

VOLUME 56, NUMBER 23

PHYSICAL REVIEW LETTERS

9 JUNE 1986

Amplitude for n -Gluon Scattering

Stephen J. Parke and T. R. Taylor

Fermi National Accelerator Laboratory, Batavia, Illinois 60510

(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

Zvi Bern

Department of Physics

University of Pittsburgh

Pittsburgh, Pennsylvania 15260

and

David A. Kosower

Fermi National Accelerator Laboratory

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Batavia, Illinois 60510

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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Lance Dixon^(b)

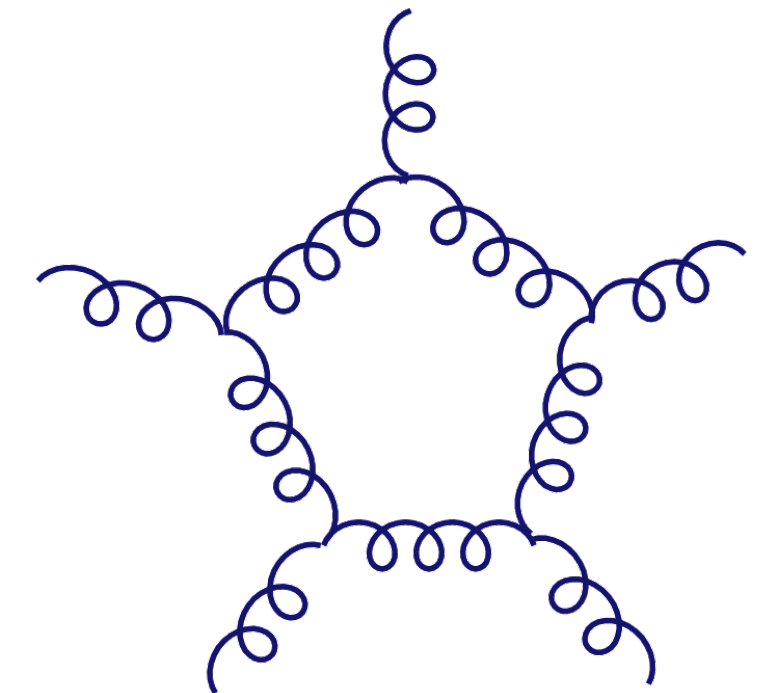
Stanford Linear Accelerator Center, Stanford, California 94309

David A. Kosower^(c)

Theory Division, CERN, CH-1211 Geneva 23, Switzerland

(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!



Nuclear Physics B425 (1994) 217–260

NUCLEAR
PHYSICS B

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

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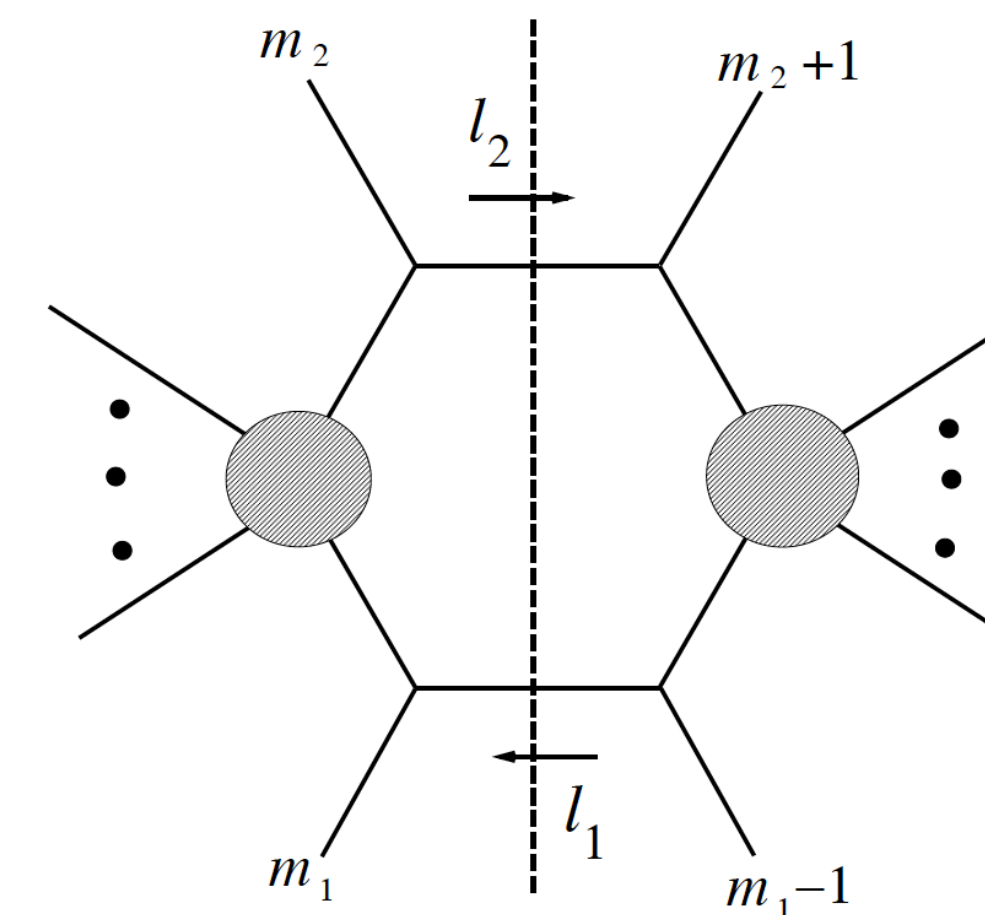
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F-91191 Gif-sur-Yvette cedex, France

Received 11 March 1994; accepted for publication 6 April 1994

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.

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





ELSEVIER

Nuclear Physics B 435 (1995) 59–101

NUCLEAR
PHYSICS B

Fusing gauge theory tree amplitudes into loop amplitudes

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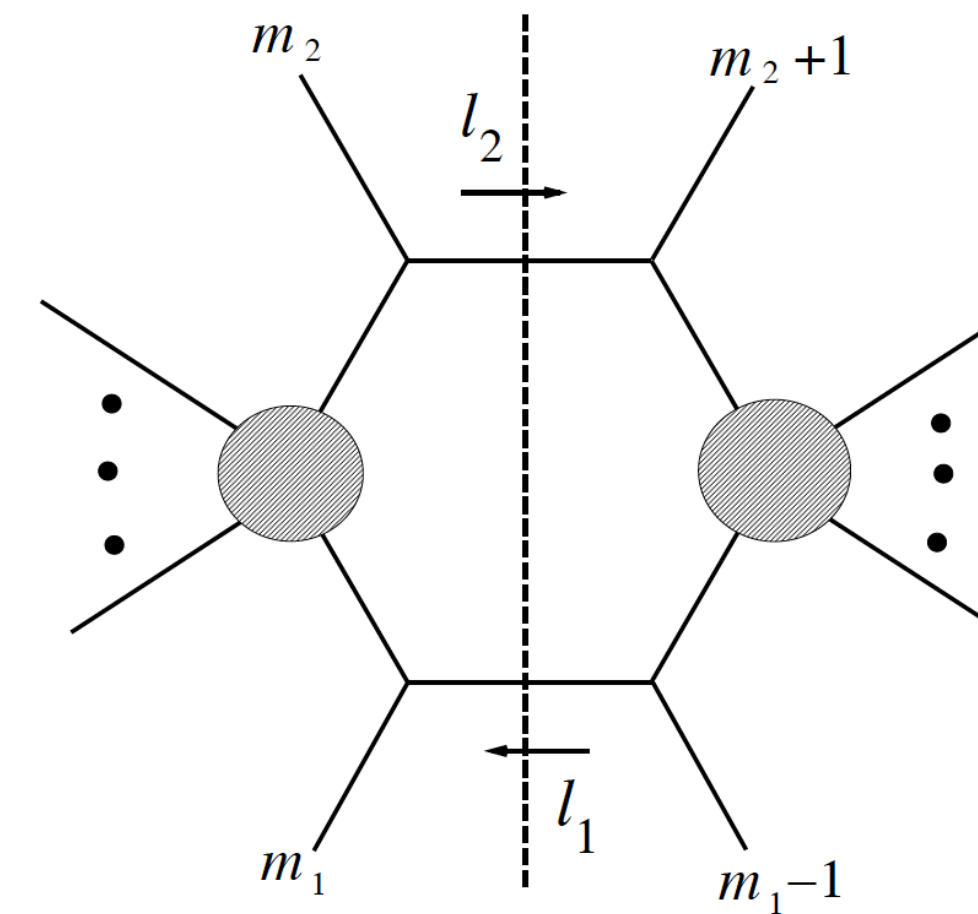
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Received 20 September 1994; accepted 1 November 1994

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.



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

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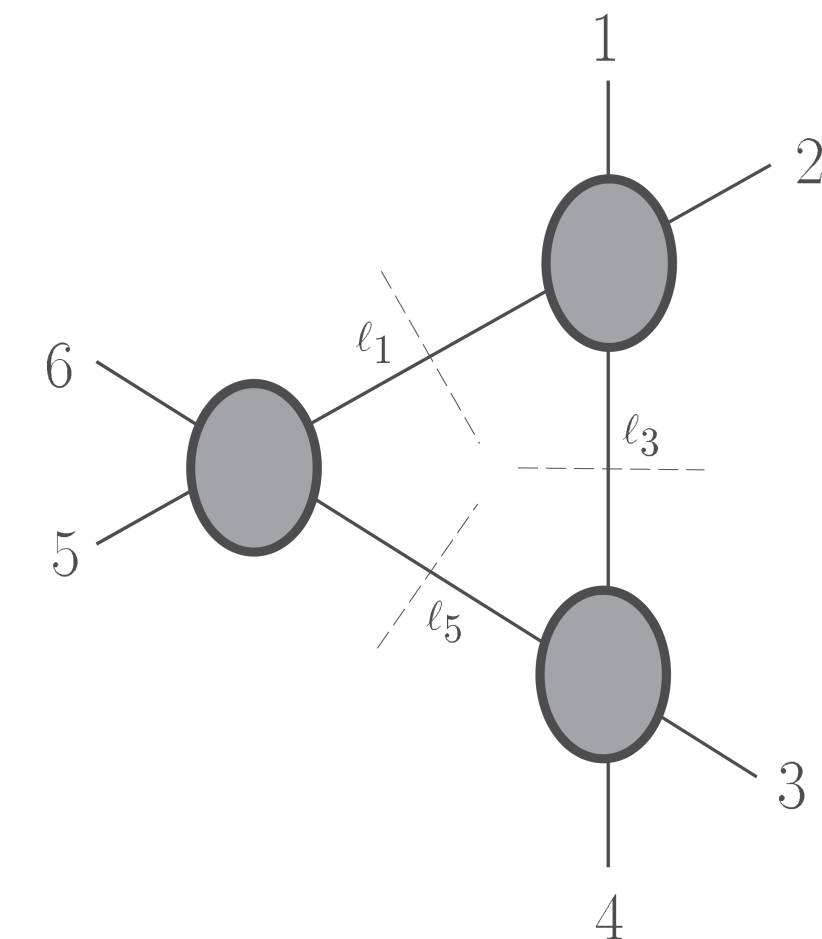
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Received 13 August 1997; accepted 20 October 1997

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.



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Saclay-SPhT-T99/147
hep-ph/0001001
January 1, 2000

A Two-Loop Four-Gluon Helicity Amplitude in QCD

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Abstract

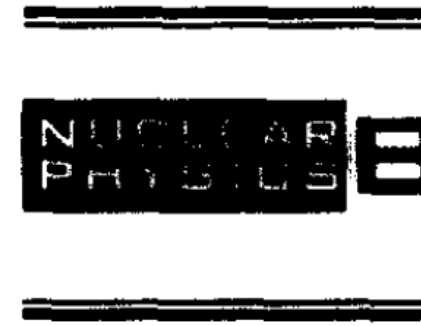
We present the two-loop pure gauge contribution to the gluon-gluon scattering amplitude with maximal helicity violation. Our construction of the amplitude does not rely directly on Feynman diagrams, but instead uses its analytic properties in $4 - 2\epsilon$ dimensions. We evaluate the loop integrals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

arXiv:hep-ph/0001001v2 24 Jun 2011

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



Nuclear Physics B 530 (1998) 401–456



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

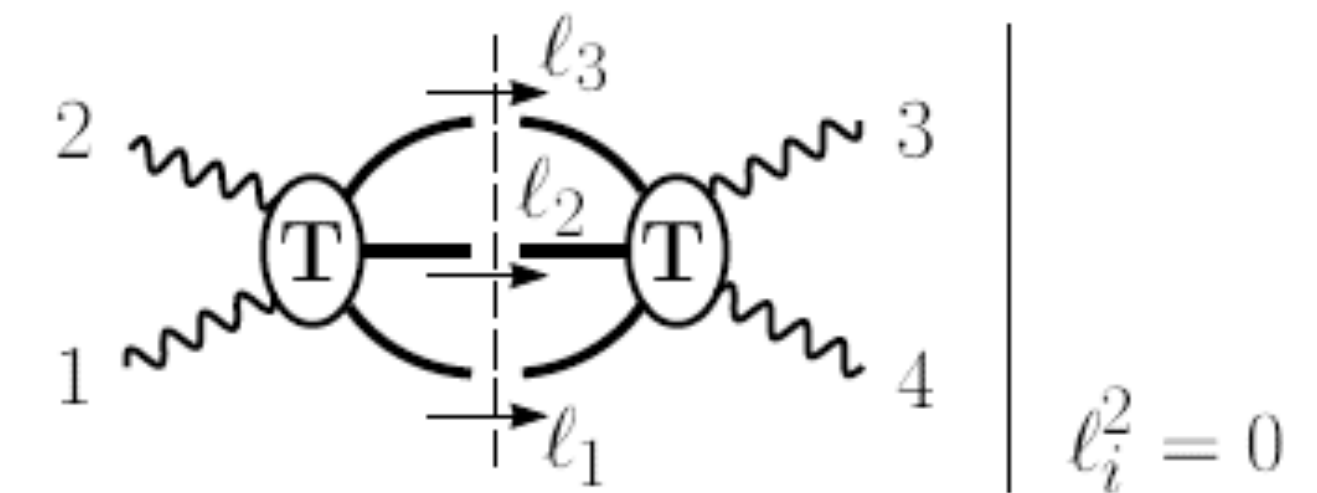
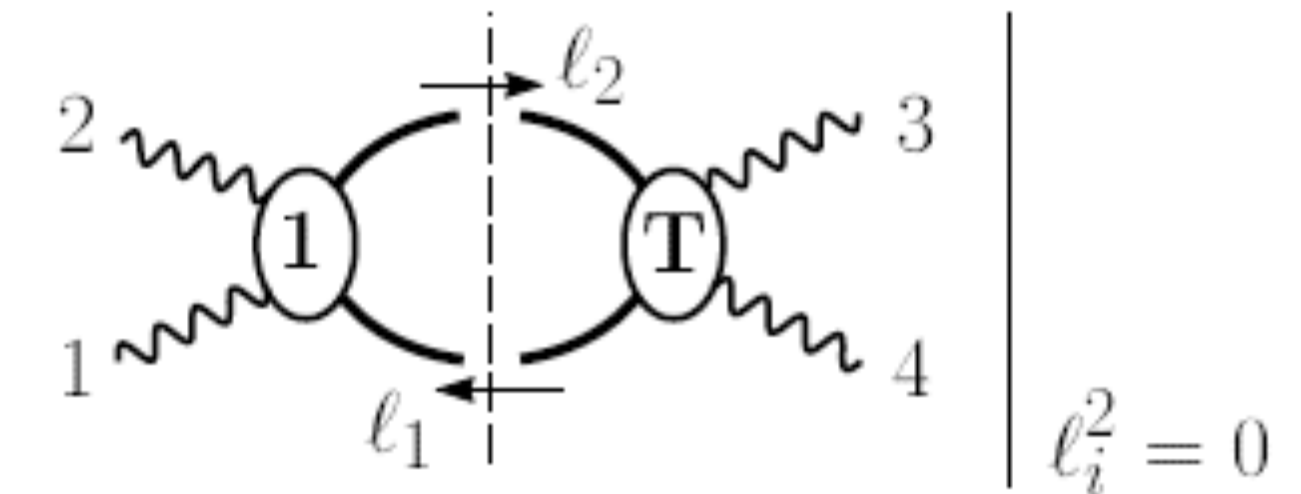
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Received 17 March 1998; accepted 15 May 1998

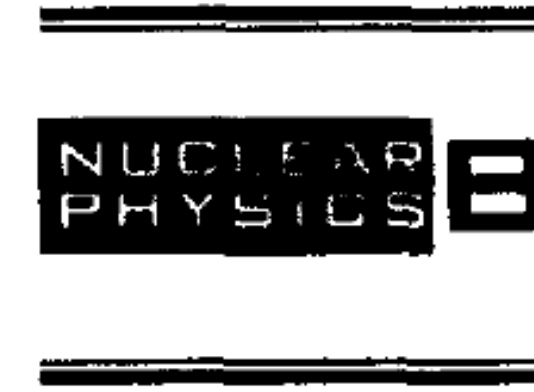


We had KLT



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Nuclear Physics B 546 (1999) 423–479



Multi-leg one-loop gravity amplitudes from gauge theory

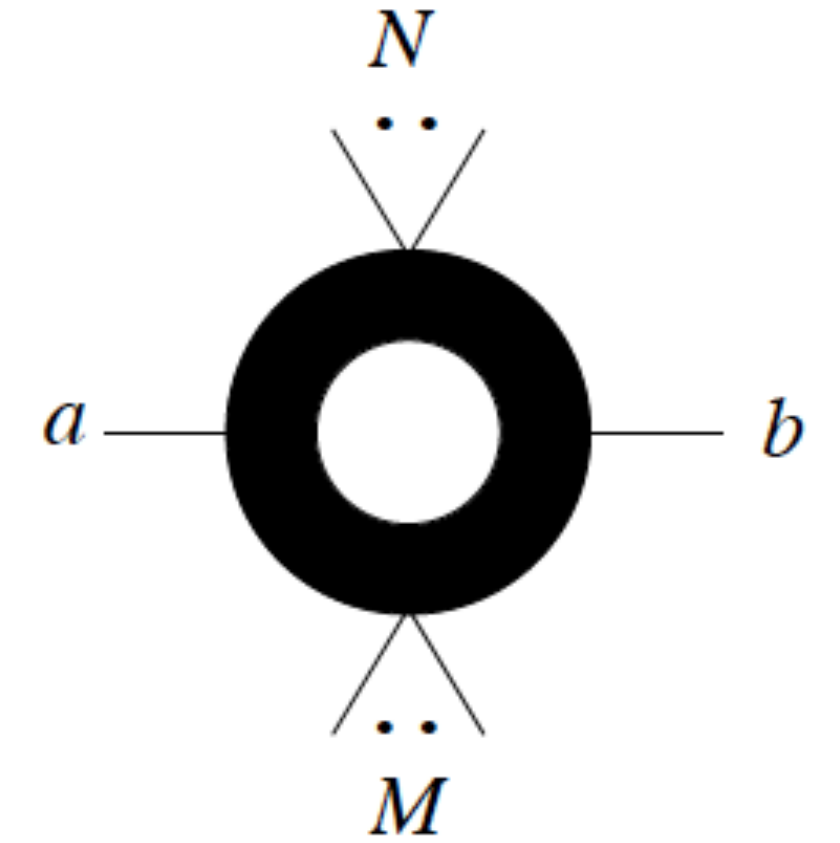
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Received 26 November 1998; accepted 8 January 1999



Planar Amplitudes in Maximally Supersymmetric Yang-Mills Theory

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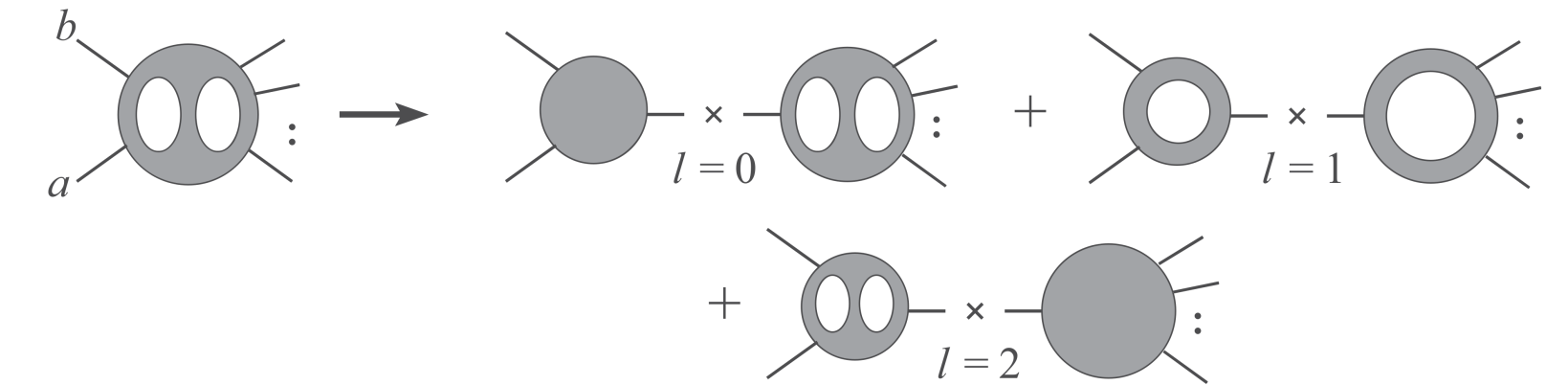
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(Received 7 September 2003; published 18 December 2003)



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)

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

arXiv:hep-th/0611086v1 8 Nov 2006

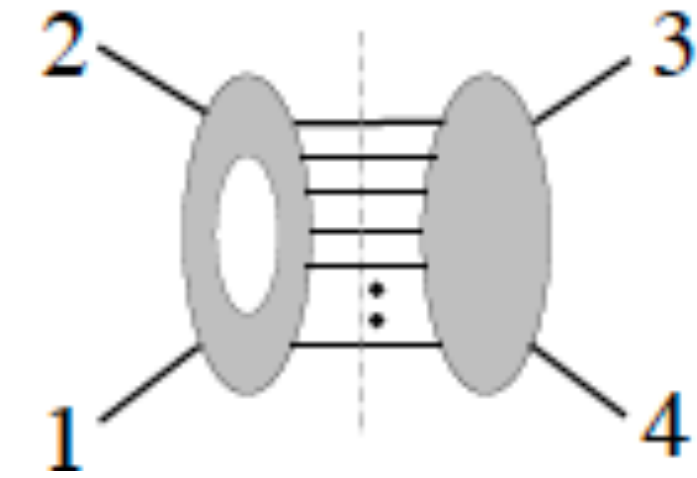
Is $\mathcal{N} = 8$ Supergravity Ultraviolet Finite?

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No real calculations!

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.

Abstract says: “We comment on calculations needed ...” not “We calculate ...”

Study of Supergravity Divergences Came Back to Life.

UCLA

Theoretical Elementary Particle Physics
DEPARTMENT OF PHYSICS & ASTRONOMY

DECEMBER 11th - 15th, 2006
UCLA Physics and Astronomy Building
on 4th floor

Attendees:

Zvi Bern
Freddy Cachazo
Lance Dixon
Sergio Ferrara*
Michael Green
Michael Gutperle
Paul Howe*
Chris Hull*
David Kosower
Per Kraus
Harald Ita
Radu Roiban
Marcus Spradlin
Kelly Stelle
Anastasia Volovich
Chuan-jie Zhu *
and others

(*) to be confirmed

"IS N=8 SUPERGRAVITY FINITE?"



ABSTRACT

Conventional wisdom holds that no four-dimensional gravitational theory can be finite. However, using modern computational methods based on unitarity, it has been shown that N=8 supergravity is less divergent than previously thought. More cancellations may well be in store, as suggested also by string-theoretic arguments. This workshop will examine the ultraviolet properties of N=8 supergravity in the light of all the current evidence. The intimate connection of N=8 supergravity to N=4 super-Yang-Mills theory will also be discussed.

Organizing Committee:
Zvi Bern,
Lance Dixon,
Michael Gutperle
David Kosower

Sponsors:
US Department of Energy;
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Pictures...
UCLA Royce Hall,
Mondrian-like art.