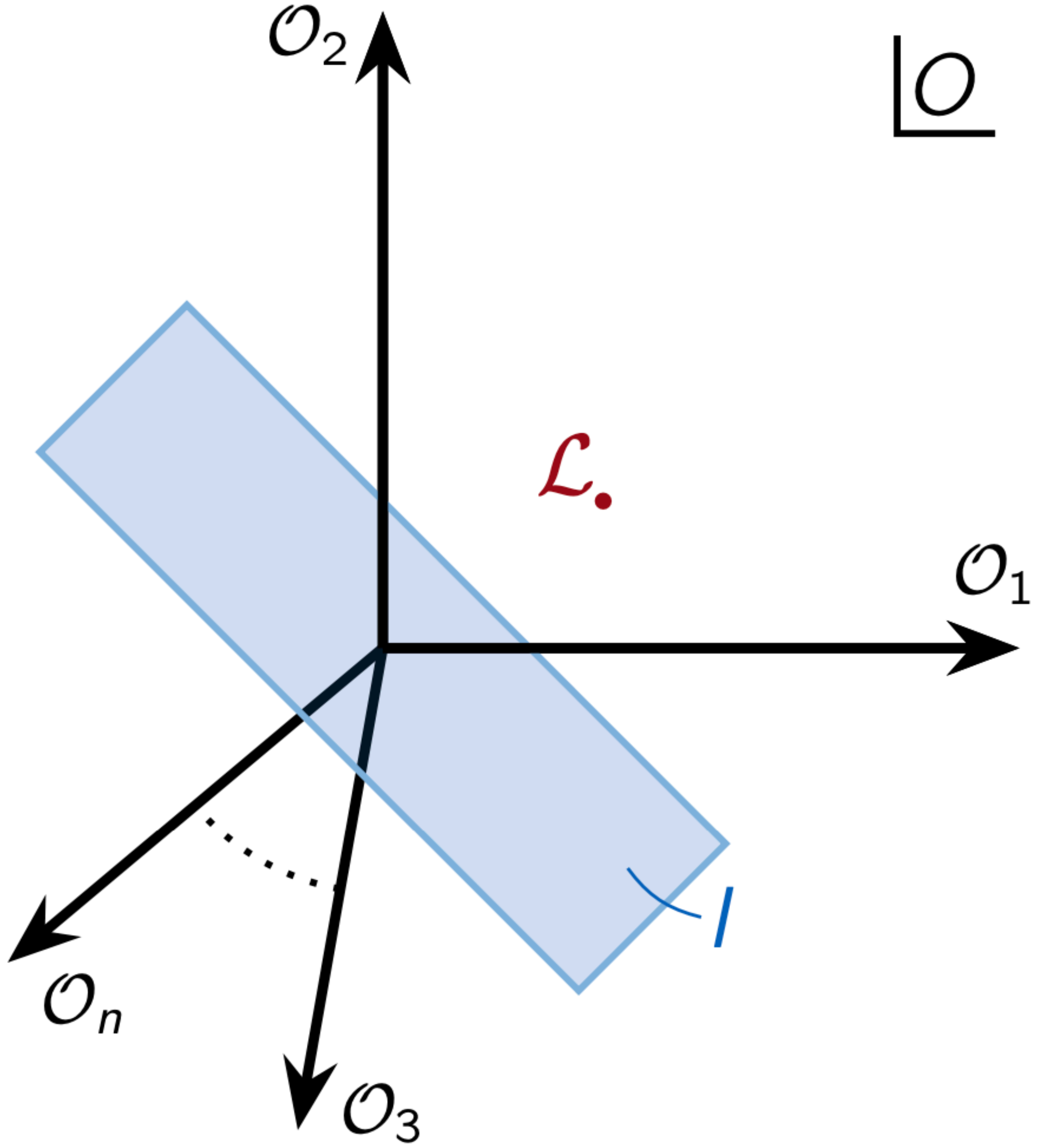


(log supertrace)



$I \subseteq O$ is the space of all operators identities, such as IBP relations, yielding e.g.

$$\mathcal{O}_1 + 2\,\mathcal{O}_3 = 0$$

interpreted as

$$\mathcal{O}_1 + 2\,\mathcal{O}_3 \in I$$

Linear simplifications

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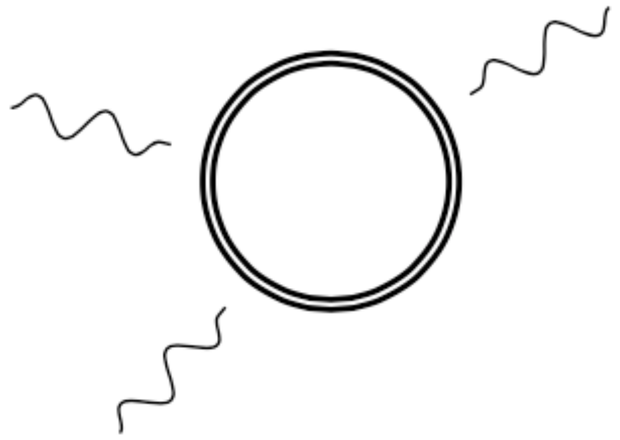

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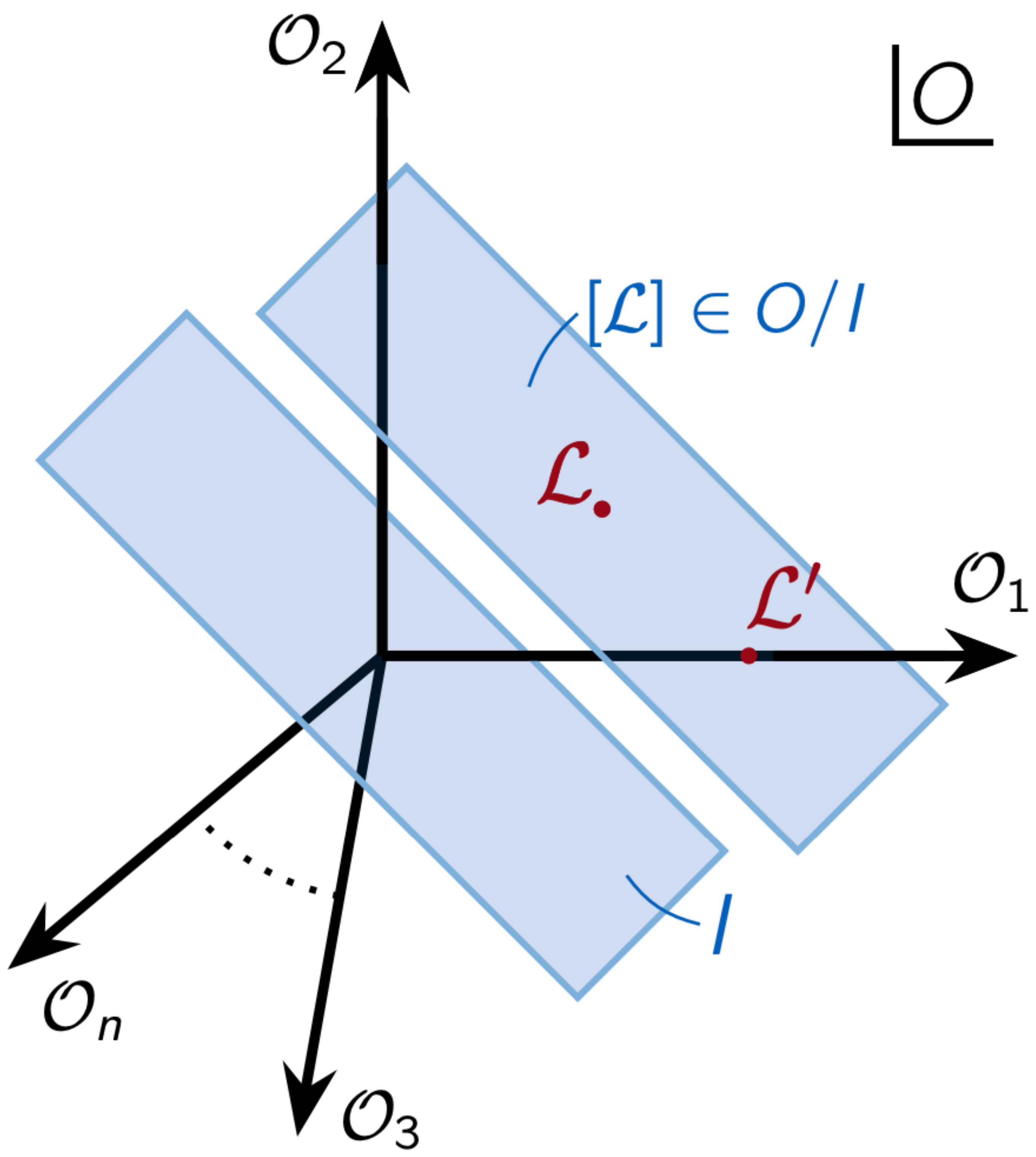

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interpreted as

$$\mathcal{O}_1 + 2\,\mathcal{O}_3 \in I$$

By gaussian elimination, we can *choose* a representative element for $[\mathscr{L}_{\text{EFT}}] \in O/I$ to get an EFT basis

In[13]:= `LEFT // GreensSimplify // NiceForm`

Out[13]//NiceForm=

$$-\frac{1}{15}\hbar g^2 \frac{1}{M\Psi^2} D_\nu G^{\mu\nu A} D_\rho G^{\mu\rho A} - \frac{1}{180}\hbar g^3 \frac{1}{M\Psi^2} G^{\mu\nu A} G^{\mu\rho B} G^{\nu\rho C} f^{ABC}$$

Evanescent operators

Evanescent operators appear from special type of linear simplification (valid only for $d = 4$)

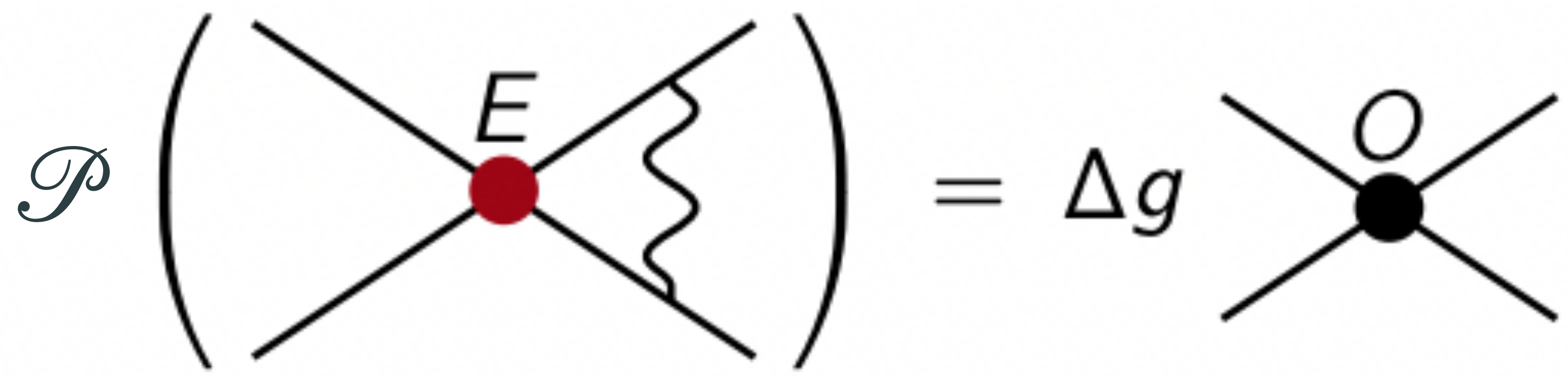
$$O_d = \underbrace{\mathscr{P}\, O_d}_{\text{Physical part}} + \underbrace{\overbrace{\mathscr{E}}^{Id - \mathscr{P}}\, O_d}_{\text{Evanescent part}}$$

$\mathscr{P} \equiv$ Projection to the physical ($d = 4$) basis

E.g. Fierz identities

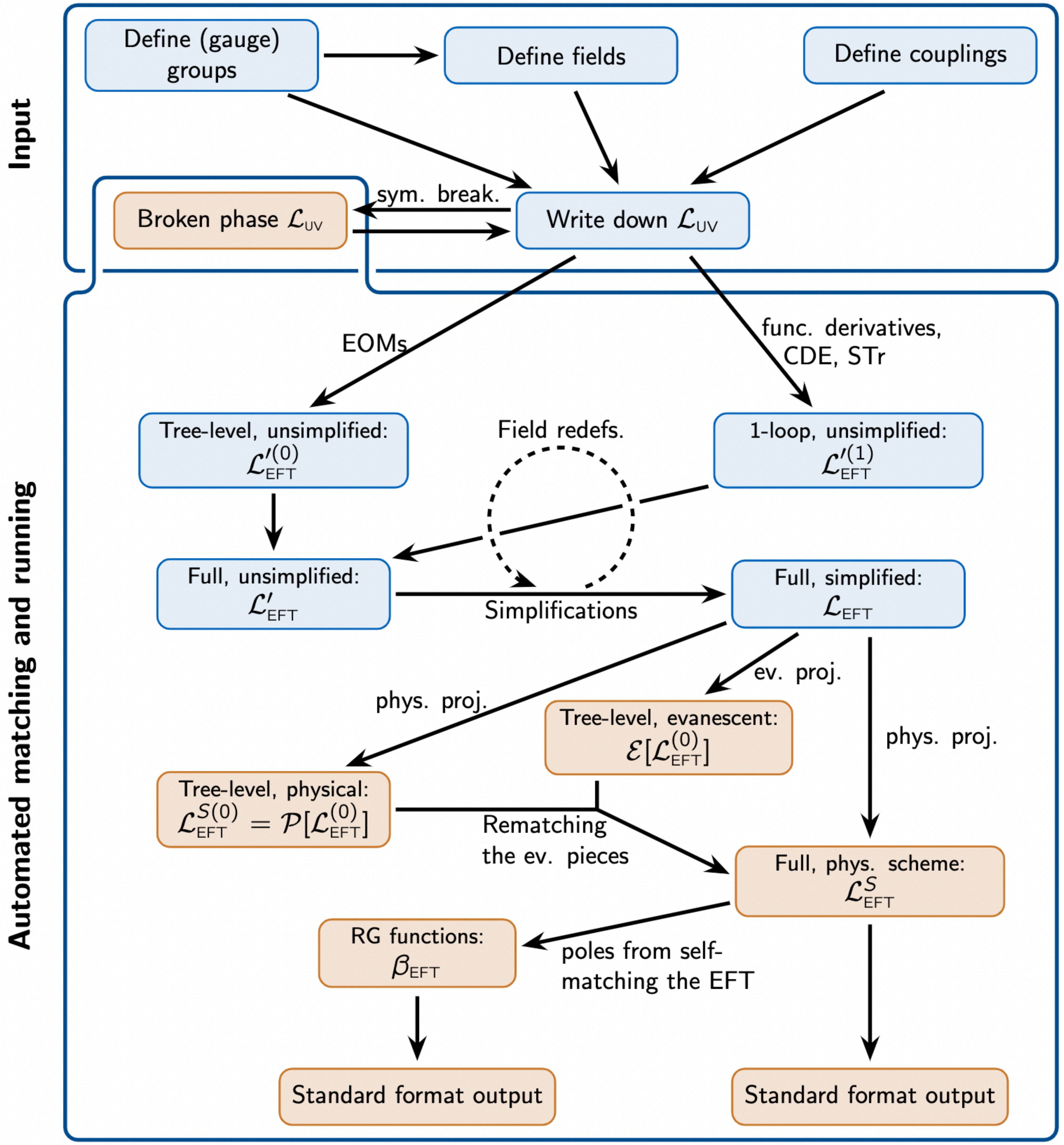
$$(\bar{\ell}_p e_r)(\bar{e}_s \ell_t) = -\frac{1}{2}(\bar{\ell}_p \gamma_\mu \ell_t)(\bar{e}_s \gamma^\mu e_r) + \overbrace{E_{\ell e}^{prst}}^{\text{rank}\,(d-4)} \longrightarrow (\bar{\ell}_p e_r)(\bar{e}_s \ell_t) + \frac{1}{2}(\bar{\ell}_p \gamma_\mu \ell_t)(\bar{e}_s \gamma^\mu e_r) - E_{\ell e}^{prst} \in I$$

Representative elements are chosen so evanescent operators are retained. Afterwards, these are removed by shifting the coefficients of physical operators



e.g. $E_{\ell e}^{prst} \to -\frac{g_L\, y_e^{ts}}{128\pi^2}\, Q_{eW}^{pr} +$ [other contributions]

Future plans



Proof of concept already available at:
https://gitlab.com/matchete/matchete

Expected future functionalities include:

- Handling of evanescent contributions
- Complete basis reduction and identification
- One-loop RG computations
- Heavy vectors and symmetry breaking
- Interface with other EFT tools (UFO / WCxf outputs)
- Other γ_5 and regularization/renormalization schemes
- Matching and running beyond one loop

Going beyond one loop

[JFM, Thomsen, Palavic, w.i.p]

The quantum effective action is the generating functional of 1PI functions

$$e^{i\Gamma_{\mathrm{UV}}[\hat{\eta}]} = \int \mathscr{D}\eta \, \exp\left(i\,S_{\mathrm{UV}}[\eta + \hat{\eta}] + i \int_x J\,\eta \right)$$

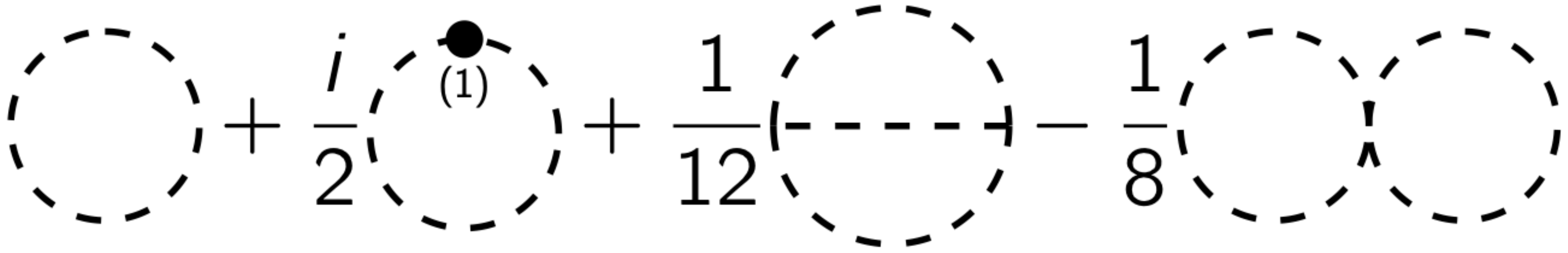
η : Quantum fields (loop lines)

$\hat{\eta}$: Classical fields (tree lines)

The loop expansion is produced with the saddlepoint approximation :

$$\Gamma_{\mathrm{UV}}[\hat{\eta}] = S_{\mathrm{UV}}[\hat{\eta}] - i \ln \int \mathscr{D}\eta \exp\left[i \left(\frac{\eta^2}{2} Q[\hat{\eta}] + \frac{\eta^3}{3!} B[\hat{\eta}] + \frac{\eta^4}{4!} D[\hat{\eta}] + \dots \right) \right]$$

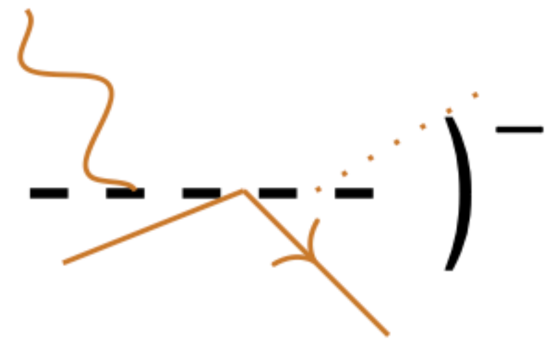
$$= S_{\mathrm{UV}}[\hat{\eta}] + \frac{i}{2} \log$$



$$+ \mathcal{O}(\hbar^3)$$

All propagators are dressed with arbitrary background field insertions

$$\mathcal{Q}_{IJ}[\hat{\eta}] = \frac{\delta^2 S}{\delta\eta^I \delta\eta^J}[\hat{\eta}] = \left(\quad \right)^{-1}$$



Going beyond one loop

The EFT action is given by

$$S_{\rm EFT}[\phi] = \Gamma_{\rm UV}[\hat{\Phi}, \phi]\Big|_{\rm hard} \qquad \frac{\delta\Gamma_{\rm UV}\big|_{\rm hard}}{\delta\Phi}[\hat{\Phi}, \phi] = 0$$

Φ : Heavy

ϕ : Light

"hard" denotes the part where all loop momenta are $p \sim \Lambda$ (incl. tree-level contributions) $^{(*)}$

- Already used at one loop order [JFM, Portolés, Ruiz-Femenía, 1607.02142; Z. Zhang 1610.00710]
- Explicit proof to two-loop order [JFM, Thomsen, Palavic, w.i.p]
- The hard region is by far the easiest to compute (only vacuum diagrams at zero external momenta)
- Enables functional matching at any loop order

$^{(*)}$ Method of regions: Beneke, Smirnov, hep-ph/9711391; Jantzen, 1111.2589

Conclusions

- (Automated) EFT matching is crucial to BSM phenomenology

- Functional matching is ideal for automation (also useful for pen-and-paper computations!)

- Complete one-loop automation: Lagrangian in, fully simplified EFT Lagrangian out not yet available
  - Ongoing progress with MATCHETE

- The ultimate goal is a code (or chain of codes) that fully automates
  - Matching
  - RG evolution

  } **Multi-step matching**

  - Connection to observables / fit to data — **Interface with other EFT pheno codes**

  streamlining future BSM analyses

Organized by Jason Aebischer, Adrián Carmona, Claudia Cornella, JFM, and Anders Eller Thomsen

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Thank you