

27/05/2022

# Call for expression of interest: Post-doctoral researcher in particle physics phenomenology - Funded by the HFRI programme HOCTOOLS-II

This job offer has expired

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## Where to apply

Application Deadline: 31/08/2022 00:00 - Europe/Athens

## Contact Details

**Where to send your application.**

### COMPANY

National Center for Scientific Research &quot;Demokritos&quot;

### E-MAIL

cgppdo@inp.demokritos.gr

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## Hiring/Funding Organisation/Institute

**ORGANISATION/COMPANY**

**COUNTRY**

National Center for Scientific Research  
&quot;Demokritos&quot;

Greece

**DEPARTMENT**

Institute of Nuclear and Particle Physics -  
Theoretical High Energy Physics

**CITY**

Agia Paraskevi

**POSTAL CODE**

15341

**ORGANISATION TYPE**

Public Research Institution

**STREET**

Patr. Gregoriou E & 27  
Neapoleos Str.

**WEBSITE**

<http://www.inp.demokritos.gr>

**ORGANISATION/COMPANY**

National Center for Scientific Research  
&quot;Demokritos&quot;

**LOCATION**

Greece › Athens

**RESEARCH FIELD**

Physics › Other

**TYPE OF CONTRACT**

Temporary

**RESEARCHER PROFILE**

Recognised Researcher (R2)  
Established Researcher (R3)

**JOB STATUS**

Full-time

**APPLICATION DEADLINE**

31/08/2022 00:00 - Europe/Athens

**HOURS PER WEEK**

40

## OFFER DESCRIPTION

- Post-doctoral fellow, remunerated, 26 months.

The post-doctoral researcher will contribute to Work packages, WP1, WP3 and WP4. It is expected to have appropriate expertise in amplitude reduction at the integrand level, at least at one loop. Under the guidance and advice of the Principal Investigator (PI), and the other senior members of the team, and in collaboration with the PI's PhD students, his main task is the development of the HELAC2LOOP programme. After a brief familiarisation with the HELAC framework, it is expected to develop the so-called topology and skeleton generator at two loops, including the rational terms, and implement the cut-equations to reduce the amplitude in terms of irreducible integrals.

WP1: Amplitude reduction at the integrand level beyond one-loop

Establishing and studying the reduction of a general two-loop amplitude at the integrand level will be the main objective addressed within WP1.

Task 1: Expressing  $n$ -particle two-loop amplitude, at the integrand level, in terms of the  $(n + 4)$ -particle tree-order ones, using HELAC generator.

Task 2: Using the cut-equations to decompose the amplitude in terms of irreducible-integral coefficients.

Task 3: Computation of rational terms and implementation in HELAC, up to two loops.

Task 4: Once this reduction scheme is being established it will be implemented in an efficient computer code, HELAC2LOOP, as part of the HELAC framework.

WP2: Evaluation of multi-loop Master Integrals

The evaluation of Master Integrals at two loops is the objective of WP2. Based on the method of simplified differential equations approach and the Internal Reduction method, we plan to analytically express all five-point two-loop Master Integrals with one off-shell leg and provide computational tools for their efficient numerical evaluation.

Task 1: Determination of a pure-function basis of MI, based on their maximal cuts of MI in Baikov representation and their dlog-form.

Task 2: Construction of canonical differential equations making use of recently developed computational tools of integration by parts identities.

Task 3: Implementing the analytic results in an efficient computer code, integrated in HALEAC2LOOP.

WP3: Automated computation and applications to scattering processes at the LHC

Within the current project we provide two-loop amplitudes for 2 to 3 processes, relevant to 3-photon, 3-jet and  $W/Z/H + 2$ -jet production.

Task 1: Validating HELAC2LOOP for 2 to 2 processes against known results on two-loop matrix elements for 2-parton,  $W/Z/H + 1$ -parton and  $V_1V_2$  ( $V_{1;2} = W/Z/H$ ) production.

Task2: Using HELAC2LOOP to evaluate new two-loop amplitudes for 3-photon, 3-jet and  $W/Z/H + 2$ -jet production.

Task 3: Designing and developing the necessary interfaces to the computational framework of sector-improved residue subtraction method, STRIPPER, in order to study QCD NNLO corrections to 2 to 3 processes at the LHC.

For more information see here

## More Information

ADDITIONAL INFORMATION

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# Additional comments

This is a call for expression of interest. The actual opening will follow the rules of the host institution. The position will be filled as soon as the appropriate candidate is selected. The selected researcher has to start the work contract before 2/2023.

## REQUIREMENTS

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### Offer Requirements

#### **REQUIRED EDUCATION LEVEL**

Physics: PhD or equivalent

## Skills/Qualifications

PhD in theoretical particle physics

## Specific Requirements

The successful candidate should be familiar with Linux, Fortran, C++, Mathematica, Maple and LaTeX.

It is desirable to have working experience with HELAC or similar generators, integration-by-parts reduction software for multi-loop integrals such as FIRE/KIRA/REDUZE, Feynman integral computational tools such as FIESTA/pySecDec/MBTools.

#### **WORK LOCATION(S)**

1 position(s) available at  
Institute of Nuclear  
&amp;amp; Particle  
Physics

Greece

Athens

EURAXESS offer ID: 791312

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