

1. VIRTUAL  
THEORY  
SUMMER  
SCHOOL



# The Amplitude Games

12 – 30 July 2021



<https://indico.mitp.uni-mainz.de/event/204/>

Organized by Maximilian Stahlhofen | U Freiburg • Christian Bogner •  
Zoltán Szőr • Stefan Weinzierl | JGU Mainz • Camila S. Machado | DESY



Coming soon:  
The Amplitude Games  
The Final





*In the year 2021 fifteen teams*

*In the year 2021 fifteen teams  
participated in the first Amplitude Games.*

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participated in the first Amplitude Games.*

*In the year 2021 fifteen teams  
participated in the first Amplitude Games.*

*They competed in the disciplines of*

*In the year 2021 fifteen teams  
participated in the first Amplitude Games.*

*They competed in the disciplines of*

*In the year 2021 fifteen teams  
participated in the first Amplitude Games.*

*They competed in the disciplines of*

*Basics of Scattering Amplitudes*



*In the year 2021 fifteen teams  
participated in the first Amplitudes Summer*

*They competed in the disciplines of*

*Basics of Scattering Amplitudes*

*Jet physics*

*In the year 2021 fifteen teams  
participated in the first Amplitudes Games.*

*They competed in the disciplines of*

*Basics of Scattering Amplitudes*

*Jet physics*

*Effective Field Theories*

*In the year 2021 fifteen teams  
participated in the first Amplitudes ~~course~~*

*They competed in the disciplines of*

*Basics of Scattering Amplitudes*

*Jet physics*

*Effective Field Theories*

*Geometry of Amplitudes*

*In the year 2021 fifteen teams  
participated in the first Amplitudes game.*

*They competed in the disciplines of*

*Basics of Scattering Amplitudes*

*Jet physics*

*Effective Field Theories*

*Geometry of Amplitudes*

*Mathematical concepts*

*In the year 2021 fifteen teams  
participated in the first Amplitudes' season.*

*They competed in the disciplines &*

*Basics of Scattering Amplitudes*

*Jet physics*

*Effective Field Theories*

*Geometry of Amplitudes*

*Mathematical concepts*

*Polylogs, elliptic polylogs etc.*

*At the year 2021 Einstein Forum,  
participated in the first Amplitudes course.*

*They competed in the disciplines:*

*Basics of Scattering Amplitudes  
Jet physics*

*Effective Field Theories*

*Geometry of Amplitudes*

*Mathematical concepts*

*Polylogs, elliptic polylogs etc.*

*The Coaction*

In the year 2021, fifteen young  
participants in the York Workshops came...  
*They competed in the disciplines of*

*Basics of Scattering Amplitudes,  
Jet physics  
Effective Field Theories  
Geometry of Amplitudes*

*Mathematical concepts*

*Polylogs, elliptic polylogs etc.*

*The Coaction*

*Double Copy*

*Investigated in the first half of the 20th century...*  
*They competed in the 1960s/70s/80s.*

*Basics of Scattering Amplitudes*  
*Jet physics*  
*Effective Field Theories*  
*Geometry of Amplitudes*

*Mathematical concepts*

*Polylogs, elliptic polylogs etc.*

*The Coaction*

*Double Copy*

*Bootstrap*



*They competed in the 1920s.*

*Basics of Scattering Amplitudes.*

*Let physics*

*Effective Field Theories*

*Geometry of Amplitudes*

*Mathematical concepts*

*Polylogs, elliptic polylogs etc.*

*The Coaction*

*Double Copy*

*Bootstrap*

*Amplitudes from the nodal Riemann surfaces*

*My computer in the background,  
Books of Scattering Amplitudes,  
JET physics  
Effective Field Theories  
Geometry of Amplitudes  
Mathematical concepts  
Polylogs, elliptic polylogs etc.,*

*The Coaction*

*Double Copy*

*Bootstrap*

*Amplitudes from the nodal Riemann sphere*

*String Amplitudes*

*Basis of Scattering Amplitudes*  
*As physics*  
*Effective Field Theories*  
*Geometry of Amplitudes*  
*Mathematical concepts*  
*Polylogs, elliptic polylogs etc.*  
*The Coaction*  
*Double Copy*

*Bootstrap*

*Amplitudes from the nodal Riemann surface*

*String Amplitudes*

*Study of Scattering Amplitudes*  
*4d physics*  
*Effective Field Theories*  
*Geometry of Amplitudes*  
*Mathematical concepts*  
*Polylogs, elliptic polylogs etc.*  
*The Coaction*  
*Double Copy*  
*Bootstrap*  
*Amplitudes from the nodal Riemann surface*  
*String Amplitudes*

*String  
Effective Field Theories  
Geometry of Amplitudes  
Mathematical concepts  
Polylogs, elliptic polylogs etc..  
The Coaction  
Double Copy  
Bootstrap  
Amplitudes from the nodal Riemann surface  
String Amplitudes*

*The winning team will be announced*

*2D/3D Field Theories  
Symmetry of Amplitudes  
Mathematical concepts  
Polylogs, elliptic polylogs, etc..  
The Coaction  
Double Copy  
Bootstrap  
Amplitudes from the nodal Riemann ~~surface~~  
String Amplitudes*

*The winning team will be announced  
shortly.*

*Symmetry of Amplitudes,  
Mathematical Concepts,  
Polygons, elliptic polylogarithms,  
The Coaction  
Double Copy  
Bootstrap  
Amplitudes from the nodal Riemann surface  
String Amplitudes*

*The winning team will be announced  
shortly.*

*Mathematical concepts  
Riemann, elliptic polylog, etc...  
The Coaction  
Double Copy  
Bootstrap  
Amplitudes from the nodal Riemann surface  
String Amplitudes*

*The winning team will be announced  
shortly.*



*Polymorphic bootstrap...*  
*The Conjecture*  
*Double Copy*  
*Bootstrap*  
*Amplitudes from the nodal Riemann surfaces*  
*String Amplitudes*

*The winning team will be announced  
shortly.*

*for citation  
please copy  
bootstrap  
Amplitudes from the noble ~~Research Papers~~  
String Amplitudes*

*The winning team will be announced  
shortly.*

Julio Cruz  
Abstract  
Amplitudes from the noble Neoclassical Regime  
String Amplitudes

*The winning team will be announced  
shortly.*

*Starting  
amplitudes from the stable vacuum states  
- Ring Amplitudes*

*The winning team will be announced  
shortly.*

*Amplitudes from the worldsheet, Regge,  
String Amplitudes*

*The winning team will be announced  
shortly.*

*.only Amplitude*

*The winning team will be assessed  
shortly.*

*The winning team will be assessed  
shortly.*

*The winning team will be announced shortly.*



The winning team will be announced  
shortly.

...



# The prize



After the second week (700 points out of 1100 points):

- Team 1 (650 points)
- Team 10 (603 points)
- Team 6 (600 points)
- Team 17 (566 points)
- Team 7 (554 points)

and the winner is ...

- Scientific Programs (for a period of several weeks)

MITP hosts several programs per year, each lasting for a period of up to four weeks. These programs are organized by a small team of scientists. Each will be attended by up to 25 scientists at any given time, who are expected to spend at least two weeks at MITP. Local housing expenses for accepted participants will be covered by MITP. The MITP guest relations team will arrange for housing according to the individual needs of participants.

- Topical Workshops (focused one-week workshops)

MITP offers to the scientific community the opportunity to hold one-week workshops devoted to a specific topic at the forefront of current research with a maximum number of 30 participants. MITP provides sufficient funds for participants and organizers.

<https://www.mitp.uni-mainz.de/>

and the winner is ...



# Team 1

- Andrés Aguilar
- Hao Chen
- Jorge Jaber-Urquiza
- Yuyu Mo
- Michael Saavedra

# Congratulations!

Participation is everything!

# Many thanks to

our lecturers:

- Henriette Elvang
- Alexander Huss
- Ira Rothstein
- Jacob Bourjaily
- Ruth Britto
- Claude Duhr
- Erik Panzer
- Donal O'Connell
- Lance Dixon
- Yvonne Geyer
- Oliver Schlotterer

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the homework correction team:

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- Juan Pablo Vesga Simmons
- Johann Usovitsch

# Many thanks to

the MITP staff:

- Olga Zeeh-Sourli
- Silke Köster
- Kerstin Massmann
- Sibylle Wittek
- Felix Achtmann

# Final words

- We hope that you enjoyed the school, learned new things about physics and made contact to fellow Ph.D. students.
- We hope that the ideas and content of the lecturers find fertile ground and we look forward to see in the future publications from you!

The organisers

Christian Bogner, Camila S. Machado, Maximilian Stahlhofen, Zoltán Szőr and Stefan Weinzierl