

Career Development Plan - Year 1

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Name of Supervisor: Johannes Bluemlein

Date: 24/03/2015

BRIEF OVERVIEW OF RESEARCH PROJECT AND MAJOR ACCOMPLISHMENTS EXPECTED (half page should be sufficient)

The accurate calculation of QED radiative corrections in e^+e^- annihilation is particularly important for phenomenological applications such as the precise determination of the Z boson width at a future linear collider, because they include large logarithmic enhancements of the ratio of the electron mass m_e and the physical scale of the process M_Z . The process constitutes an important background to Higgs production. All logarithmic and the constant term in m_e^2/s can be factorized by means of universal operator matrix elements, which carry all the dependence on m_e , and into massless Wilson coefficients. The power corrections in m_e^2/s are negligibly small. While the method works for massless external lines, it still has to be established for massive external fermion lines in the operator product expansion.

The first stages of this project will be focused on the calculation of the two-loop cross section. This will allow to determine a consistent expansion in terms of operator matrix elements and to derive the corresponding Feynman rules. Important other applications concern the production of other heavy bosons out of massive fermion initial states. Generalizations to 3-loops are possible.

LONG TERM CAREER OBJECTIVES (over 5 years):

1. Goals:

- ✓ Original research work, leading to publications on peer-reviewed journals.
- ✓ Presentation of my research to the community of particle physics.
- ✓ Completion of the first postdoc contract leading to a new position in particle physics.

2. What further research activity or other training is needed to attain these goals?

- ✓ Interaction with other scientists in particle physics, especially experimentalists, and with mathematicians, in order to get multiple points of view on the problem.
- ✓ Networking, communication and presentation skills.
- ✓ Training in writing applications for scientific positions and research grants.

- ✓ Secondment to Private Sector Partner to learn about research out of the academic environment.

SHORT-TERM OBJECTIVES (1-2 years):

1. *Research results:*

- *Anticipated publications:*
 - ✓ Completion of the initial problem on the two-loop calculation and the operator product expansion.
 - ✓ Further extension of the methods above to the three-loop case.
- *Anticipated conference, workshop attendance, courses, and/or seminar presentations:*
 - ✓ Attending all HiggsTools meetings (Young Researcher meetings, Annual Meetings, Annual Schools, etc).
 - ✓ Attending major conferences in the area of particle physics, such as Loops and Legs in 2016, and presentation of my research.
 - ✓ Presentation of work at HiggsTools Annual Meetings and Young Researcher Meetings. Giving Seminars within Zeuthen and at other nodes of the network.

2. *Research Skills and techniques:*

- *Training in specific new areas, or technical expertise etc.:*
 - ✓ Further training in modern mathematical methods, especially regarding the treatment of special functions and in computational techniques for multiloop calculations.
 - ✓ Further training in the application of theory to experiment.

3. *Research management:*

- *Fellowship or other funding applications planned (indicate name of award if known; include fellowships with entire funding periods, grants written/applied for/received, professional society presentation awards or travel awards, etc.)*
 - ✓ Aim is to make application for EU Marie Skłodowska-Curie Fellowship in 2016.

4. *Communication skills:*

see above

5. *Other professional training (course work, teaching activity)*

- ✓ Teaching to undergraduate students, which will also to improve communication and presentation skills.

6. *Anticipated networking opportunities*

- ✓ Networking with the other ESRs within Higgstools and with the researchers at Zeuthen.

7. *Other activities (community, etc.) with professional relevance:*

- ✓ Training in how to communicate science effectively, in order to convey how it can contribute to society.

Date & Signature of ESR: 24/03/2015 *Giulio Taliani*

Date Signature of Supervisor: *J. Blum*