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Local Unitarity: a locally infrared-finite representation of differential cross-sections

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It is well-known that perturbative expansions of QFT observable suffer from infrared (IR) divergences both in the phase-space of real-emission contributions and in the loop amplitudes of virtual contributions.
Traditionally, the two are handled separately through a combination of local subtraction counterterm and dimensional regulation.
Local Unitarity is an alternative formulation using the Loop-Tree Duality (LTD) theorem and where the Kinoshita–Lee–Nauenberg (KLN) cancellation pattern is leveraged to achieve a direct cancellation of real-emission and loop IR divergences, independently for each forward scattering graph.
Together with an automated local renormalization procedure based on the R-operation, the resulting expression is locally finite and thus amenable to numerical integration at arbitrary perturbative orders and for processes with final-state singularities only.
I will showcase our first computations within this new paradigm, for physical cross-sections up to N3LO.

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