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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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