HI JENA
Helmholtz Institute Jena

HIXPS

Master Project in High-Intensity Laser-Plasma-Theory

Simulation of Nonlinear Breit-Wheeler Pair Production Spectra

Breit-Wheeler pair production, i.e. the conversion of light into matter, is probably one of the most difficult fundament QED process to investigate experimentally. It becomes possible only now to study the process by using high-intensity Petawatt-class lasers, which can provide the required photon fluxes necessary to produce detectable amounts of matter from light in the laboratory. In the non-linear regime the process behaves like a nonlinear quantum tunneling process, which is often described as 'breakdown of the vacuum'. Theoretically, the process is described within the framework of strong-field QED (SF-QED).

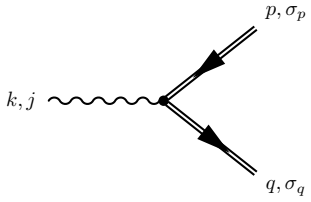
For planned future BW pair production experiments in the linear and non-linear regimes we need better theoretical predictions of the expected spectra and angular distributions of the generated pairs. This will be an important aspect of the project. Besides that, the project offers great opportunities for further exploring SF-QED processes at large.

Your have

- High level of motivation and self-responsible work ethics
- Interest in analytical and numerical work, some programming skills
- Excellent knowledge of electrodynamics and special relativity
- Particle physics and quantum field theory knowledge beneficial

We Offer

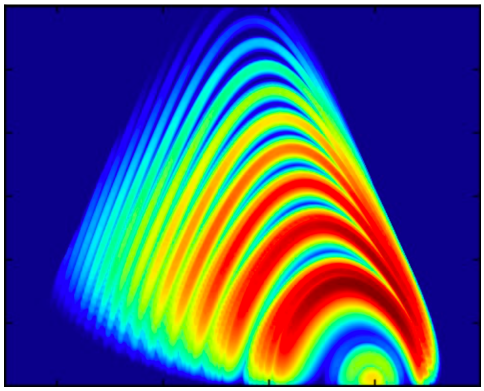
- An interesting and timely theoretical research project with close connection to experiment
- Challenging analytical and numerical tasks
- A well-defined core project with opportunities for own exploration of the field of SF-QED



$$S_{\mathrm{NBW}} = -ie \int \mathrm{d}^4x \, \bar{\Psi}_q^{(-)}(x) \not{\epsilon} e^{-ik.x} \Psi_p^{(+)}(x)$$

↑ SF-QED Feynman diagram and S-matrix

Positron spectrum in the multi-photon regime →



Contact:
Computational High-Intensity Plasma Science
Dr. Daniel Seipt, Helmholtzweg 4, Office D207
Tel: +49-3641-947624
daniel.seipt@uni-jena.de