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Title:	Calculating Scattering Amplitudes Using Modern Techniques
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Abstract:	Understanding the nature of fundamental particles and their interactions is a ma- jor step towards unravelling the existing mysteries of the universe and to probe new physics. That's why scattering experiments are performed at colliders on such a large scale. What lies at the core of these collider experiments are the gauge-invariant perturbative scattering amplitudes which provide essential information about the cross-sections of these scattering processes. This thesis gives a glimpse about the traditional Feynman diagrammatic approach and its limitations, when it comes to calculate these scattering amplitudes. We review modern techniques like Trace based Colour-Decompositions and Spinor-Helicity Formalism and discuss, how they have an upper hand over traditional approach, specially while calculat- ing multi-parton or multi-leg scattering amplitudes in the theory of QCD. We see, how symmetries and compact expressions like Parke-Taylor MHV amplitudes can make the computation of such complicated scattering amplitudes less intense and more efficient. We further discuss recursive techniques like BCFW Recursion Relation that entirely discard the need of Feynman diagrams and just uses the analytic properties of scattering amplitudes to write higher multiplicity amplitudes in terms of lower ones. We give a proof of Parke-Taylor formulae for multi-gluons and also for MHV amplitudes involving a quark-anti quark pair, using these BCFW recursion relations. This thesis just sticks to massless particles and talks about am- plitudes only at tree-level. However, these techniques can be used to calculate higher order perturbative corrections that involves loop as well. We use BCFW recursion technique and MHV amplitudes to numerically calculate Next to Leading Order (NLO) i.e., one gluon real correction to diphoton production at hadron colliders. We see how this technique can make the calculations less cumbersome and give results with higher accuracy.
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