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McMule – a Monte Carlo generator for low energy processes

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McMule, a Monte Carlo for MUons and other LEptons, implements many major QED processes at NNLO (eg. $ee \rightarrow ee, e\mu \rightarrow e\mu, ee \rightarrow \mu\mu, \ell p \rightarrow \ell p, \mu \rightarrow \nu \bar{\nu} e$) including effects from the lepton masses. This makes McMule suitable for predictions for low-energy experiments such as MUonE, CMD-III, PRad, or MUSE.

Recently, McMule gained the ability to generate events at NNLO directly rather than just differential distributions. To avoid negative event weights it employs cellular resampling (2109.07851 & 2303.15246) directly as part of the generation step which further reduces the fraction of negative weights.

Significance

1) McMule caters to many low-energy experiments whose accuracy requires NNLO-QED predictions as part of the full simulation. This requires an NNLO event generator.

2) McMule offers the first demonstration of cellular resampling at NNLO as well as the benefits it allows when part of the event generation rather than used as a postprocessing step.

References

https://arxiv.org/abs/2007.01654 https://mcmule.readthedocs.io/

Experiment context, if any

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