• N. Arkani-Hamed, Y. t. Huang and D. O'Connell, "Kerr black holes as elementary particles," JHEP **01**, 046 (2020) doi:10.1007/JHEP01(2020)046 [arXiv:1906.10100 [hep-th]]. 224 citations counted in INSPIRE as of 13 Sep 2024

## Towards Quantum Gravity

- R. Aoude, K. Haddad and A. Helset, "On-shell heavy particle effective theories," JHEP **05**, 051 (2020) doi:10.1007/JHEP05(2020)051 [arXiv:2001.09164 [hep-th]]. 163 citations counted in INSPIRE as of 16 Sep 2024

  The author introduce on-shell variables for HPETs with the aim to present such a formalism will allow the extension of HBET to higher spins and to facilitate its application to higher loop orders.
- J. Mazza, E. Franzin and S. Liberati, "A novel family of rotating black hole mimickers," JCAP **04**, 082 (2021) doi:10.1088/1475-7516/2021/04/082 [arXiv:2102.01105 [gr-qc]]. 135 citations counted in INSPIRE as of 16 Sep 2024

  The author employ the Newman-Janis procedure to generalize SV metric, which generates the rotating blackhole mimickers. A method towards the quantum theory of gravity.

## Double copy relation

- H. Johansson and A. Ochirov, "Double copy for massive quantum particles with spin," JHEP **09**, 040 (2019) doi:10.1007/JHEP09(2019)040 [arXiv:1906.12292 [hep-th]]. 161 citations counted in INSPIRE as of 16 Sep 2024

  This paper explores the double copy structure of gravitational theories coupled to massive matter with spin, which is relevant for understanding black hole scattering and gravitational waves.
- T. Adamo, J. J. M. Carrasco, M. Carrillo-González, M. Chiodaroli, H. Elvang, H. Johansson, D. O'Connell, R. Roiban and O. Schlotterer, "Snowmass White Paper: the Double Copy and its Applications," [arXiv:2204.06547 [hep-th]]. 92 citations counted in INSPIRE as of 16 Sep 2024

  This Snowmass white paper provides a brief introduction to the double copy, its applications, current research and future challenges.
- E. Chacón, S. Nagy and C. D. White, "The Weyl double copy from twistor space," JHEP **05**, 2239 (2021) doi:10.1007/JHEP05(2021)239 [arXiv:2103.16441 [hep-th]]. 72 citations counted in INSPIRE as of 16 Sep 2024

  The author show how the current form and scope of the Weyl double copy can be derived from a certain procedure in twistor space.
- C. D. White, "Twistorial Foundation for the Classical Double Copy," Phys. Rev. Lett. **126**, no.6, 061602 (2021) doi:10.1103/PhysRevLett.126.061602 [arXiv:2012.02479 [hep-th]]. 90 citations counted in INSPIRE as of 17 Sep 2024

  The author show that a particular incarnation- the Weyl double copy- can be derived using well-established ideas from twistor theory.

- L. Borsten, H. Kim, B. Jurčo, T. Macrelli, C. Saemann and M. Wolf, "Double Copy from Homotopy Algebras," Fortsch. Phys. **69**, no.8-9, 2100075 (2021) doi:10.1002/prop.202100075 [arXiv:2102.11390 [hep-th]]. 76 citations counted in INSPIRE as of 16 Sep 2024

  The author give a detailed exposition of the BRST Lagrangian double copy and show that colour-kinematics duality and the BRST-Lagrangian double copy can be elegantly articulated in terms of homotopy algebras.
- W. T. Emond, Y. T. Huang, U. Kol, N. Moynihan and D. O'Connell, "Amplitudes from Coulomb to Kerr-Taub-NUT," JHEP **05**, 055 (2022) doi:10.1007/JHEP05(2022)055 [arXiv:2010.07861 [hep-th]]. 71 citations counted in INSPIRE as of 17 Sep 2024 The author dentify the amplitudes corresponding to each of these solutions and con rm that the amplitudes double-copy when the solutions are related by the classical double copy.
- H. Godazgar, M. Godazgar, R. Monteiro, D. Peinador Veiga and C. N. Pope, "Weyl Double Copy for Gravitational Waves," Phys. Rev. Lett. **126**, no.10, 101103 (2021) doi:10.1103/PhysRevLett.126.101103 [arXiv:2010.02925 [hep-th]]. 73 citations counted in INSPIRE as of 17 Sep 2024

  The author establish the status of the Weyl double copy relation for radiative solutions of the vacuum Einstein equations.
- I. Bah, R. Dempsey and P. Weck, "Kerr-Schild Double Copy and Complex Worldlines," JHEP 02, 180 (2020) doi:10.1007/JHEP02(2020)180 [arXiv:1910.04197 [hep-th]]. 62 citations counted in INSPIRE as of 17 Sep 2024

  The author use the classical double copy to identify a necessary condition for Maxwell theory sources to constitute single copies of Kerr-Schild solutions, and give a parameterization of the corresponding single copies in terms of Li´ enard-Wiechert fields of charges on complex worldlines.
- G. Elor, K. Farnsworth, M. L. Graesser and G. Herczeg, "The Newman-Penrose Map and the Classical Double Copy," JHEP 12, 121 (2020) doi:10.1007/JHEP12(2020)121 [arXiv:2006.08630 [hep-th]]. 66 citations counted in INSPIRE as of 17 Sep 2024 The author present a novel map, called Newman-Penrose map, between a certain class of real, exact solutions of Einstein's equations and self-dual solutions of the at-space vacuum Maxwell equations.
- L. Borsten and S. Nagy, "The pure BRST Einstein-Hilbert Lagrangian from the double-copy to cubic order," JHEP **07**, 093 (2020) doi:10.1007/JHEP07(2020)093 [arXiv:2004.14945 [hep-th]]. 64 citations counted in INSPIRE as of 17 Sep 2024 The author construct the pure gravity BRST Einstein Hilbert Lagrangian, to cubic order, using the BRST convolution product and BCJ double-copy.
- J. Plefka, C. Shi and T. Wang, "Double copy of massive scalar QCD," Phys. Rev. D 101, no.6, 066004 (2020) doi:10.1103/PhysRevD.101.066004 [arXiv:1911.06785 [hep-th]]. 56 citations counted in INSPIRE as of 17 Sep 2024

  The author construct the gravitational theory emerging from the double-copy of massive scalar quantum chromodynamics in general dimensions.

- D. A. Easson, G. Herczeg, T. Manton and M. Pezzelle, "Isometries and the double copy," JHEP **09**, 162 (2023) doi:10.1007/JHEP09(2023)162 [arXiv:2306.13687 [gr-qc]]. 18 citations counted in INSPIRE as of 17 Sep 2024

  The authors show that the geodicity of the Kerr-Schild vector and the existence of a timelike Killing vector, are in fact consequences of the vacuum conditions instead of assumptions.
- R. Bonezzi, C. Chiaffrino, F. Diaz-Jaramillo and O. Hohm, "Gauge invariant double copy of Yang-Mills theory: The quartic theory," Phys. Rev. D **107**, no.12, 126015 (2023) doi:10.1103/PhysRevD.107.126015 [arXiv:2212.04513 [hep-th]]. 27 citations counted in INSPIRE as of 17 Sep 2024

  The author gives an explicit gauge invariant, off-shell and local double copy construction of gravity
- S. Chawla and C. Keeler, "Aligned fields double copy to Kerr-NUT-(A)dS," JHEP 04, 005 (2023) doi:10.1007/JHEP04(2023)005 [arXiv:2209.09275 [hep-th]]. 17 citations counted in INSPIRE as of 17 Sep 2024

  The author find a double copy relation between Abelian gauge fields and a large class of black hole spacetimes with spherical horizon topology known as the Kerr-NUT-(A)dS family.

#### Gravitational waves

• P. Di Vecchia, C. Heissenberg, R. Russo and G. Veneziano, "The gravitational eikonal: From particle, string and brane collisions to black-hole encounters," Phys. Rept. **1083**, 1-169 (2024) doi:10.1016/j.physrep.2024.06.002 [arXiv:2306.16488 [hep-th]]. 60 citations counted in INSPIRE as of 16 Sep 2024 Review paper. The author discuss how the gravitational ekinoal approach can be applied to invarious different physical set ups involving particles, strings and branes and then we mainly concentrate on the most recent developments.

#### Effective theories of BH

• L. Cangemi, M. Chiodaroli, H. Johansson, A. Ochirov, P. Pichini and E. Skvortsov, "Kerr Black Holes From Massive Higher-Spin Gauge Symmetry," Phys. Rev. Lett. 131, no.22, 221401 (2023) doi:10.1103/PhysRevLett.131.221401 [arXiv:2212.06120 [hep-th]]. 52 citations counted in INSPIRE as of 16 Sep 2024

The author propose that the dynamics of Kerr black holes is strongly constrained by the principle of gauge symmetry, and show that the known three-point Kerr amplitudes are uniquely predicted using massive higher-spin gauge symmetry.

## Classical and Quantum gravitational scattering

• R. Aoude, K. Haddad and A. Helset, "Classical Gravitational Spinning-Spinless Scattering at O(G2S∞)," Phys. Rev. Lett. **129**, no.14, 141102 (2022) doi:10.1103/PhysRevLett.129.141102 [arXiv:2205.02809 [hep-th]]. 73 citations counted in INSPIRE as of 16 Sep 2024

The author calculate the classical gravitational scattering amplitude for one spinning and one spinless object at  $O(G^2)$  and all orders in spin, which exhibits the spin structure that has been conjectured to describe Kerr black holes

- F. Alessio and P. Di Vecchia, "Radiation reaction for spinning black-hole scattering," Phys. Lett. B 832, 137258 (2022) doi:10.1016/j.physletb.2022.137258 [arXiv:2203.13272 [hep-th]]. 54 citations counted in INSPIRE as of 16 Sep 2024 Starting from the leading soft term of the 5-point amplitude, involving a graviton and two Kerr black holes, the author determine the radiative contribution to the real part of the two-loop eikonal.
- G. U. Jakobsen and G. Mogull, "Conservative and Radiative Dynamics of Spinning Bodies at Third Post-Minkowskian Order Using Worldline Quantum Field Theory," Phys. Rev. Lett. 128, no.14, 141102 (2022) doi:10.1103/PhysRevLett.128.141102 [arXiv:2201.07778 [hep-th]]. 96 citations counted in INSPIRE as of 16 Sep 2024 Using the spinning worldline quantum field theory formalism, the author compute the conservative scattering angle and the radiation-reaction effects.
- A. Cristofoli, R. Gonzo, N. Moynihan, D. O'Connell, A. Ross, M. Sergola and C. D. White, "The uncertainty principle and classical amplitudes," JHEP **06**, 181 (2024) doi:10.1007/JHEP06(2024)181 [arXiv:2112.07556 [hep-th]]. 80 citations counted in INSPIRE as of 16 Sep 2024

  The author discussed how the classical limit is encoded in the quantum-first definition of field theory through scattering amplitudes
- R. Aoude and A. Ochirov, "Classical observables from coherent-spin amplitudes," JHEP 10, 008 (2021) doi:10.1007/JHEP10(2021)008 [arXiv:2108.01649 [hep-th]]. 75 citations counted in INSPIRE as of 16 Sep 2024

  The author promote the KMOC formalism to describe general classical spinning objects by using coherent spin states.
- C. Cheung, N. Shah and M. P. Solon, "Mining the Geodesic Equation for Scattering Data," Phys. Rev. D **103**, no.2, 024030 (2021) doi:10.1103/PhysRevD.103.024030 [arXiv:2010.08568 [hep-th]]. 65 citations counted in INSPIRE as of 17 Sep 2024 The author explore how the geodesic equation encodes conservative dynamics in the presence of an arbitrary perturbative correction away from a non-spinning black hole binary system in general relativity.
- A. Luna, N. Moynihan, D. O'Connell and A. Ross, "Observables from the spinning eikonal," JHEP **08**, 045 (2024) doi:10.1007/JHEP08(2024)045 [arXiv:2312.09960 [hep-th]]. 14 citations counted in INSPIRE as of 17 Sep 2024

  The author study the classical dynamics of spinning particles using scattering amplitudes and eikonal exponentiation.
- D. Kosmopoulos and M. P. Solon, "Gravitational self force from scattering amplitudes in curved space," JHEP **03**, 125 (2024) doi:10.1007/JHEP03(2024)125 [arXiv:2308.15304 [hep-th]]. 18 citations counted in INSPIRE as of 17 Sep 2024 The author employ scattering amplitudes in curved space to model the dynamics of a light probe particle orbiting in the background spacetime.

- Z. Bern, D. Kosmopoulos, A. Luna, R. Roiban, T. Scheopner, F. Teng and J. Vines, "Quantum field theory, worldline theory, and spin magnitude change in orbital evolution," Phys. Rev. D 109, no.4, 045011 (2024) doi:10.1103/PhysRevD.109.045011 [arXiv:2308.14176 [hep-th]]. 21 citations counted in INSPIRE as of 17 Sep 2024 The author clarify the nature of additional Wilson coefficients appear compared to current worldline approaches.
- R. Gonzo and C. Shi, "Boundary to bound dictionary for generic Kerr orbits," Phys. Rev. D **108**, no.8, 084065 (2023) doi:10.1103/PhysRevD.108.084065 [arXiv:2304.06066 [hep-th]]. 20 citations counted in INSPIRE as of 17 Sep 2024

  The author establish a new relation between classical observables for scattering and bound orbits of a massive probe particle in a Kerr background.
- N. E. J. Bjerrum-Bohr, L. Planté and P. Vanhove, "Effective Field Theory and Applications: Weak Field Observables from Scattering Amplitudes in Quantum Field Theory," [arXiv:2212.08957 [hep-th]]. 19 citations counted in INSPIRE as of 17 Sep 2024

The author discuss classical components of perturbative weak-field scattering amplitudes until the fourth post-Minkowskian order based on an effective field theory extension of the Einstein-Hilbert action.

## Holography

- S. Pasterski and A. Puhm, "Shifting spin on the celestial sphere," Phys. Rev. D **104**, no.8, 086020 (2021) doi:10.1103/PhysRevD.104.086020 [arXiv:2012.15694 [hep-th]]. 69 citations counted in INSPIRE as of 17 Sep 2024

  The author aims to expand the existing framework surrounding conformal primary states. They explore conformal primary wavefunctions for all half integer spins up to the graviton within the Celestial Holography program.
- E. Crawley, A. Guevara, E. Himwich and A. Strominger, "Self-dual black holes in celestial holography," JHEP **09**, 109 (2023) doi:10.1007/JHEP09(2023)109 [arXiv:2302.06661 [hep-th]]. 19 citations counted in INSPIRE as of 17 Sep 2024

  The author use the celestial holography formalism to construct 2D quantum states for 4D linearized rotating self-dual black holes in (2,2) signature Klein space.

## Formal Amplitude Method

- A. S. K. Chen, H. Elvang and A. Herderschee, "Bootstrapping the String Kawai-Lewellen-Tye Kernel," Phys. Rev. Lett. **131**, no.3, 031602 (2023) doi:10.1103/PhysRevLett.131.031602 [arXiv:2302.04895 [hep-th]]. 15 citations counted in INSPIRE as of 17 Sep 2024

  This paper extends the minimal rank KLT bootstrap to 6-point, finding novel restrictions on the 4 and 5-point double-copy maps.
- A. Cristofoli, A. Elkhidir, A. Ilderton and D. O'Connell, "Large gauge effects and the structure of amplitudes," JHEP **06**, 204 (2023) doi:10.1007/JHEP06(2023)204 [arXiv:2211.16438 [hep-th]]. 12 citations counted in INSPIRE as of 17 Sep 2024

The author show that large gauge transformations modify the structure of momentum conservation.

Z. Bern, J. J. Carrasco, M. Chiodaroli, H. Johansson and R. Roiban, "The duality between color and kinematics and its applications," J. Phys. A **57**, no.33, 333002 (2024) doi:10.1088/1751-8121/ad5fd0 [arXiv:1909.01358 [hep-th]]. 455 citations counted in INSPIRE as of 23 Sep 2024

## CK duality in curved spacetime

- C. Cheung, J. Parra-Martinez and A. Sivaramakrishnan, "On-shell correlators and color-kinematics duality in curved symmetric spacetimes," JHEP **05**, 027 (2022) doi:10.1007/JHEP05(2022)027 [arXiv:2201.05147 [hep-th]]. 50 citations counted in INSPIRE as of 23 Sep 2024
  - The author introduce a isometry frame on symmetric manifold to define a perturbatively calculable quantity—the on-shell correlator, which can be seen as the generalization of on-shell quantity to curved spacetime.
- M. Ben-Shahar and H. Johansson, "Off-shell color-kinematics duality for Chern-Simons," JHEP **08**, 035 (2022) doi:10.1007/JHEP08(2022)035 [arXiv:2112.11452 [hep-th]]. 52 citations counted in INSPIRE as of 23 Sep 2024

  The author show that 3D Chern-Simons theory obeys off-shell color-kinematics duality and this holds both for gauge field and BRST ghosts.
- C. Cheung and J. Mangan, "Covariant color-kinematics duality," JHEP 11, 069 (2021) doi:10.1007/JHEP11(2021)069 [arXiv:2108.02276 [hep-th]]. 65 citations counted in INSPIRE as of 23 Sep 2024

  The author construct an explicit implementation of the double copy at the level of fields and equations of motion. They find that YM theory has a so-called "covariant double copy" property and can be related to GR.
- H. H. Chi, H. Elvang, A. Herderschee, C. R. T. Jones and S. Paranjape, "Generalizations of the double-copy: the KLT bootstrap," JHEP **03**, 077 (2022) doi:10.1007/JHEP03(2022)07 [arXiv:2106.12600 [hep-th]]. 50 citations counted in INSPIRE as of 23 Sep 2024 The author formulate a new program to generalize the double-copy of tree amplitudes. They solve the KLT bootstrap equations perturbatively to find the most general higher-derivative corrections to the 4- and 5-point field theory KLT kernel.
- X. Zhou, "Double Copy Relation in AdS Space," Phys. Rev. Lett. **127**, no.14, 141601 (2021) doi:10.1103/PhysRevLett.127.141601 [arXiv:2106.07651 [hep-th]]. 58 citations counted in INSPIRE as of 23 Sep 2024

  The author present a double copy relation in AdS<sub>5</sub> which relates tree-level four-point amplitudes of supergravity, super Yang-Mills and bi-adjoint scalars.
- M. Campiglia and S. Nagy, "A double copy for asymptotic symmetries in the self-dual sector," JHEP **03**, 262 (2021) doi:10.1007/JHEP03(2021)262 [arXiv:2102.01680 [hep-th]]. 63 citations counted in INSPIRE as of 23 Sep 2024

  The author find an infinite set of double copy constructible symmetries the self-dual sectors of Yang-Mills (YM) and gravity, in the light-cone formulation.

- S. Albayrak, S. Kharel and D. Meltzer, "On duality of color and kinematics in (A)dS momentum space," JHEP **03**, 249 (2021) doi:10.1007/JHEP03(2021)249 [arXiv:2012.10460 [hep-th]]. 80 citations counted in INSPIRE as of 24 Sep 2024 The author explore color-kinematic duality for tree-level AdS/CFT correlators in momentum space, including the integrated correlator and the integrand.
- C. Armstrong, A. E. Lipstein and J. Mei, "Color/kinematics duality in AdS<sub>4</sub>," JHEP **02**, 194 (2021) doi:10.1007/JHEP02(2021)194 [arXiv:2012.02059 [hep-th]]. 87 citations counted in INSPIRE as of 24 Sep 2024

  The author find analogous BCJ relations for Yang-Mills amplitudes in AdS4 and spell out the relation to 3d conformal correlators in momentum space, and speculate on the double copy to graviton amplitudes in AdS4.
- E. Casali and A. Puhm, "Double Copy for Celestial Amplitudes," Phys. Rev. Lett. 126, no.10, 101602 (2021) doi:10.1103/PhysRevLett.126.101602 [arXiv:2007.15027 [hep-th]]. 66 citations counted in INSPIRE as of 24 Sep 2024

  The author show that the celestial amplitudes persist the double copy relation by imposing a celestial double copy.

## Gravitational scattering

• M. V. S. Saketh, J. Vines, J. Steinhoff and A. Buonanno, "Conservative and radiative dynamics in classical relativistic scattering and bound systems," Phys. Rev. Res. 4, no.1, 013127 (2022) doi:10.1103/PhysRevResearch.4.013127 [arXiv:2109.05994 [gr-qc]]. 65 citations counted in INSPIRE as of 23 Sep 2024

The author compute for the first time the changes in linear momentum and the total radiated linear momentum, in the relativistic classical scattering of two point-charges, at sixth order in the charge.

## Classical double copy

- R. Monteiro, D. O'Connell, D. Peinador Veiga and M. Sergola, "Classical solutions and their double copy in split signature," JHEP **05**, 268 (2021) doi:10.1007/JHEP05(2021)268 [arXiv:2012.11190 [hep-th]]. 82 citations counted in INSPIRE as of 24 Sep 2024 The author find a classical interpretation for the three-point amplitude in a split-signature and the double copy of them give some implications of Lorentz signature. spacetime
- L. de la Cruz, B. Maybee, D. O'Connell and A. Ross, "Classical Yang-Mills observables from amplitudes," JHEP 12, 076 (2020) doi:10.1007/JHEP12(2020)076 [arXiv:2009.03842 [hep-th]]. 73 citations counted in INSPIRE as of 24 Sep 2024 The author study the classical Yang-Mills observables from the perspective of amplitudes, rather than equations of motion.
- C. Shi and J. Plefka, "Classical double copy of worldline quantum field theory," Phys. Rev. D **105**, no.2, 026007 (2022) doi:10.1103/PhysRevD.105.026007 [arXiv:2109.10345 [hep-th]]. 50 citations counted in INSPIRE as of 23 Sep 2024 The author establish a classical double copy relation of WQFT for classical observables (deflection, radiation).

- D. A. Easson, C. Keeler and T. Manton, "Classical double copy of nonsingular black holes," Phys. Rev. D **102**, no.8, 086015 (2020) doi:10.1103/PhysRevD.102.086015 [arXiv:2007.16186 [gr-qc]]. 53 citations counted in INSPIRE as of 24 Sep 2024 The author apply the classical double copy procedure to a class of regular, nonsingular black hole solutions, called T-dual-de sitter black hole. They also present the connection between horizons on the gravity side and electric fields on the gauge theory side of the double copy.
- C. Keeler, T. Manton and N. Monga, "From Navier-Stokes to Maxwell via Einstein," JHEP **08**, 147 (2020) doi:10.1007/JHEP08(2020)147 [arXiv:2005.04242 [hep-th]]. 56 citations counted in INSPIRE as of 24 Sep 2024 The author build the single copy gauge fields which map to fluid-dual metrics, for two different classes of Navier-Stokes solutions.

#### Twistor method

• C. D. White, "Twistorial Foundation for the Classical Double Copy," Phys. Rev. Lett. 126, no.6, 061602 (2021) doi:10.1103/PhysRevLett.126.061602 [arXiv:2012.02479 [hep-th]]. 90 citations counted in INSPIRE as of 24 Sep 2024

The author show that a particular incarnation - the Weyl double copy - can be derived using well-established ideas from twistor theory and answer many questions about double copy.

## Kinematics algebra

• E. Chacón, H. García-Compeán, A. Luna, R. Monteiro and C. D. White, "New heavenly double copies," JHEP 03, 247 (2021) doi:10.1007/JHEP03(2021)247 [arXiv:2008.09603 [hep-th]]. 59 citations counted in INSPIRE as of 24 Sep 2024

The author generalize the algebra of self-dual YM by Moyal deformations, in which case the color-kinematic duality is manifest. They also disscuss the classical integrability (or otherwise) of the gauge and gravity theories.

# BRST double copy

• L. Borsten, B. Jurčo, H. Kim, T. Macrelli, C. Saemann and M. Wolf, "Becchi-Rouet-Stora-Tyutin-Lagrangian Double Copy of Yang-Mills Theory," Phys. Rev. Lett. 126, no.19, 191601 (2021) doi:10.1103/PhysRevLett.126.191601 [arXiv:2007.13803 [hep-th]]. 63 citations counted in INSPIRE as of 24 Sep 2024

The author show that the double copy of gauge theory amplitudes to N = 0 supergravity amplitudes extends from tree level to loop level.

A. Momeni, J. Rumbutis and A. J. Tolley, "Massive Gravity from Double Copy," JHEP 12, 030 (2020) doi:10.1007/JHEP12(2020)030 [arXiv:2004.07853 [hep-th]]. 56 citations counted in INSPIRE as of 24 Sep 2024

The author explor the possibility of constructing an interacting massive spin-2 theory, i.e. massive gravity, as a double copy of massive Yang-Mills theory.