Parke & Taylor

VOLUME 56, NUMBER 23 PHYSICAL REVIEW LETTERS 9 JUNE 1986

Amplitude for *n*-Gluon Scattering

Stephen J. Parke and T. R. Taylor
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(Received 17 March 1986)

A nontrivial squared helicity amplitude is given for the scattering of an arbitrary number of gluons to lowest order in the coupling constant and to leading order in the number of colors.

PACS numbers: 12.38.Bx

Computations of the scattering amplitudes for the used to improve the existing numerical programs for

QCD Amplitudes from String Theory

Fermi National Accelerator Laboratory

Fermilab–Pub–91/111–T
Pitt–91–05
June, 1991

The Computation of Loop Amplitudes in Gauge Theories

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Abstract

We present a detailed derivation of a new and efficient technique based on the technology of four-dimensional heterotic strings, for computing one-loop amplitudes in gauge theories, along with expressions for the one-loop dimensionally regularized helicity amplitudes for the process with four external gluons. We also give a set of computational rules presupposing ignorance of string theory.

Precursor Paper

VOLUME 70, NUMBER 18 PHYSICAL REVIEW LETTERS 3 MAY 1993

One-Loop Corrections to Five-Gluon Amplitudes

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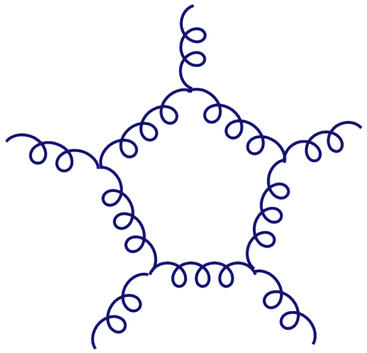
(Received 1 March 1993)

We present the one-loop helicity amplitudes with five external gluons. The computation employs string-based methods, new techniques for performing tensor integrals, and improvements in the spinor helicity method.



5 gluon loop amplitude is simple!

Simplicity at one-loop in gauge theory.

ELSEVIER

Nuclear Physics B425 (1994) 217–260

NUCLEAR PHYSICS B

One-loop n-point gauge theory amplitudes, unitarity and collinear limits

Zvi Bern [a,1], Lance Dixon [b,2], David C. Dunbar [a,3], David A. Kosower [c,4]

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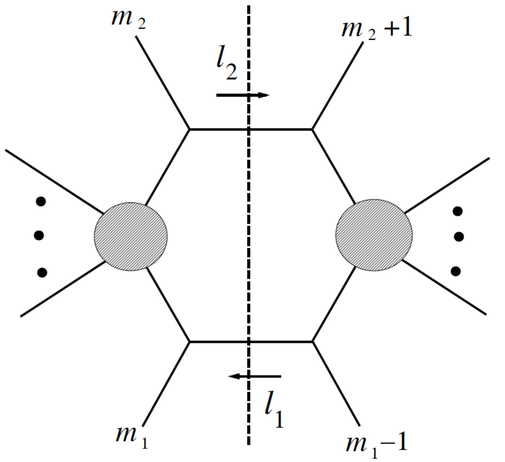

Abstract

We present a technique which utilizes unitarity and collinear limits to construct ansätze for one-loop amplitudes in gauge theory. As an example, we obtain the one-loop contribution to amplitudes for n-gluon scattering in $N=4$ supersymmetric Yang–Mills theory with the helicity configuration of the Parke–Taylor tree amplitudes. We prove that our $N=4$ ansatz is correct using general properties of the relevant one-loop n-point integrals. We also give the "splitting amplitudes" which govern the collinear behavior of one-loop helicity amplitudes in gauge theories.

$$A^{\text{tree}}(l_1^+, 1^-, 2^-, 3^+, \ldots, m^+, l_3^+) = \frac{\langle 12\rangle^4}{\langle l_1 1\rangle\langle 12\rangle\cdots\langle m l_1\rangle\langle l_1 l_2\rangle}$$

Simplicity at one-loop in gauge theory.

ELSEVIER

Nuclear Physics B 435 (1995) 59–101

NUCLEAR PHYSICS B

Fusing gauge theory tree amplitudes into loop amplitudes

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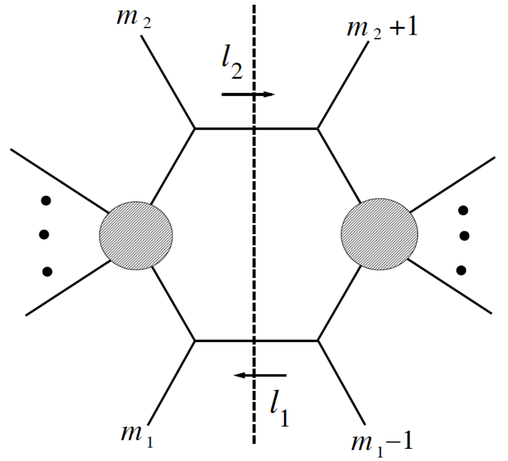
Received 20 September 1994; accepted 1 November 1994

Abstract

We identify a large class of one-loop amplitudes for massless particles that can be constructed via unitarity from tree amplitudes, without any ambiguities. One-loop amplitudes for massless supersymmetric gauge theories fall into this class; in addition, many non-supersymmetric amplitudes can be rearranged to take advantage of the result. As applications, we construct the one-loop amplitudes for n-gluon scattering in $N = 1$ supersymmetric theories with the helicity configuration of the Parke–Taylor tree amplitudes, and for six-gluon scattering in $N = 4$ super-Yang–Mills theory for all helicity configurations.



Simplicity at one-loop in gauge theory.

One-loop amplitudes for e^+e^- to four partons

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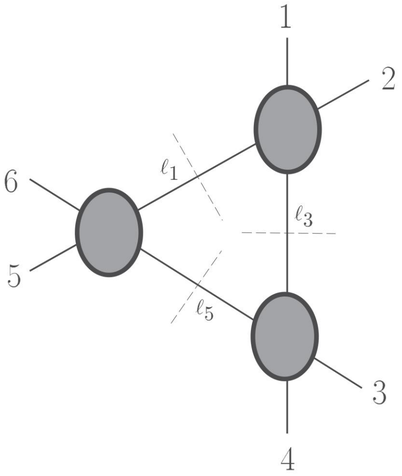
Received 13 August 1997; accepted 20 October 1997

Abstract

We present the first explicit formulæ for the complete set of one-loop helicity amplitudes necessary for computing next-to-leading order corrections for e^+e^- annihilation into four jets, for W, Z or Drell–Yan production in association with two jets at hadron colliders, and for three-jet production in deeply inelastic scattering experiments. We include a simpler form of the previously published amplitudes for e^+e^- to four quarks. We obtain the amplitudes using their analytic properties to constrain their form. Systematically eliminating spurious poles from the amplitudes leads to relatively compact results. © 1998 Elsevier Science B.V.



Two-loops

SLAC–PUB–8324
UCLA/99/TEP/48
Saclay-SPhT-T99/147
hep-ph/0001001
January 1, 2000

A Two-Loop Four-Gluon Helicity Amplitude in QCD

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Abstract

We present the two-loop pure gauge contribution to the gluon-gluon scattering amplitude with maximal helicity violation. Our construction of the amplitude does not rely directly on Feynman diagrams, but instead uses its analytic properties in $4-2\epsilon$ dimensions. We evaluate the loop integrals appearing in the amplitude through $\mathcal{O}(\epsilon^0)$ in terms of polylogarithms.

Our First Paper on Gravity, $N = 8$ Supergravity at 2 Loops

ELSEVIER

Nuclear Physics B 530 (1998) 401–456

NUCLEAR PHYSICS B

On the relationship between Yang–Mills theory and gravity and its implication for ultraviolet divergences

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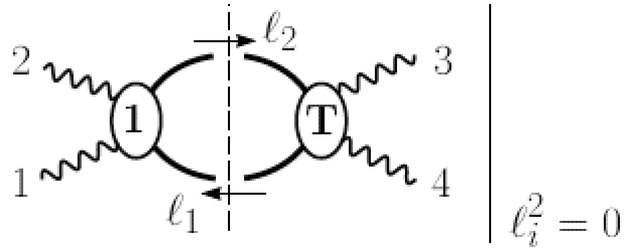
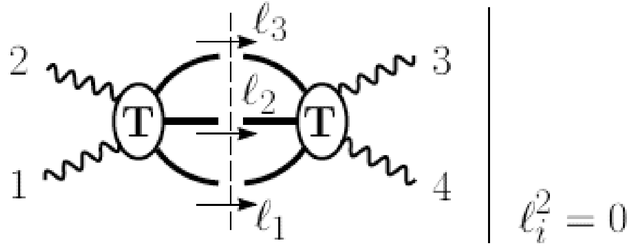
Received 17 March 1998; accepted 15 May 1998





We had KLT

2nd Paper: MHV One-Loop Gravity Amplitudes

ELSEVIER

Nuclear Physics B 546 (1999) 423–479

NUCLEAR PHYSICS B

Multi-leg one-loop gravity amplitudes from gauge theory

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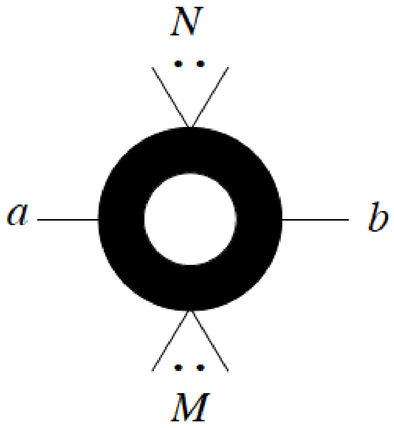

ABDK/BDS

Planar Amplitudes in Maximally Supersymmetric Yang-Mills Theory

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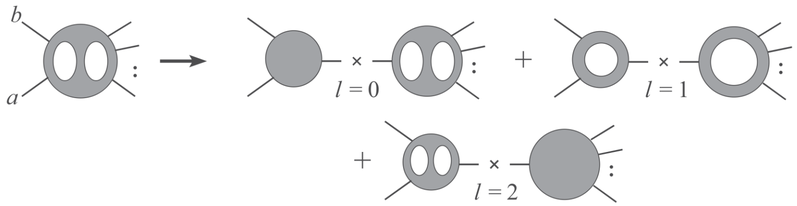
(Received 7 September 2003; published 18 December 2003)



Iteration of planar amplitudes in maximally supersymmetric Yang-Mills theory at three loops and beyond

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(Received 25 June 2005; published 4 October 2005)

"amplitudes" became "Amplitudes" in 2004

hep-th/0312171

Perturbative Gauge Theory As A String Theory In Twistor Space

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Perturbative scattering amplitudes in Yang-Mills theory have many unexpected properties, such as holomorphy of the maximally helicity violating amplitudes. To interpret these results, we Fourier transform the scattering amplitudes from momentum space to twistor space, and argue that the transformed amplitudes are supported on certain holomorphic curves. This in turn is apparently a consequence of an equivalence between the perturbative expansion of $\mathcal{N} = 4$ super Yang-Mills theory and the D-instanton expansion of a certain string theory, namely the topological B model whose target space is the Calabi-Yau supermanifold $\mathbb{CP}^{3|4}$.

The 2nd Era of Studying UV in Sugra

Is $\mathcal{N} = 8$ Supergravity Ultraviolet Finite?

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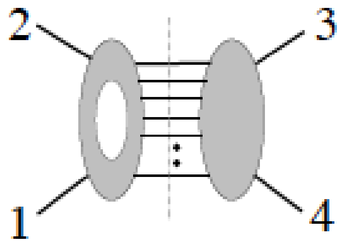
Conventional wisdom holds that no four-dimensional gravity field theory can be ultraviolet finite. This understanding is based mainly on power counting. Recent studies confirm that one-loop $\mathcal{N} = 8$ supergravity amplitudes satisfy the so-called "no-triangle hypothesis", which states that triangle and bubble integrals cancel from these amplitudes. A consequence of this hypothesis is that for any number of external legs, at one loop $\mathcal{N} = 8$ supergravity and $\mathcal{N} = 4$ super-Yang-Mills have identical superficial degrees of ultraviolet behavior in D dimensions. We describe how the unitarity method allows us to promote these one-loop cancellations to higher loops, suggesting that previous power counts were too conservative. We discuss higher-loop evidence suggesting that $\mathcal{N} = 8$ supergravity has the same degree of divergence as $\mathcal{N} = 4$ super-Yang-Mills theory and is ultraviolet finite in four dimensions. We comment on calculations needed to reinforce this proposal, which are feasible using the unitarity method.



No real calculations!

Abstract says: "We comment on calculations needed …" not "We calculate …"

Study of Supergravity Divergences Came Back to Life.