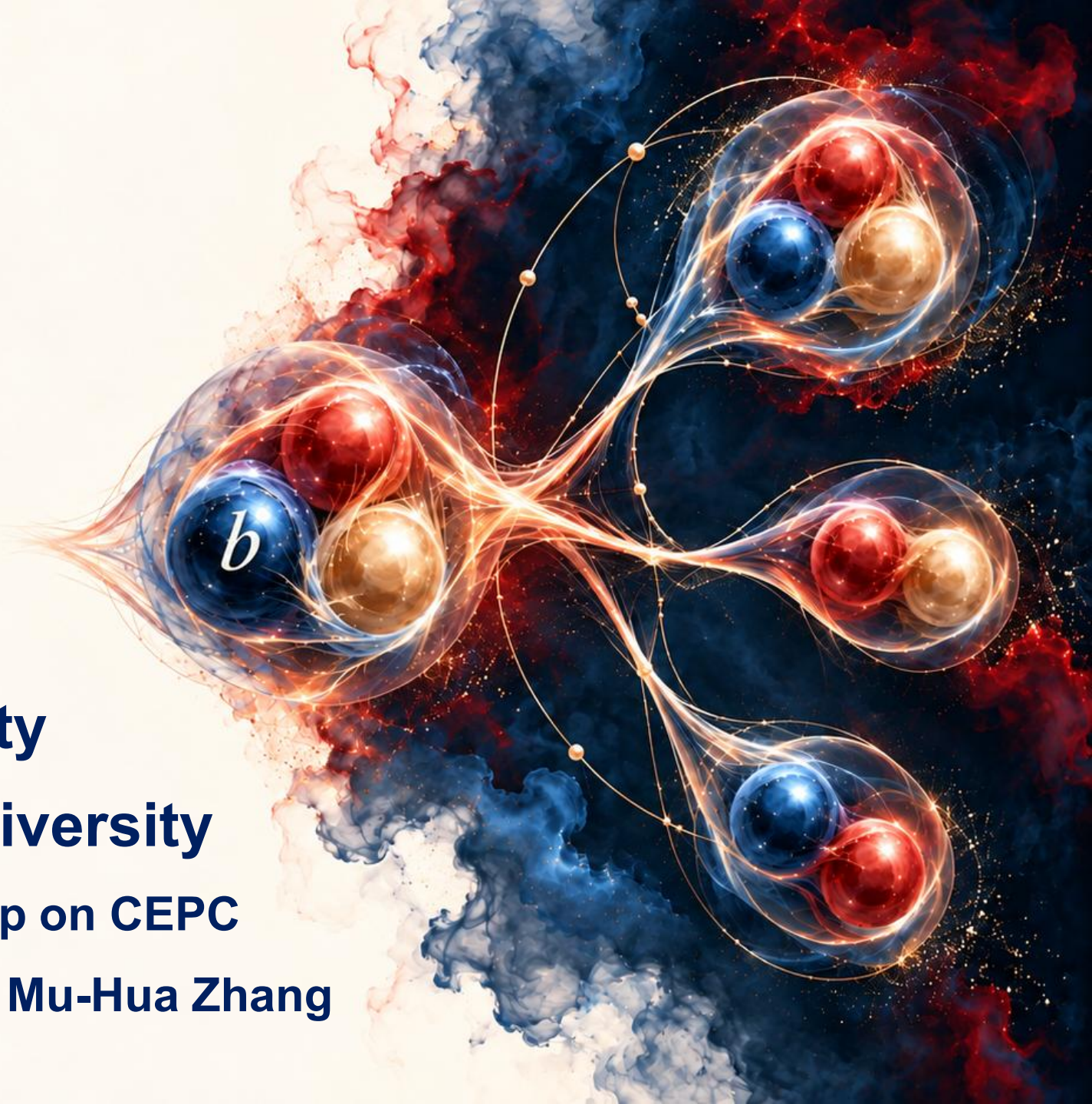
蘭州大學 | LANZHOU UNIVERSITY

A New Paradigm For AI-Driven Flavor SU(3) ANALYSIS



Ji Xu（徐吉）

Lanzhou University

2026.10.24 @ Fudan University

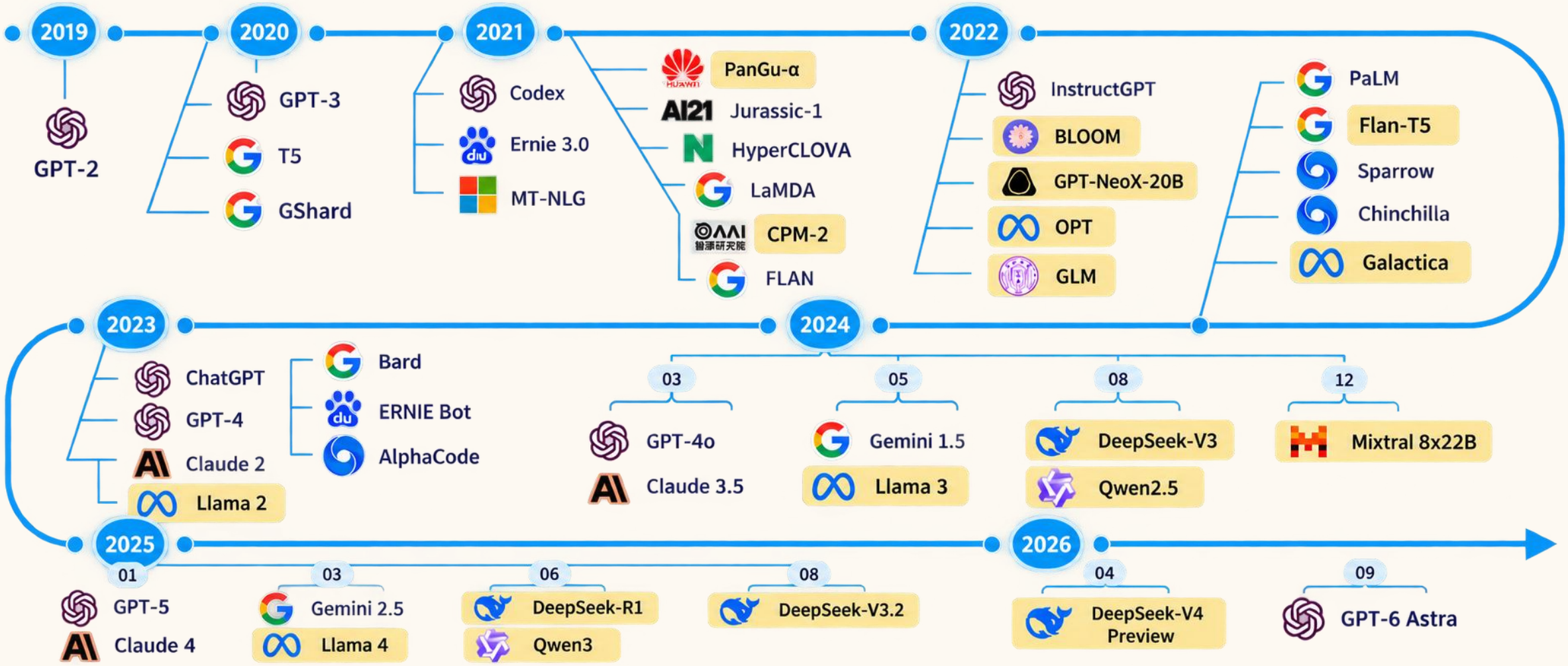
The 2026 International Workshop on CEPC

In Collaboration with Wei Wang and Mu-Hua Zhang

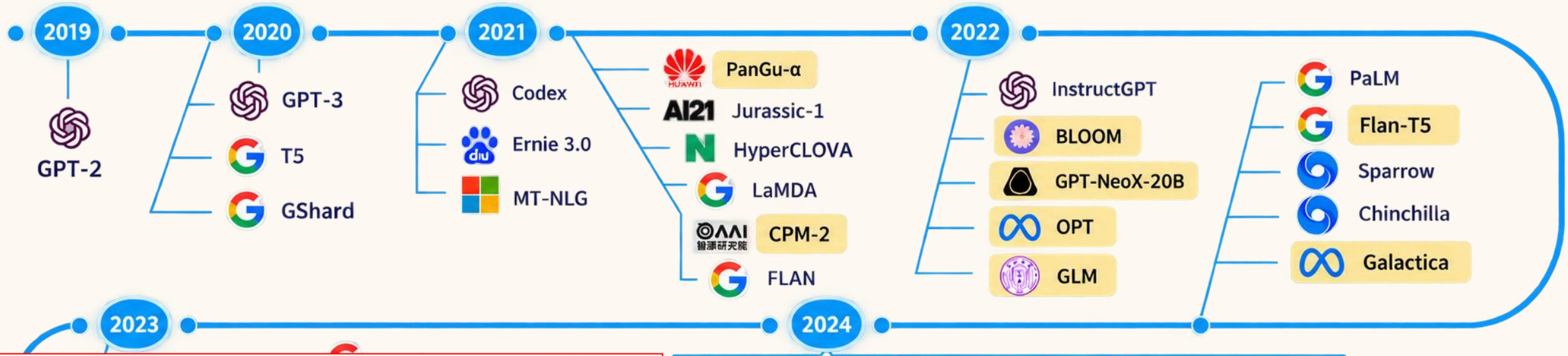
Outline

- Large Language Models and Agents
- SU(3) amplitude analysis
- Our agent workflow
- Results and Comparison
- Summary

What Are Large Language Models?



What Are Large Language Models?



LLM SCALE, 2018–2026

YEAR	MODEL	PARAMETERS
2018	GPT-1	117M
2019	GPT-2	1.5B
2020	GPT-3	175B
2024	DeepSeek-V3	671B total / 37B active
2025	DeepSeek-R1	671B total / 37B active
2026	DeepSeek-V4.1-Flash	552B MoE / 8B–16B active
2026	GPT-6 Astra	Not disclosed

Total and active MoE parameters are not directly comparable.

How Large Language Models Work

An LLM predicts the next token using the tokens already seen.

01 TOKEN

BPE merges frequent character sequences into subword tokens. Each token maps to a vector.

Schematic example

"flavor SU(3) analysis"

characters → frequent chunks

[fl] [avor] [SU] [(] [3] [)] [ana] [lysis]

02 NEXT-TOKEN PREDICTION

The model assigns probabilities to possible next tokens. It appends the selected token, then predicts again.

Example

"three valence" → "quarks"

The output becomes part of the next input.

03 TRANSFORMER

Self-attention lets each token combine information from other tokens in the sequence.

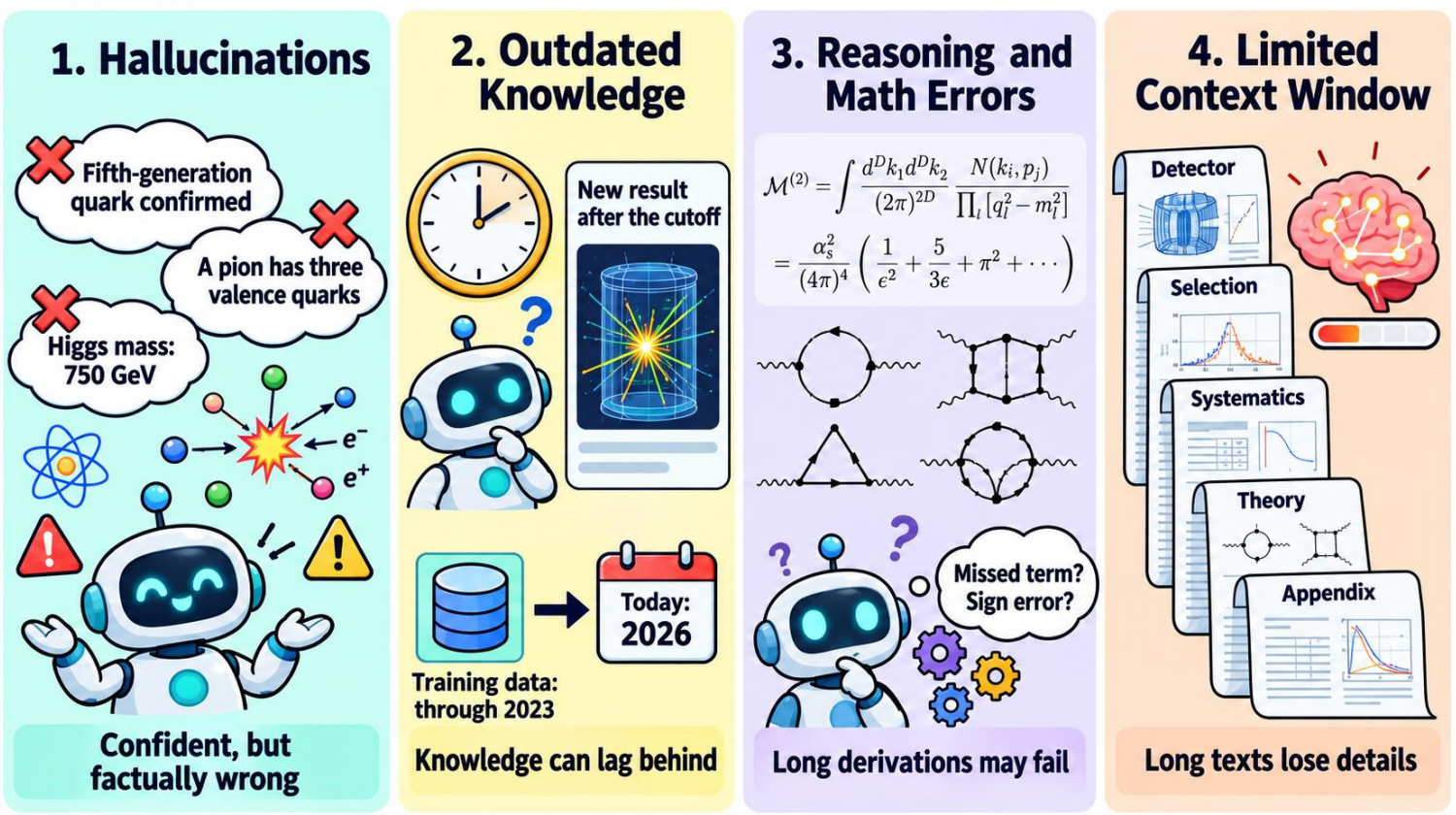
Weighted context

$$Z_i = \Sigma_j \, a_{ji} \, v_j$$

Training objective: to increase the probability of real text

Some Limitations of Large Language Models

- **Hallucination:** plausible-sounding but factually incorrect content.
- **Staleness:** knowledge is frozen at the training cutoff date.
- **Unreliable reasoning:** multi-step numerical derivation is prone to errors at intermediate steps.
- **Limited context:** key details are easily lost in long documents and long procedures.



Performance on autonomously completing real-world tasks not very well

Some Limitations of Large Language Models

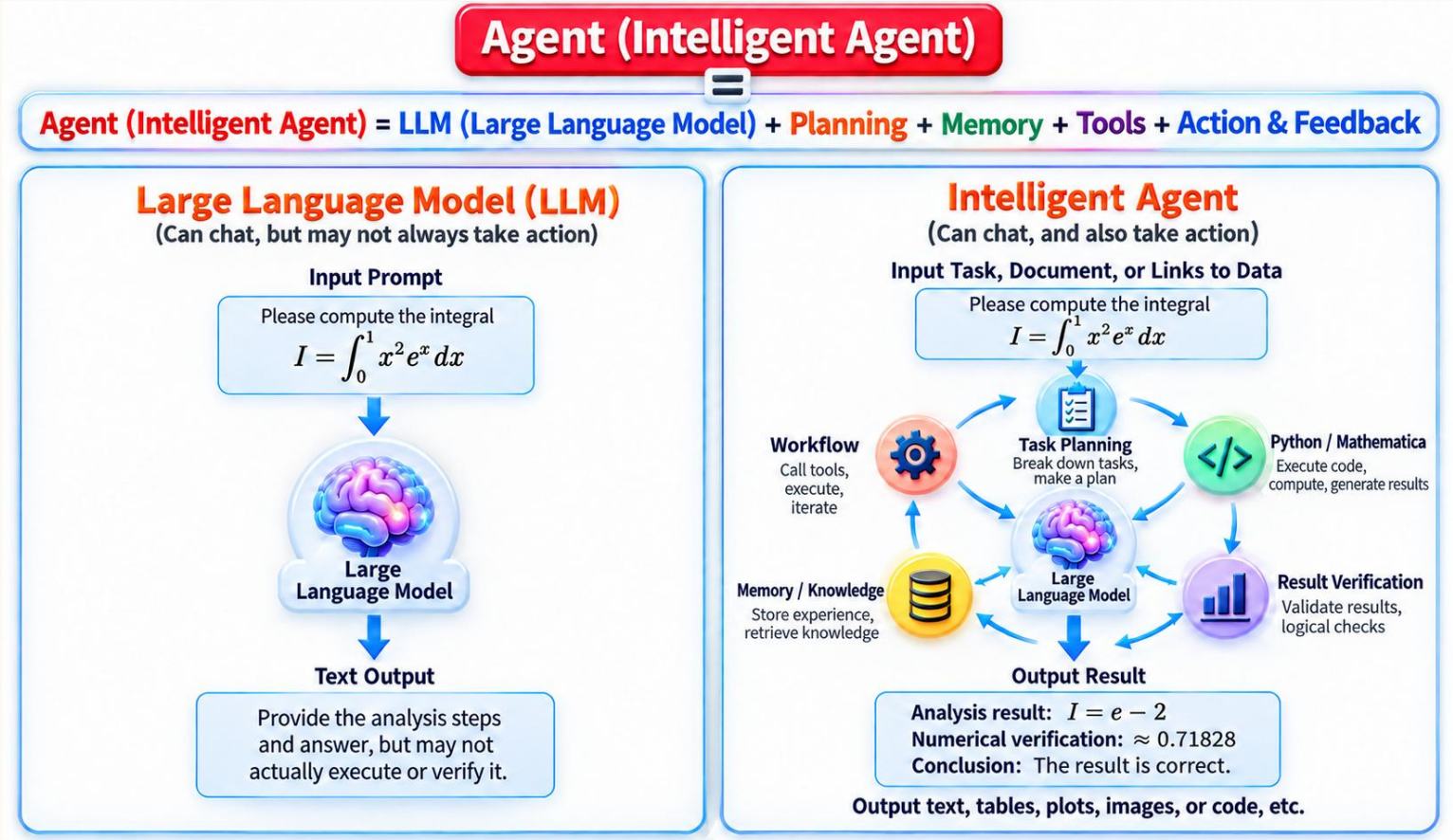
- **Hallucination:** plausible-sounding but factually incorrect content.
- **Staleness:** knowledge is frozen at the training cutoff date.
- **Unreliable reasoning:** multi-step numerical derivation is prone to errors at intermediate steps.
- **Limited context:** key details are easily lost in long documents and long procedures.



Performance on autonomously completing real-world tasks not very well

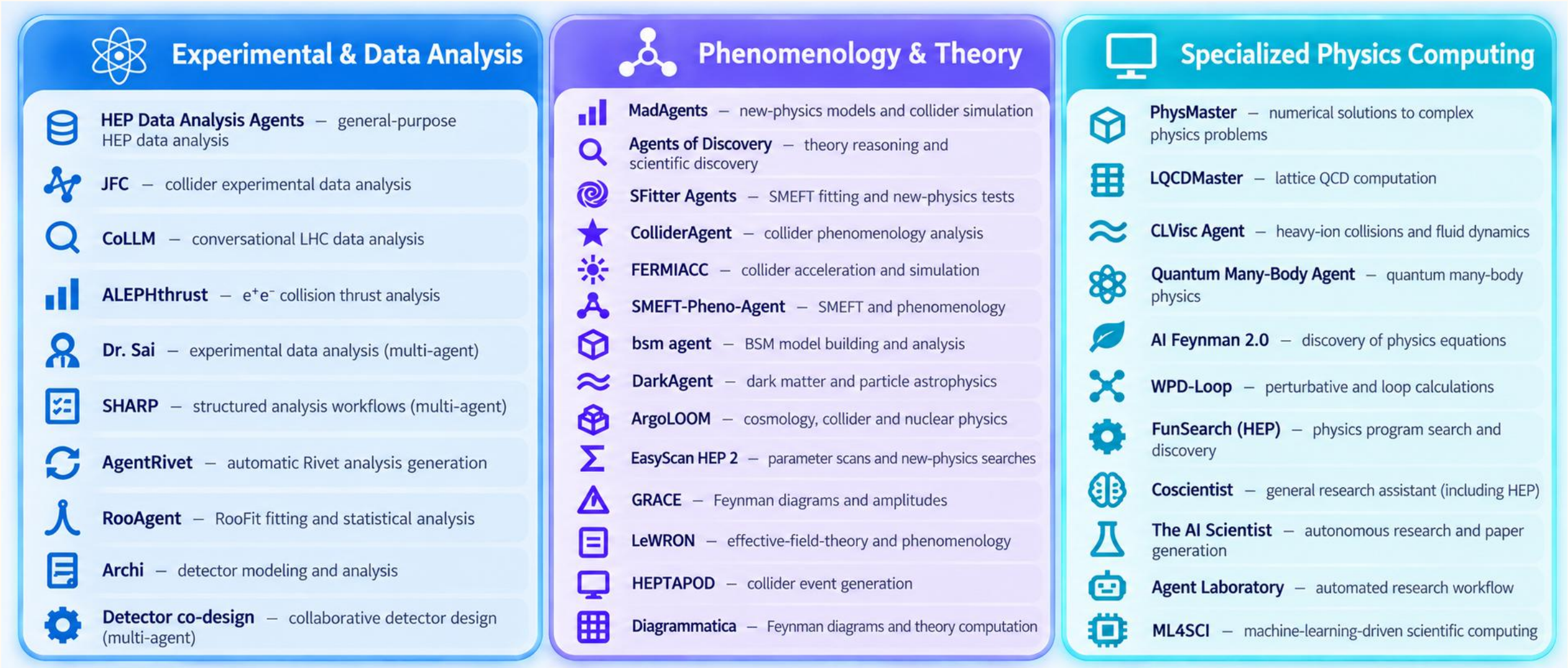
AI Agents Help Mitigate These Limitations

- **Large model:** responsible for understanding intent and making judgments; the "brain" of the agent.
- **Planning:** decomposing a goal into an executable sequence of steps.
- **Memory:** retaining intermediate results and history to support long-horizon workflows.
- **Tools and action:** invoking external tools to actually alter the state of the world.



Agent = Large Model + Planning + Memory + Tools + Action

Scientific Research Agents in High-Energy Physics



Adapted from arXiv:2609.00107 [hep-ph]. We regret that not all agents could be included; the field is evolving too rapidly!

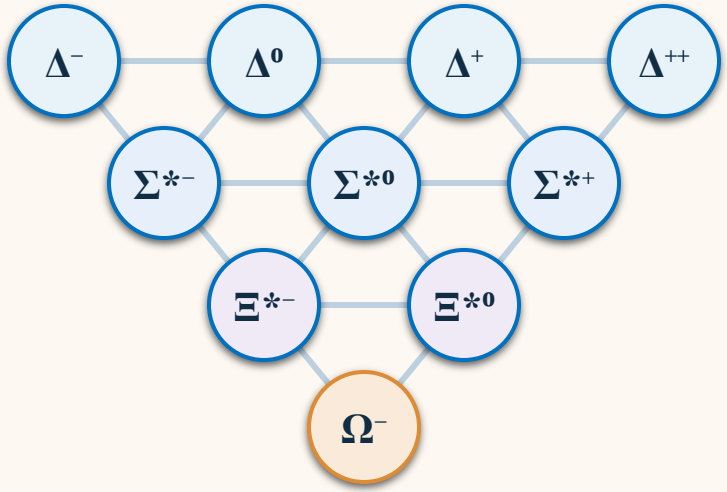
SU(3) amplitude analysis

Origins of Flavor SU(3) analysis

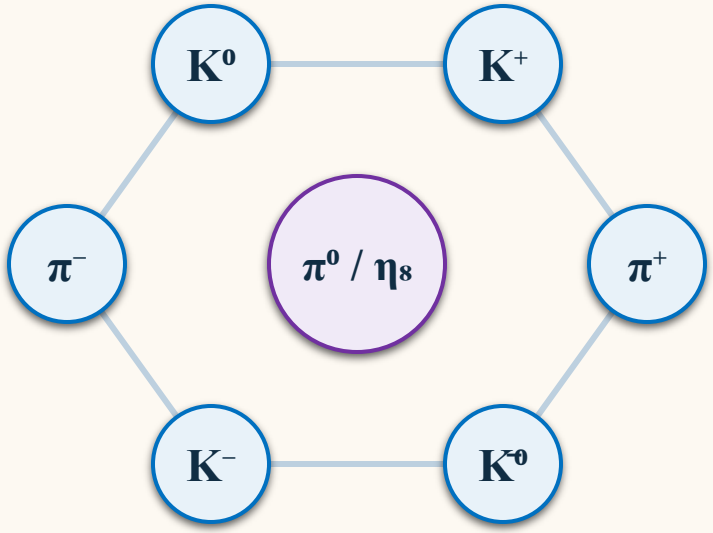
1961 The Eightfold Way grouped hadrons into flavor multiplets.

1964 The u, d, s quark model gave the symmetry a physical basis.

Light-baryon decuplet (10)



Pseudoscalar-meson octet (8)



Why SU(3) matters

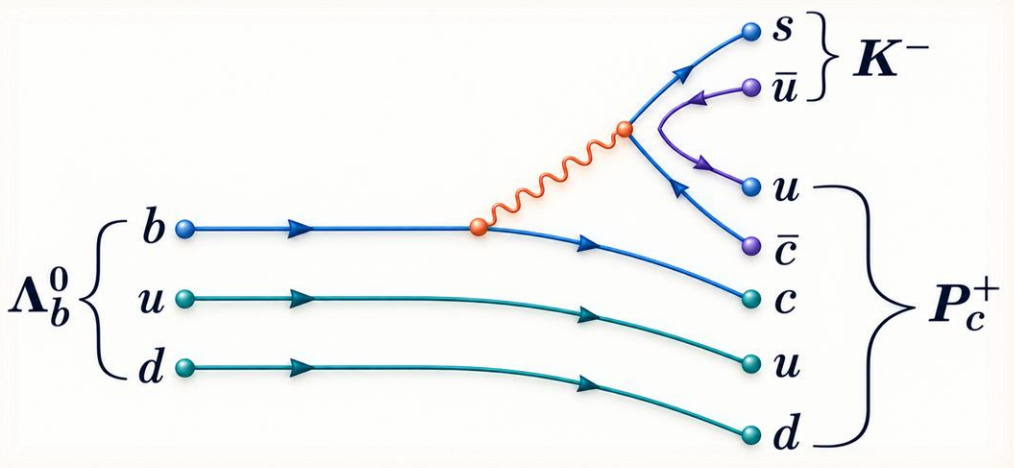
Flavor SU(3) expresses many decay channels through a few reduced amplitudes.

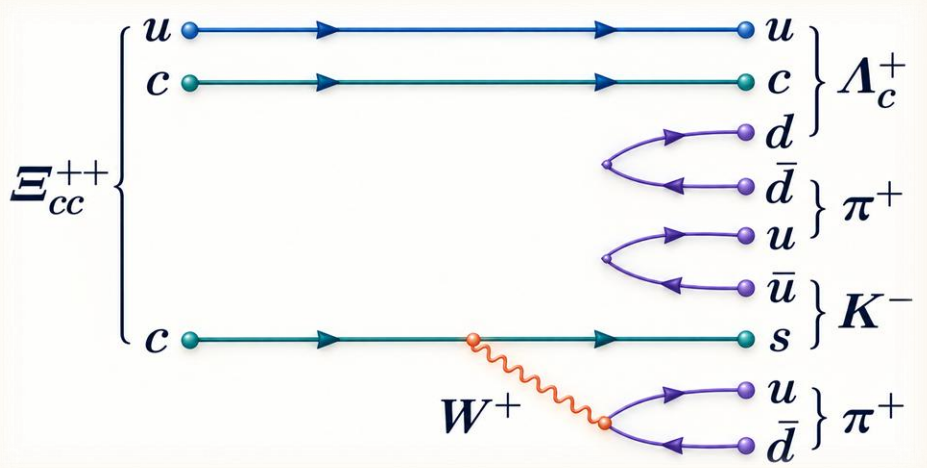
Channel relations guide unmeasured modes and test flavor-symmetry breaking.

SU(3) amplitude analysis

Origins of Flavor SU(3) analysis

It expresses many decay channels through a smaller set of reduced amplitudes.





Why SU(3) matters

Flavor SU(3) expresses many decay channels through a few reduced amplitudes.

Channel relations guide unmeasured modes and test flavor-symmetry breaking.

SU(3) amplitude analysis

The traditional calculation

01 **Choose multiplets and Hamiltonian**

02 Write every invariant contraction

03 Expand particle components

04 Find relations of various channels

➢ **For Nonleptonic Ξ_{cc} and Ω_{cc} decays into a charmed baryon and a light meson**

- Write down the multiplets

$$T_{cc} = \begin{pmatrix} \Xi_{cc}^{++}(ccu) \\ \Xi_{cc}^{+}(ccd) \\ \Omega_{cc}^{+}(ccs) \end{pmatrix}$$

$$T_{c\bar{3}} = \begin{pmatrix} 0 & \Lambda_c^+ & \Xi_c^+ \\ -\Lambda_c^+ & 0 & \Xi_c^0 \\ -\Xi_c^+ & -\Xi_c^0 & 0 \end{pmatrix}$$

$$M_8 = \begin{pmatrix} \frac{\pi^0}{\sqrt{2}} + \frac{\eta}{\sqrt{6}} & \pi^+ & K^+ \\ \pi^- & -\frac{\pi^0}{\sqrt{2}} + \frac{\eta}{\sqrt{6}} & K^0 \\ K^- & \bar{K}^0 & -2\frac{\eta}{\sqrt{6}} \end{pmatrix}$$

- Determine the formation of involved operators in SU(3) multiplets

$$(H_{\bar{6}})_3^{31} = -(H_{\bar{6}})_3^{13} = (H_{\bar{6}})_2^{12} = -(H_{\bar{6}})_2^{21} = \sin(\theta_C),$$
$$(H_{15})_3^{31} = (H_{15})_3^{13} = -(H_{15})_2^{12}$$
$$= -(H_{15})_2^{21} = \sin(\theta_C).$$

SU(3) amplitude analysis

The traditional calculation

01 Choose multiplets and Hamiltonian

02 **Write every invariant contraction**

03 Expand particle components

04 Find relations of various channels

➢ **The effective Hamiltonian for decays involving the antitriplet heavy baryons**

$$\begin{aligned}\mathcal{H}_{\text{eff}} = & b_3 (T_{cc})^i (\overline{T}_{c\bar{3}})_{[ij]} M_l^k (H_{\overline{6}})_k^{jl} \\ & + b_4 (T_{cc})^i (\overline{T}_{c\bar{3}})_{[jl]} M_i^k (H_{\overline{6}})_k^{jl} \\ & + b_5 (T_{cc})^i (\overline{T}_{c\bar{3}})_{[jk]} M_l^k (H_{\overline{6}})_i^{jl} \\ & + b_6 (T_{cc})^i (\overline{T}_{c\bar{3}})_{[ij]} M_l^k (H_{15})_k^{jl} \\ & + b_7 (T_{cc})^i (\overline{T}_{c\bar{3}})_{[jk]} M_l^k (H_{15})_i^{jl} .\end{aligned}$$

SU(3) amplitude analysis

The traditional calculation

01 Choose multiplets and Hamiltonian

02 Write every invariant contraction

03 **Expand particle components**

04 Find relations of various channels

➢ **The Expanded amplitude**

Table 5 Doubly charmed baryons decays into a cqq (antitriplet) and a light meson

Channel	Amplitude	Channel	Amplitude
$\Xi_{cc}^{++} \to \Xi_c^+ \pi^+$	$b_3 - 2b_4 + b_6$	$\Xi_{cc}^{++} \to \Lambda_c^+ \pi^+$	$(b_3 - 2b_4 + b_6)\,(-\sin(\theta_C))$
$\Xi_{cc}^{+} \to \Lambda_c^+ \overline{K}^0$	$b_3 - b_5 - b_6 + b_7$	$\Xi_{cc}^{++} \to \Xi_c^+ K^+$	$(b_3 - 2b_4 + b_6)\sin(\theta_C)$
$\Xi_{cc}^{+} \to \Xi_c^+ \pi^0$	$\frac{2b_4 - b_5 - b_7}{\sqrt{2}}$	$\Xi_{cc}^{+} \to \Lambda_c^+ \pi^0$	$\frac{(b_3 - 2b_4 - b_6 + 2b_7)\sin(\theta_C)}{\sqrt{2}}$
$\Xi_{cc}^{+} \to \Xi_c^+ \eta$	$\frac{-2b_4 + b_5 - 3b_7}{\sqrt{6}}$	$\Xi_{cc}^{+} \to \Lambda_c^+ \eta$	$\frac{(-3b_3 + 2b_4 + 2b_5 + 3b_6)\sin(\theta_C)}{\sqrt{6}}$
$\Xi_{cc}^{+} \to \Xi_c^0 \pi^+$	$b_3 - b_5 + b_6 - b_7$	$\Xi_{cc}^{+} \to \Xi_c^+ K^0$	$(2b_4 - b_5 + b_7)\,(-\sin(\theta_C))$
$\Omega_{cc}^{+} \to \Xi_c^+ \overline{K}^0$	$b_3 - 2b_4 - b_6$	$\Xi_{cc}^{+} \to \Xi_c^0 K^+$	$(b_3 - b_5 + b_6 - b_7)\sin(\theta_C)$
$\Xi_{cc}^{++} \to \Lambda_c^+ K^+$	$(b_3 - 2b_4 + b_6)\sin^2(\theta_C)$	$\Omega_{cc}^{+} \to \Lambda_c^+ \overline{K}^0$	$(2b_4 - b_5 + b_7)\sin(\theta_C)$
$\Xi_{cc}^{+} \to \Lambda_c^+ K^0$	$(b_3 - 2b_4 - b_6)\sin^2(\theta_C)$	$\Omega_{cc}^{+} \to \Xi_c^+ \pi^0$	$\frac{(b_3 - b_5 - b_6 - b_7)\sin(\theta_C)}{\sqrt{2}}$
$\Omega_{cc}^{+} \to \Lambda_c^+ \pi^0$	$-\sqrt{2} b_7 \sin^2(\theta_C)$	$\Omega_{cc}^{+} \to \Xi_c^+ \eta$	$\frac{(-3b_3 + 4b_4 + b_5 + 3b_6 - 3b_7)\sin(\theta_C)}{\sqrt{6}}$
$\Omega_{cc}^{+} \to \Lambda_c^+ \eta$	$\sqrt{\frac{2}{3}}\,(2b_4 - b_5)\sin^2(\theta_C)$	$\Omega_{cc}^{+} \to \Xi_c^0 \pi^+$	$(b_3 - b_5 + b_6 - b_7)\sin(\theta_C)$
$\Omega_{cc}^{+} \to \Xi_c^+ K^0$	$(b_3 - b_5 - b_6 + b_7)\sin^2(\theta_C)$		
$\Omega_{cc}^{+} \to \Xi_c^0 K^+$	$(b_3 - b_5 + b_6 - b_7)\left(-\sin^2(\theta_C)\right)$		

SU(3) amplitude analysis

The traditional calculation

01 Choose multiplets and Hamiltonian

02 Write every invariant contraction

03 Expand particle components

04 **Find relations of various channels**

➢ **Obtain the relations for decay widths**

$$\Gamma\left(\Xi_{cc}^{++} \to \Lambda_c^+ \pi^+\right) = \Gamma\left(\Xi_{cc}^{++} \to \Xi_c^+ K^+\right),$$
$$\Gamma\left(\Xi_{cc}^{+} \to \Xi_c^+ K^0\right) = \Gamma\left(\Omega_{cc}^{+} \to \Lambda_c^+ \overline{K}^0\right),$$
$$\Gamma\left(\Omega_{cc}^{+} \to \Xi_c^0 \pi^+\right) = \Gamma\left(\Xi_{cc}^{+} \to \Xi_c^0 K^+\right).$$

SU(3) amplitude analysis

The traditional calculation

01 Choose multiplets and Hamiltonian

02 Write every invariant contraction

03 Expand particle components

04 Find relations of various channels



The challenge is completeness and complexity—not one difficult equation.

Design Principles for SU(3) Agent

- Physicists need only specify what is to be computed.
- The agent is responsible for translating requirements into an executable computational plan.
- Human checkpoints are retained throughout the workflow, and the results are reproducible and auditable.
- Ease of use and user-friendly.



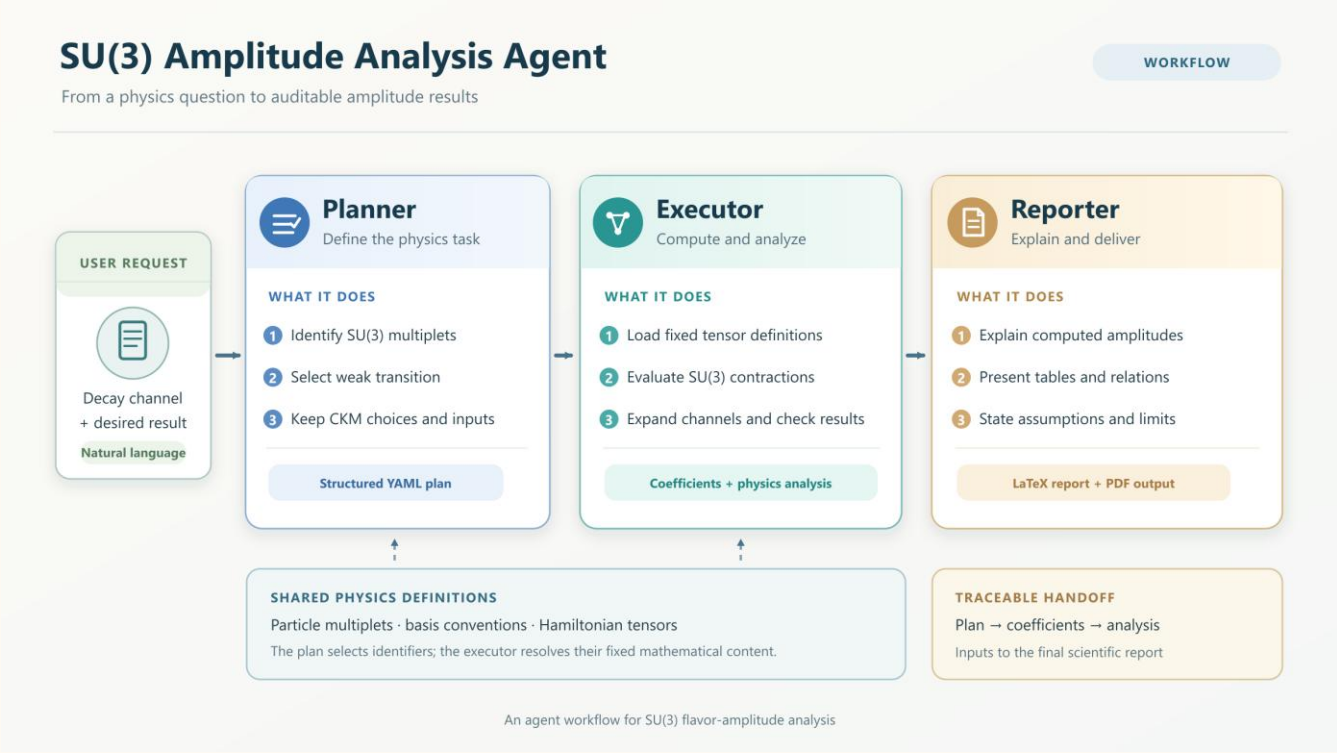
The Flavor SU(3) Agent

Will be released as open-source on GitHub.

Delegate the engineering workflow to AI and leave the physics to physicists

Overall Architecture of SU(3) Agents

- **Planner:** Converts a decay request into a reviewed plan specifying the SU(3) multiplets, weak Hamiltonian, CKM sector, and desired outputs.
- **Executor:** Computes the channel amplitudes through SU(3) tensor contractions and checks symmetry relations and parameter redundancy.
- **Reporter:** Presents the verified amplitudes, assumptions, and checks in a structured LaTeX/PDF report.



Workflow: Planner → Executor → Reporter

Planner: Physics Specification

Physics specification

- Identify the observable and decay channel.
- Choose hadron multiplets, weak sector and CKM factors.
- Hand off a YAML plan with requested outputs and unresolved questions.

Review and revise

Critique checks physics consistency. Rewrite repairs consequential errors before handoff.

```
[1] Engine, then Planner...
  → Engine: computing IRA coefficients...
     Engine done: 3914 chars, 67 lines
  Planner/solve: attempt 1/3
  planner: max_tokens=8000
    [OK] Planner/solve: attempt 1/3 — Plan generated; YAML structure and enum checks passed.
  Planner/critique: attempt 1/3
  planner: max_tokens=8000
    [FAILED] Planner/critique: attempt 1/3 — Each issue requires path, problem and correction
  Planner/critique: attempt 2/3
  planner: max_tokens=8000
    [OK] Planner/critique: attempt 2/3 — Review returned; review structure check passed.
  Planner/rewrite: attempt 1/3
  planner: max_tokens=8000
    [OK] Planner/rewrite: attempt 1/3 — Revised output returned and accepted by the local format check.
  → Plan YAML (1314 chars):
  ──────────────────────────────────────────────────────────────────────────────────────────────────────────────────
  │ task:
  │   name: 'BtoPP_SU3_IRA_amplitudes'
  │   description: 'Compute symbolic SU(3) IRA amplitudes for charmless B -> PP decays.'
  │   task_mode: 'non-standard'
  │   quantity: 'amplitude'
  │   decay_type: 'nonleptonic'
  │   hadronic_process: 'BtoPP'
  │   questions:
  │     - 'Which specific B -> PP channels (initial B meson and ordered pseudoscalar pair) should be included?'
  │     - 'Which weak sector(s) should be used: b-to-d (Hbd), b-to-s (Hbs), or both?'
  │
  │ physics:
  │   basis: 'eta8eta1'
  │   symmetry: 'exactSU3'
  │   initial:
  │     kind: 'Meson'
  │     representation: 'B3bar'
  │   finals:
  │     - kind: 'Meson'
  │       representation: 'P8'
  │     - kind: 'Meson'
  │       representation: 'P8'
  │   hamiltonian:
  │     kind: 'EffectiveHamiltonian'
  │     representations: ['H3bar', 'H6', 'H15bar']
  │
  │ channels: []
  │
  │ inputs: {}
  │
  │ ... (7 more lines)
  ──────────────────────────────────────────────────────────────────────────────────────────────────────────────────
```

Executor: Amplitude Calculation and Validation

Execution and analysis

- Load fixed particle and operator definitions from the physics reference.
- Evaluate SU(3) contractions and expand each decay channel.
- Check relations and parameter redundancy against the computed coefficients.

Separation of roles

The engine supplies coefficients; the LLM interprets the results.

```
[2] Executor: calling LLM for scientific analysis...
  Executor/generate: attempt 1/3
  executor: max_tokens=32000
    [OK] Executor/generate: attempt 1/3 — Output generated and accepted by the local format check.
  Executor/critique: attempt 1/3
  executor: max_tokens=32000
  executor: output truncated; retrying once with max_tokens=64000.
    [OK] Executor/critique: attempt 1/3 — Review returned; review structure check passed.
  Executor/rewrite: attempt 1/3
  executor: max_tokens=32000
    [OK] Executor/rewrite: attempt 1/3 — Revised output returned and accepted by the local format check.
  → Analysis: 18551 chars
```

```
=== IRA contraction definitions: B → P P ===
T_f = sum_r c_fr X_r^T; X_r^T multiplies I_r below (it is not equal to I_r).
P = M; repeated flavor indices are summed. All 10 tree-basis terms are shown.
  I_A3T: B_i . H(3bar)^i . P^k_j . P^j_k   [parameter: A3T]
  I_C3T: B_i . H(3bar)^k . P^i_j . P^j_k   [parameter: C3T]
  I_B3T: B_i . H(3bar)^i . P^k_k . P^j_j   [parameter: B3T]
  I_D3T: B_i . P^i_j . H(3bar)^j . P^k_k   [parameter: D3T]
  I_A6T: B_i . H(6)^{ij}_k . P^l_j . P^k_l   [parameter: A6T]
  I_C6T: B_i . P^i_j . H(6)^{jl}_k . P^k_l   [parameter: C6T]
  I_B6T: B_i . H(6)^{ij}_k . P^k_j . P^l_l   [parameter: B6T]
  I_A15T: B_i . H(15bar)^{ij}_k . P^l_j . P^k_l   [parameter: A15T]
  I_C15T: B_i . P^i_j . H(15bar)^{jk}_l . P^l_k   [parameter: C15T]
  I_B15T: B_i . H(15bar)^{ij}_k . P^k_j . P^l_l   [parameter: B15T]

=== Channel coefficients (local engine; CKM-free tree component) ===
Basis: eta_q/eta_s; engine permutation/identical-state convention.
Only registered engine channels are listed; no penguin or basis conversion is implied.
Zero coefficients are omitted; unlisted IRA parameters have coefficient 0.
  B⁻→π⁰π⁻ [b→d] | C15T: 4*sqrt(2)
  B⁻→π⁻η_q [b→d] | C3T: sqrt(2); D3T: sqrt(2); A6T: sqrt(2); B6T: sqrt(2); A15T: 3*sqrt(2); C15T: 2*sqrt(2); B15T: 3*sqrt(2)
  B⁻→π⁻η_s [b→d] | D3T: 1; C6T: 1; B6T: 1; C15T: -1; B15T: 3
  B⁻→K⁰K⁻ [b→d] | C3T: 1; A6T: 1; C6T: -1; A15T: 3; C15T: -1
  B⁰→π⁺π⁻ [b→d] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: 3
  B⁰→π⁰π⁰ [b→d] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: -5
  B⁰→π⁰η_q [b→d] | C3T: -1; D3T: -1; A6T: -1; B6T: -1; A15T: 5; C15T: 2; B15T: 5
  B⁰→π⁰η_s [b→d] | D3T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: 5/sqrt(2)
  B⁰→K⁺K⁻ [b→d] | A3T: 2; A15T: 2
  B⁰→K⁰K̄⁰ [b→d] | A3T: 2; C3T: 1; A6T: 1; C6T: -1; A15T: -3; C15T: -1
  B⁰→η_qη_q [b→d] | A3T: 2; C3T: 1; B3T: 4; D3T: 2; A6T: -1; C6T: -1; B6T: -2; A15T: 1; C15T: 1; B15T: 2
  B⁰→η_qη_s [b→d] | B3T: 2*sqrt(2); D3T: 1/sqrt(2); C6T: 1/sqrt(2); B6T: 1/sqrt(2); C15T: -1/sqrt(2); B15T: -1/sqrt(2)
  B⁰→η_sη_s [b→d] | A3T: 2; B3T: 2; A6T: 2; B6T: 2; A15T: -2; B15T: -2
  B_s⁰→π⁰K⁰ [b→d] | C3T: -1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 1/sqrt(2); C15T: 5/sqrt(2)
  B_s⁰→π⁻K⁺ [b→d] | C3T: 1; A6T: -1; C6T: 1; A15T: -1; C15T: 3
  B_s⁰→K⁰η_q [b→d] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -sqrt(2); A15T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: -sqrt(2)
  B_s⁰→K⁰η_s [b→d] | C3T: 1; D3T: 1; A6T: -1; B6T: -1; A15T: -1; C15T: -2; B15T: -1
  B⁻→π⁰K⁻ [b→s] | C3T: 1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 3/sqrt(2); C15T: 7/sqrt(2)
  B⁻→π⁻K̄⁰ [b→s] | C3T: 1; A6T: 1; C6T: -1; A15T: 3; C15T: -1
  B⁻→K⁻η_q [b→s] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: 1/sqrt(2); C6T: 1/sqrt(2); B6T: sqrt(2); A15T: 3/sqrt(2); C15T: 5/sqrt(2); B15T: 3*sqrt(2)
  B⁻→K⁻η_s [b→s] | C3T: 1; D3T: 1; A6T: 1; B6T: 1; A15T: 3; C15T: -2; B15T: 3
  B⁰→π⁺K⁻ [b→s] | C3T: 1; A6T: -1; C6T: 1; A15T: -1; C15T: 3
  B⁰→π⁰K̄⁰ [b→s] | C3T: -1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 1/sqrt(2); C15T: 5/sqrt(2)
  B⁰→K̄⁰η_q [b→s] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -sqrt(2); A15T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: -sqrt(2)
  B⁰→K̄⁰η_s [b→s] | C3T: 1; D3T: 1; A6T: -1; B6T: -1; A15T: -1; C15T: -2; B15T: -1
  B_s⁰→π⁺π⁻ [b→s] | A3T: 2; A15T: 2
  B_s⁰→π⁰π⁰ [b→s] | A3T: 2; A15T: 2
  B_s⁰→π⁰η_q [b→s] | A6T: -2; B6T: -2; A15T: 4; B15T: 4
  B_s⁰→π⁰η_s [b→s] | C6T: -sqrt(2); B6T: -sqrt(2); C15T: 2*sqrt(2); B15T: 2*sqrt(2)
  B_s⁰→K⁺K⁻ [b→s] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: 3
  B_s⁰→K⁰K̄⁰ [b→s] | A3T: 2; C3T: 1; A6T: 1; C6T: -1; A15T: -3; C15T: -1
  B_s⁰→η_qη_q [b→s] | A3T: 2; B3T: 4; A15T: 2; B15T: 4
  B_s⁰→η_qη_s [b→s] | B3T: 2*sqrt(2); D3T: sqrt(2); C15T: sqrt(2); B15T: -sqrt(2)
  B_s⁰→η_sη_s [b→s] | A3T: 2; C3T: 2; B3T: 2; D3T: 2; A15T: -4; C15T: -4; B15T: -4
Displayed: 34 channel(s). Full LLM analysis: 03_executor_analysis.md
```

Executor: Amplitude Calculation and Validation

This agent helped us identify an error in the earlier literature.

$\overline{B}_s^0 \to K^+K^-$	$2A_3^T - A_6^T + A_{15}^T + C_3^T + C_6^T + 3C_{15}^T$
$\overline{B}_s^0 \to K^0\overline{K}^0$	$2A_3^T + A_6^T - 3A_{15}^T + C_3^T - C_6^T - C_{15}^T$
$\overline{B}_s^0 \to \eta_q\eta_q$	$2(A_3^T + A_{15}^T + 2(B_3^T + B_{15}^T))$
$\overline{B}_s^0 \to \eta_q\eta_s$	$\sqrt{2}(2B_3^T - B_{15}^T + C_{15}^T + D_3^T)$
$\overline{B}_s^0 \to \eta_s\eta_s$	$A_3^T - 2A_{15}^T + B_3^T - 2B_{15}^T + C_3^T - 2C_{15}^T + D_3^T$

[Xiao-Gang He, Yu-Ji Shi, Wei Wang, EPJC, 80 (2020)]

```
=== IRA contraction definitions: B → P P ===
T_f = sum_r c_fr X_r^T; X_r^T multiplies I_r below (it is not equal to I_r).
P = M; repeated flavor indices are summed. All 10 tree-basis terms are shown.
  I_A3T: B_i . H(3bar)^i . P^k_j . P^j_k   [parameter: A3T]
  I_C3T: B_i . H(3bar)^k . P^i_j . P^j_k   [parameter: C3T]
  I_B3T: B_i . H(3bar)^i . P^k_k . P^j_j   [parameter: B3T]
  I_D3T: B_i . P^i_j . H(3bar)^j . P^k_k   [parameter: D3T]
  I_A6T: B_i . H(6)^{ij}_k . P^l_j . P^k_l   [parameter: A6T]
  I_C6T: B_i . P^i_j . H(6)^{jl}_k . P^k_l   [parameter: C6T]
  I_B6T: B_i . H(6)^{ij}_k . P^k_j . P^l_l   [parameter: B6T]
  I_A15T: B_i . H(15bar)^{ij}_k . P^l_j . P^k_l   [parameter: A15T]
  I_C15T: B_i . P^i_j . H(15bar)^{jk}_l . P^l_k   [parameter: C15T]
  I_B15T: B_i . H(15bar)^{ij}_k . P^k_j . P^l_l   [parameter: B15T]

=== Channel coefficients (local engine; CKM-free tree component) ===
Basis: eta_q/eta_s; engine permutation/identical-state convention.
Only registered engine channels are listed; no penguin or basis conversion is implied.
Zero coefficients are omitted; unlisted IRA parameters have coefficient 0.
  B⁻→π⁰π⁻ [b→d] | C15T: 4*sqrt(2)
  B⁻→π⁻η_q [b→d] | C3T: sqrt(2); D3T: sqrt(2); A6T: sqrt(2); B6T: sqrt(2); A15T: 3*sqrt(2); C15T: 2*sqrt(2); B15T: 3*sqrt(2)
  B⁻→π⁻η_s [b→d] | D3T: 1; C6T: 1; B6T: 1; C15T: -1; B15T: 3
  B⁻→K⁰K⁻ [b→d] | C3T: 1; A6T: 1; C6T: -1; A15T: 3; C15T: -1
  B⁰→π⁺π⁻ [b→d] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: 3
  B⁰→π⁰π⁰ [b→d] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: -5
  B⁰→π⁰η_q [b→d] | C3T: -1; D3T: -1; A6T: -1; B6T: -1; A15T: 5; C15T: 2; B15T: 5
  B⁰→π⁰η_s [b→d] | D3T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: 5/sqrt(2)
  B⁰→K⁺K⁻ [b→d] | A3T: 2; A15T: 2
  B⁰→K⁰K̄⁰ [b→d] | A3T: 2; C3T: 1; A6T: 1; C6T: -1; A15T: -3; C15T: -1
  B⁰→η_qη_q [b→d] | A3T: 2; C3T: 1; B3T: 4; D3T: 2; A6T: -1; C6T: -1; B6T: -2; A15T: 1; C15T: 1; B15T: 2
  B⁰→η_qη_s [b→d] | B3T: 2*sqrt(2); D3T: 1/sqrt(2); C6T: 1/sqrt(2); B6T: 1/sqrt(2); C15T: -1/sqrt(2); B15T: -1/sqrt(2)
  B⁰→η_sη_s [b→d] | A3T: 2; B3T: 2; A6T: 2; B6T: 2; A15T: -2; B15T: -2
  B̄ₛ⁰→π⁰K⁰ [b→d] | C3T: -1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 1/sqrt(2); C15T: 5/sqrt(2)
  B̄ₛ⁰→π⁻K⁺ [b→d] | C3T: 1; A6T: -1; C6T: 1; A15T: -1; C15T: 3
  B̄ₛ⁰→K⁰η_q [b→d] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -sqrt(2); A15T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: -sqrt(2)
  B̄ₛ⁰→K⁰η_s [b→d] | C3T: 1; D3T: 1; A6T: -1; B6T: -1; A15T: -1; C15T: -2; B15T: -1
  B⁻→π⁰K⁻ [b→s] | C3T: 1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 3/sqrt(2); C15T: 7/sqrt(2)
  B⁻→π⁻K̄⁰ [b→s] | C3T: 1; A6T: 1; C6T: -1; A15T: 3; C15T: -1
  B⁻→K⁻η_q [b→s] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: 1/sqrt(2); C6T: 1/sqrt(2); B6T: sqrt(2); A15T: 3/sqrt(2); C15T: 5/sqrt(2); B15T: 3*sqrt(2)
  B⁻→K⁻η_s [b→s] | C3T: 1; D3T: 1; A6T: 1; B6T: 1; A15T: 3; C15T: -2; B15T: 3
  B⁰→π⁺K⁻ [b→s] | C3T: 1; A6T: -1; C6T: 1; A15T: -1; C15T: 3
  B⁰→π⁰K̄⁰ [b→s] | C3T: -1/sqrt(2); A6T: 1/sqrt(2); C6T: -1/sqrt(2); A15T: 1/sqrt(2); C15T: 5/sqrt(2)
  B⁰→K̄⁰η_q [b→s] | C3T: 1/sqrt(2); D3T: sqrt(2); A6T: -1/sqrt(2); C6T: -1/sqrt(2); B6T: -sqrt(2); A15T: -1/sqrt(2); C15T: 1/sqrt(2); B15T: -sqrt(2)
  B⁰→K̄⁰η_s [b→s] | C3T: 1; D3T: 1; A6T: -1; B6T: -1; A15T: -1; C15T: -2; B15T: -1
  B̄ₛ⁰→π⁺π⁻ [b→s] | A3T: 2; A15T: 2
  B̄ₛ⁰→π⁰π⁰ [b→s] | A3T: 2; A15T: 2
  B̄ₛ⁰→π⁰η_q [b→s] | A6T: -2; B6T: -2; A15T: 4; B15T: 4
  B̄ₛ⁰→π⁰η_s [b→s] | C6T: -sqrt(2); B6T: -sqrt(2); C15T: 2*sqrt(2); B15T: 2*sqrt(2)
  B̄ₛ⁰→K⁺K⁻ [b→s] | A3T: 2; C3T: 1; A6T: -1; C6T: 1; A15T: 1; C15T: 3
  B̄ₛ⁰→K⁰K̄⁰ [b→s] | A3T: 2; C3T: 1; A6T: 1; C6T: -1; A15T: -3; C15T: -1
  B̄ₛ⁰→η_qη_q [b→s] | A3T: 2; B3T: 4; A15T: 2; B15T: 4
  B̄ₛ⁰→η_qη_s [b→s] | B3T: 2*sqrt(2); D3T: sqrt(2); C15T: sqrt(2); B15T: -sqrt(2)
  B̄ₛ⁰→η_sη_s [b→s] | A3T: 2; C3T: 2; B3T: 2; D3T: 2; A15T: -4; C15T: -4; B15T: -4
Displayed: 34 channel(s). Full LLM analysis: 03_executor_analysis.md
```

Reporter: Verified Results

Scientific output

- Combine the YAML plan, coefficient table and Executor analysis.
- Write the SU(3) setup, amplitude tables and limitations in LaTeX.
- Review and revise the manuscript.

```
[3] Reporter: generating LaTeX paper...
  Reporter/generate: attempt 1/3
  reporter: max_tokens=32000
    [OK] Reporter/generate: attempt 1/3 — Output generated and accepted by the local format check.
  Reporter/critique: attempt 1/3
  reporter: max_tokens=32000
    [OK] Reporter/critique: attempt 1/3 — Review returned; review structure check passed.
  Reporter/rewrite: attempt 1/3
  reporter: max_tokens=32000
    [OK] Reporter/rewrite: attempt 1/3 — Revised output returned and accepted by the local format check.
  → LaTeX: 24723 chars
[4] Compile: pdflatex not found, .tex saved
```

Computed coefficients stay fixed in the report.

Testing SU(3) Agent: Reproducing Existing Literature

➢ **Nonleptonic B-meson decay: $B \to PP$**

$$\begin{aligned}\mathcal{A}_t^{\mathrm{IRA}} = {} & A_3^T B_i (H_{\bar{3}})^i (M)^j_k (M)^k_j + C_3^T B_i (M)^i_j (M)^j_k (H_{\bar{3}})^k + B_3^T B_i (H_3)^i (M)^k_k (M)^j_j + D_3^T B_i (M)^i_j (H_{\bar{3}})^j (M)^k_k \\ & + A_6^T B_i (H_6)^{ij}_k (M)^l_j (M)^k_l + C_6^T B_i (M)^i_j (H_6)^{jl}_k (M)^k_l + B_6^T B_i (H_6)^{ij}_k (M)^k_j (M)^l_l \\ & + A_{15}^T B_i (H_{\overline{15}})^{ij}_k (M)^l_j (M)^k_l + C_{15}^T B_i (M)^i_j (H_{\overline{15}})^{jk}_l (M)^l_k + B_{15}^T B_i (H_{\overline{15}})^{ij}_k (M)^k_j (M)^l_l .\end{aligned}$$

```
PS D:\Software\Microsoft VS Code> & D:\Python\Python313\python.exe d:/Research/SU3Agent/flavor_su3-main/run.py

  +-----------------------------------------------+
  |   F L A V O R     S U ( 3 )                   |
  |              I R A   A G E N T                |
  |        B -> P P  |  Tensor Contractions       |
  +-----------------------------------------------+

Type 'help' for usage, 'quit' to exit.

flavor> B- → pi0 pi-
## B⁻ → π⁰ π⁻ (ΔS=0)

### Amplitude
  A(B⁻ → π⁰ π⁻) = 4*sqrt(2)·C15T

### IRA Coefficients
  · C15T: 4*sqrt(2)

### Decay type: B → P P — IRA contractions (tree)
  A_t^IRA =
    A3T * (B_i . H(3bar)^i . P^k_j . P^j_k)
  + C3T * (B_i . H(3bar)^k . P^i_j . P^j_k)
  + B3T * (B_i . H(3bar)^i . P^k_k . P^j_j)
  + D3T * (B_i . P^i_j . H(3bar)^j . P^k_k)
  + A6T * (B_i . H(6)^{ij}_k . P^l_j . P^k_l)
  + C6T * (B_i . P^i_j . H(6)^{jl}_k . P^k_l)
  + B6T * (B_i . H(6)^{ij}_k . P^k_j . P^l_l)
  + A15T * (B_i . H(15bar)^{ij}_k . P^l_j . P^k_l)
  + C15T * (B_i . P^i_j . H(15bar)^{jk}_l . P^l_k)
  + B15T * (B_i . H(15bar)^{ij}_k . P^k_j . P^l_l)

  P^i_j = M^i_j in the reference formula; repeated indices i,j,k,l are summed (1..3).
  H(3bar), H(6), H(15bar) denote the Hamiltonian representations.
  A3T = A_3^T, ..., C15T = C_15^T; superscript T labels tree amplitudes.
  This is the full 10-term B → PP basis before inserting a specific channel.
  The channel coefficients above use the engine's eta_q/eta_s basis and field-to-particle convention.
  CKM factors and penguin contributions are not included in the displayed tree amplitude.

flavor>
```

[Xiao-Gang He, Wei Wang, CPC, 42 (2018)]

[Flavor SU(3) Agent]

The results are the same.

Testing SU(3) Agent: Reproducing Existing Literature

➢ **Doubly bottom baryons Ξ_{bb} and Ω_{bb} decay into a bottom baryon and a light meson.**

AI-assisted SU(3) amplitude reconstruction

[Wei Wang, Zhi-Peng Xing, Ji Xu, EPJC, 77 (2017)]

Table 17 (left panel): doubly bottom baryon decays via the charmless $b \to d$ transition

No.	Decay channel	Flavor amplitude	△ check
1	$\Xi_{bb}^0 \to \Lambda_b^0 \pi^0$	$-\frac{c_1 - c_2 + c_3 - 2c_4 - 5c_6 + 6c_7}{\sqrt{2}}$	PASS
2	$\Xi_{bb}^0 \to \Lambda_b^0 \eta$	$\frac{c_1 + c_2 - 3c_3 + 2c_4 + 2c_5 + 3c_6}{\sqrt{6}}$	PASS
3	$\Xi_{bb}^0 \to \Xi_b^0 K^0$	$c_1 - c_3 + c_5 - c_6 + 3c_7$	PASS
4	$\Xi_{bb}^0 \to \Xi_b^- K^+$	$-c_2 + 2c_4 - c_5 + 3c_7$	PASS
5	$\Xi_{bb}^- \to \Lambda_b^0 \pi^-$	$-c_1 + c_2 - c_3 + 2c_4 - 3c_6 + 2c_7$	PASS
6	$\Xi_{bb}^- \to \Xi_b^- K^0$	$c_1 - c_2 - c_3 + 2c_4 - c_6 - 2c_7$	PASS
7	$\Omega_{bb}^- \to \Lambda_b^0 K^-$	$c_2 + 2c_4 - c_5 + c_7$	PASS
8	$\Omega_{bb}^- \to \Xi_b^0 \pi^-$	$-c_1 - c_3 + c_5 - 3c_6 + c_7$	PASS
9	$\Omega_{bb}^- \to \Xi_b^- \pi^0$	$\frac{c_1 + c_3 - c_5 - 5c_6 - c_7}{\sqrt{2}}$	PASS
10	$\Omega_{bb}^- \to \Xi_b^- \eta$	$-\frac{c_1 - 2c_2 - 3c_3 + 4c_4 + c_5 + 3c_6 - 3c_7}{\sqrt{6}}$	PASS

Amplitudes follow the c_i convention of Eqs. (76) and Table 17.

The results are the same.

Testing SU(3) Agent: Reproducing Existing Literature

➢ **Doubly bottom baryons Ξ_{bb} and Ω_{bb} decay into a charmed baryon and two light mesons.**

AI-assisted SU(3) amplitude reconstruction

[Yu-Ji Shi, Wei Wang, Ye Xing, Ji Xu, EPJC, 78 (2018)]

First 20 decay channels compared with reference Table 6

No.	Decay channel	Independently reconstructed flavor amplitude	△ check
1	$\Xi_{cc}^{++} \to \Lambda_c^+ \pi^+ \overline{K}^0$	$b_2 + b_4 + 2b_8 - b_{10} + b_{11}$	PASS
2	$\Xi_{cc}^{++} \to \Xi_c^+ \pi^+ \pi^0$	$\frac{b_2+b_4+b_{10}-b_{11}}{\sqrt{2}}$	PASS
3	$\Xi_{cc}^{++} \to \Xi_c^+ \pi^+ \eta_8$	$-\frac{2b_1-b_2+4b_3+b_4+2b_8-2b_9-b_{10}+3b_{11}}{\sqrt{6}}$	PASS
4	$\Xi_{cc}^{++} \to \Xi_c^+ K^+ \overline{K}^0$	$-b_1 + b_2 - 2b_3 + b_8 + b_9 - b_{10}$	PASS
5	$\Xi_{cc}^{++} \to \Xi_c^0 \pi^+ \pi^+$	$2\,(b_2 + b_4 + b_{10} - b_{11})$	PASS
6	$\Xi_{cc}^{+} \to \Lambda_c^+ \pi^+ K^-$	$-b_1 - b_6 + 2b_7 - b_8 - b_9 + b_{12}$	PASS
7	$\Xi_{cc}^{+} \to \Lambda_c^+ \pi^0 \overline{K}^0$	$\frac{b_1-b_2-b_4+b_6-2b_7-b_8+b_9+b_{10}-b_{11}-b_{12}}{\sqrt{2}}$	PASS
8	$\Xi_{cc}^{+} \to \Lambda_c^+ \overline{K}^0 \eta_8$	$\frac{b_1+b_2+b_4+b_6-2b_7-b_8+b_9-b_{10}+b_{11}-b_{12}}{\sqrt{6}}$	PASS
9	$\Xi_{cc}^{+} \to \Xi_c^+ \pi^+ \pi^-$	$b_2 - 2b_3 - 4b_5 - b_6 + b_{10} - b_{12}$	PASS
10	$\Xi_{cc}^{+} \to \Xi_c^+ \pi^0 \pi^0$	$-2b_3 - b_4 - 4b_5 - b_6 + b_{11} - b_{12}$	PASS
11	$\Xi_{cc}^{+} \to \Xi_c^+ \pi^0 \eta_8$	$\frac{2b_3+b_4-b_6+2b_7+b_{11}-b_{12}}{\sqrt{3}}$	PASS
12	$\Xi_{cc}^{+} \to \Xi_c^+ K^+ K^-$	$-2\,(2b_5 + b_6 - b_7)$	PASS
13	$\Xi_{cc}^{+} \to \Xi_c^+ K^0 \overline{K}^0$	$b_2 - 2b_3 - 4b_5 - b_6 - b_{10} + b_{12}$	PASS
14	$\Xi_{cc}^{+} \to \Xi_c^+ \eta_8 \eta_8$	$\frac{1}{3}\,(-2b_3 - b_4 - 12b_5 - 5b_6 + 4b_7 - 3b_{11} + 3b_{12})$	PASS
15	$\Xi_{cc}^{+} \to \Xi_c^0 \pi^+ \pi^0$	$-\frac{b_2+b_4+b_{10}-b_{11}}{\sqrt{2}}$	PASS
16	$\Xi_{cc}^{+} \to \Xi_c^0 \pi^+ \eta_8$	$-\frac{2b_1-b_2-b_4+2b_6-4b_7+2b_8-2b_9-b_{10}+b_{11}+2b_{12}}{\sqrt{6}}$	PASS
17	$\Xi_{cc}^{+} \to \Xi_c^0 K^+ \overline{K}^0$	$-b_1 - b_6 + 2b_7 + b_8 + b_9 - b_{12}$	PASS
18	$\Omega_{cc}^{+} \to \Lambda_c^+ \overline{K}^0 \overline{K}^0$	$2\,(b_2 + b_4 - b_{10} + b_{11})$	PASS
19	$\Omega_{cc}^{+} \to \Xi_c^+ \pi^+ K^-$	$-b_1 + b_2 - 2b_3 - b_8 - b_9 + b_{10}$	PASS
20	$\Omega_{cc}^{+} \to \Xi_c^+ \pi^0 \overline{K}^0$	$\frac{b_1+2b_3+b_4-b_8+b_9-b_{11}}{\sqrt{2}}$	PASS

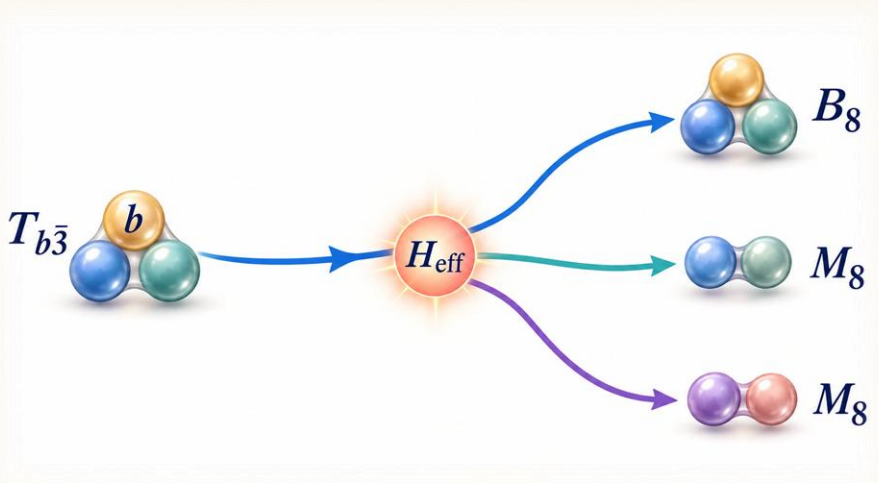
PASS means the symbolic difference between the reconstructed and reference amplitude vanishes.

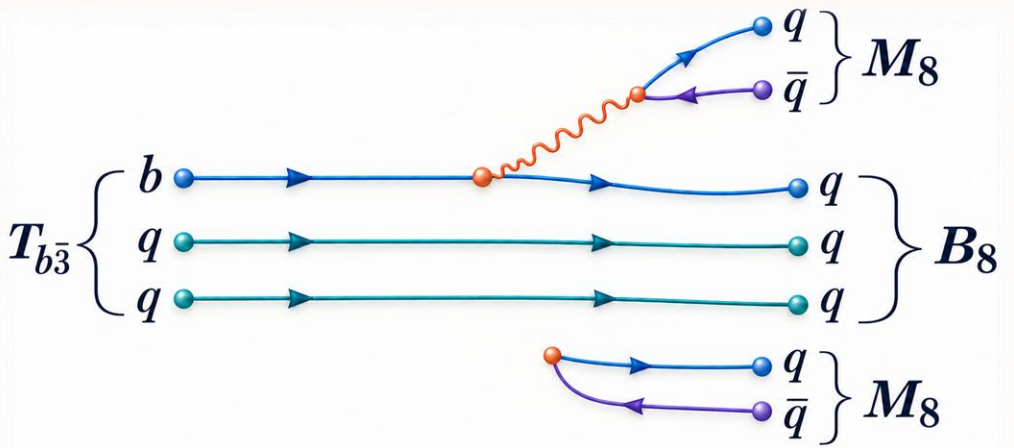
The results are the same.

SU(3) Agent: Performing a Novel Analysis

➢ **The bottom baryon decay into a light-baryon octet and two pseudoscalar octet mesons:**

$$T_{b\bar{3}} \to B_8 M_8 M_8$$





SU(3) Agent: Performing a Novel Analysis

- **The bottom baryon decay into a light-baryon octet and two pseudoscalar octet mesons:**

$$T_{b\bar{3}} \to B_8 M_8 M_8$$

- Constructing the effective Hamiltonian

$$\mathcal{H}_{\rm had} = \mathcal{H}_3 + \mathcal{H}_{\bar{6}} + \mathcal{H}_{15}.$$

$$\begin{aligned}\mathcal{H}_3 = {} & a_1\, T_i\, B_j^i\, M_k^j\, M_l^k\, (H_3)^l + a_2\, T_i\, B_l^i\, M_k^j\, M_j^k\, (H_3)^l \\ & + a_3\, T_j\, B_k^i\, M_i^j\, M_l^k\, (H_3)^l + a_4\, T_k\, B_j^i\, M_i^j\, M_l^k\, (H_3)^l \\ & + a_5\, T_k\, B_l^i\, M_i^j\, M_j^k\, (H_3)^l.\end{aligned}$$

$$\begin{aligned}\mathcal{H}_{15} = {} & c_1\, T_i\, B_j^i\, M_j^j\, M_m^k\, (H_{15})_k^{lm} + c_2\, T_i\, B_l^i\, M_m^j\, M_j^k\, (H_{15})_k^{lm} \\ & + c_3\, T_j\, B_l^i\, M_i^j\, M_m^k\, (H_{15})_k^{lm} + c_4\, T_l\, B_j^i\, M_i^j\, M_m^k\, (H_{15})_k^{lm} \\ & + c_5\, T_l\, B_m^i\, M_i^j\, M_j^k\, (H_{15})_k^{lm} + c_6\, T_k\, B_l^i\, M_i^j\, M_m^k\, (H_{15})_j^{lm} \\ & + c_7\, T_l\, B_k^i\, M_i^j\, M_m^k\, (H_{15})_j^{lm} + c_8\, T_j\, B_k^i\, M_l^j\, M_m^k\, (H_{15})_i^{lm} \\ & + c_9\, T_j\, B_l^i\, M_k^j\, M_m^k\, (H_{15})_i^{lm}.\end{aligned}$$

$$\begin{aligned}\mathcal{H}_{\bar{6}} = {} & b_1\, T_i\, B_j^i\, M_j^j\, M_m^k\, (H_{\bar{6}})_k^{lm} + b_2\, T_j\, B_l^i\, M_i^j\, M_m^k\, (H_{\bar{6}})_k^{lm} \\ & + b_3\, T_l\, B_j^i\, M_i^j\, M_m^k\, (H_{\bar{6}})_k^{lm} + b_4\, T_l\, B_m^i\, M_i^j\, M_j^k\, (H_{\bar{6}})_k^{lm} \\ & + b_5\, T_k\, B_l^i\, M_i^j\, M_m^k\, (H_{\bar{6}})_j^{lm} + b_6\, T_j\, B_k^i\, M_l^j\, M_m^k\, (H_{\bar{6}})_i^{lm}.\end{aligned}$$

- There are 5 + 6 + 9 = 20 independent flavor coefficients.

SU(3) Agent: Performing a Novel Analysis

- The decay amplitudes for different channels

AI-assisted SU(3) amplitude analysis

Table 2: first 10 $b \to d$ bottom-baryon three-body decay channels

Decay channel f	Flavor amplitude $F_f(a,b,c)$
$\Lambda_b^0 \to p\,\pi^0\,\pi^-$	$4\sqrt{2}c_1$
$\Lambda_b^0 \to p\,\pi^-\,\eta_8$	$\sqrt{\frac{2}{3}}\left(a_1 - a_3 - b_1 - b_2 + b_6 + 3c_1 + 3c_2 - 3c_3 + c_7 + c_8\right)$
$\Lambda_b^0 \to p\,K^0\,K^-$	$\left(a_1 + a_4 - b_1 - b_3 + b_5 + b_6 - c_1 + 3c_2 - c_4 + 3c_6 - c_8\right)$
$\Lambda_b^0 \to n\,\pi^+\,\pi^-$	$\left(a_1 + 2a_2 + b_1 + 3c_1 + c_2\right)$
$\Lambda_b^0 \to n\,\pi^0\,\pi^0$	$\left(a_1 + 2a_2 + b_1 - 5c_1 + c_2\right)$
$\Lambda_b^0 \to n\,\pi^0\,\eta_8$	$\frac{1}{\sqrt{3}}\left(-a_1 + a_3 + b_1 + b_2 - b_6 + c_1 + 5c_2 - 5c_3 - c_7 - c_8\right)$
$\Lambda_b^0 \to n\,K^+\,K^-$	$\left(2a_2 + a_5 - b_4 - b_5 + 2c_2 - c_5 + 3c_6 - c_9\right)$
$\Lambda_b^0 \to n\,K^0\,\overline{K}^0$	$\left(a_1 + 2a_2 + a_4 + a_5 - b_1 - b_3 - b_4 + b_6 - c_1 - 3c_2 - c_4 - c_5 - 2c_6 - c_8 - c_9\right)$
$\Lambda_b^0 \to n\,\eta_8\,\eta_8$	$\frac{1}{3}\left(a_1 + 6a_2 - 2a_3 + 4a_5 - 3b_1 + 6b_2 - 4b_4 + 4b_5 + 2b_6 + 3c_1 - 3c_2 - 6c_3 - 4c_5 - 4c_6 + 2c_7 + 2c_8 - 4c_9\right)$
$\Lambda_b^0 \to \Sigma^+\,\pi^-\,K^0$	$\left(a_3 + a_4 + b_2 - b_3 + b_5 + 3c_3 - c_4 + 3c_6 - c_7 - 2c_8\right)$

AI-assisted SU(3) amplitude analysis

Table 3: first 10 $b \to s$ bottom-baryon three-body decay channels

Decay channel f	Flavor amplitude $F_f(a,b,c)$
$\Lambda_b^0 \to p\,\pi^0\,K^-$	$\frac{1}{\sqrt{2}}\left(a_1 - b_1 - 2b_3 - b_4 + 7c_1 + 3c_2 + 4c_4 + 3c_5 + 3c_7\right)$
$\Lambda_b^0 \to p\,\pi^-\,\overline{K}^0$	$\left(a_1 - b_1 - b_4 - c_1 + 3c_2 + 3c_5 - c_7\right)$
$\Lambda_b^0 \to p\,K^-\,\eta_8$	$\frac{1}{\sqrt{6}}\left(-a_1 - 2a_3 - 2a_4 + b_1 - 2b_2 + b_4 - 2b_5 + 9c_1 - 3c_2 - 6c_3 + 6c_4 - 3c_5 - 6c_6 + 7c_7 + 4c_8\right)$
$\Lambda_b^0 \to n\,\pi^+\,K^-$	$\left(a_1 + b_1 + b_4 + 3c_1 - c_2 - c_5 + 3c_7\right)$
$\Lambda_b^0 \to n\,\pi^0\,\overline{K}^0$	$\frac{1}{\sqrt{2}}\left(-a_1 - b_1 - 2b_3 - b_4 + 5c_1 + c_2 + 4c_4 + c_5 + c_7\right)$
$\Lambda_b^0 \to n\,\overline{K}^0\,\eta_8$	$\frac{1}{\sqrt{6}}\left(-a_1 - 2a_3 - 2a_4 - b_1 + 2b_2 - b_4 + 2b_5 + 5c_1 + c_2 + 2c_3 + 6c_4 + c_5 + 2c_6 + 3c_7 + 4c_8\right)$
$\Lambda_b^0 \to \Sigma^+\,\pi^0\,\pi^-$	$\sqrt{2}\left(-b_3 + 2c_4 + 2c_7\right)$
$\Lambda_b^0 \to \Sigma^+\,\pi^-\,\eta_8$	$\sqrt{\frac{2}{3}}\left(-a_4 - b_4 - b_5 - b_6 + 3c_4 + 3c_5 - 3c_6 + c_7 + c_8\right)$
$\Lambda_b^0 \to \Sigma^+\,K^0\,K^-$	$\left(a_3 + b_2 - b_4 - b_6 + 3c_3 + 3c_5 - 2c_7 - c_8\right)$
$\Lambda_b^0 \to \Sigma^0\,\pi^+\,\pi^-$	$\sqrt{2}\left(-b_4 + 2c_5 - 2c_7\right)$

- The relations for the decay widths in SU(3) flavor limit

$$\mathcal{A}\left(\Xi_b^- \to p\,\pi^-\,K^-\right) = \frac{1}{2}\,\mathcal{A}\left(\Xi_b^- \to \Sigma^+\,\pi^-\,\pi^-\right), \qquad \frac{\Gamma_L}{\Gamma_R} = \frac{1}{2},$$

$$\mathcal{A}\left(\Xi_b^- \to \Xi^-\,\pi^0\,K^0\right) = \sqrt{3}\,\mathcal{A}\left(\Xi_b^- \to \Xi^-\,K^0\,\eta_8\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 3.$$

$$\mathcal{A}\left(\Lambda_b^0 \to \Sigma^+\,\pi^0\,\pi^-\right) = \mathcal{A}\left(\Lambda_b^0 \to \Sigma^-\,\pi^+\,\pi^0\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 1,$$

$$\mathcal{A}\left(\Lambda_b^0 \to \Lambda^0\,\pi^+\,\pi^-\right) = \mathcal{A}\left(\Lambda_b^0 \to \Lambda^0\,\pi^0\,\pi^0\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 2,$$

$$\mathcal{A}\left(\Xi_b^0 \to \Xi^-\,\pi^+\,\pi^0\right) = -\mathcal{A}\left(\Xi_b^- \to \Xi^0\,\pi^0\,\pi^-\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 1,$$

$$\mathcal{A}\left(\Xi_b^- \to p\,K^-\,K^-\right) = 2\,\mathcal{A}\left(\Xi_b^- \to \Sigma^+\,\pi^-\,K^-\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 2,$$

$$\mathcal{A}\left(\Xi_b^- \to \Sigma^-\,\pi^0\,\overline{K}^0\right) = \sqrt{3}\,\mathcal{A}\left(\Xi_b^- \to \Sigma^-\,\overline{K}^0\,\eta_8\right), \qquad \frac{\Gamma_L}{\Gamma_R} = 3.$$

Same with Mathematica codes.

Summary

- **An interesting agent capable of automatically performing SU(3) amplitude analysis (still under development).**
- **Can be cross-checked against the existing literature and yield new theoretical predictions.**
- **Frees physicists from tedious work, enabling them to focus on important physics questions.**