

# Report of Working Group 2: FR-UFO-ALOHA

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- Many enigmas got solved during this week...



# Topics

- Convention in Helas - ALOHA - MG5
- Non-standard propagators in UFO-ALOHA-MG5
- Multi-fermion operators
- FR@NLO, UFO@NLO, ALOHA@NLO

# Non-standard propagators

- Involved parties: Claude, Olivier.
- Right now, the UFO does not allow for non-standard propagators.
- This prevents certain models (e.g., Lee-Wick) to be implemented (in an easy way).
- Idea: Include propagators as two-point functions into the UFO.
- Then ALOHA can use these propagators when creating the HELAS routines.
- Open issue: How to tell ALOHA/MG5 which propagator/ Helas routine to use.

# Multi-fermion operators

- Involved parties: Céline, Claude, Gauthier, Olivier.
- A single multi-fermion operator can have contributions from more than one fermion flow:

$$g_1 (\bar{\psi}_1 \psi_2) (\bar{\psi}_3 \psi_4) + g_2 (\bar{\psi}_1 \psi_4) (\bar{\psi}_3 \psi_2)$$

- MG5 requires fermions to be ordered in a ‘canonical way’.
- This requires the use of Fierz identities.
- Status:
  - ➔ Know how to deal with generic case
  - ➔ Does this also work for identical fermions, Majoranas, etc.

# UFO@NLO

- Involved parties: Benj, Céline, Claude, Roberto, Valentin
- Beyond LO, the UFO format requires extension to include counterterms and R2.
- We discussed an extension of the UFO format that should be flexible enough to work @NLO.
- The changes to the UFO are minimal, and consist in the definition of new classes for the required objects.

# FR@NLO

- Involved parties: Benj, Céline, Claude, Roberto, Valentin
- The NLO counterterms and R2 terms should be computed by FeynRules.
- Counterterms are there, but need to get the analytic expression for the ‘independent’ counterterms (See Benj’s talk from Monday).
- R2 terms should be easily computable.
- FeynArts should be useful in both cases.
- Open issue:
  - ➔ Is there a numerical way to deal with the R2 terms.

# Conclusion

- The chain FR-UFO-ALOHA-MG5 is almost complete.
- Tree level: 90% ready
  - ➔ missing generic treatment of multi-fermion operators.
  - ➔ spin 3/2.
- NLO:
  - ➔ Counterterms ready...
  - ➔ ...but need to compute their analytic expressions.
  - ➔ Need to get the extraction of the R2 terms automatized.
  - ➔ Need to coordinate with other NLO tools.
- MadDM and FR-UFO-ALOHA?