

**P-TH** Research project title:

**Low-order harmonic (third and fifth) generation in femtosecond optical pulses propagating in chi-3 media**

**TASK:**

This task consists in demonstrating a simulation of the spatial profile of the third harmonic radiation generated in femtosecond filaments in air. An experimental paper is attached to this package. Your task is reproduce in numerical simulation the key findings of this work. In particular, you should be able to demonstrate distinct conical and on-axis components of the third harmonic radiation. As an add-on you may e.g. measure their respective energies versus the pump pulse energy as it was done in the experiment.

Crucial for this simulation are sufficient transverse (spatial) and temporal grid resolutions. Utilize the appropriate results from the paper to estimate how fine your spatial resolution should be before attempting the simulation. Show this estimate in your report.

**DELIVERABLE:**

Report in pdf format. Simulation input files and examples of generated data to illustrate that your numerical experiment captures the essential result(s) of the experiment.

**OPTIONAL EXTENSION A:**

Set up a simulation with a tightly focused pulse, and measure the ratio between the power in the third harmonic and fifth harmonic as a function of the input pulse energy or intensity in the focus. Look up a recent paper by B. Shim and A. Gaeta (in PRL) concerning the third and fifth harmonic generation in optical filaments to inform you numerical experiment.

Hint: Files with `_W_` in their names carry the all-angle integrated spectral power in the log scale. As a rough, relative measure of the energy in TH and/or FH component(s), it is sufficient to read the height of the corresponding peak.

**START-FROM-MATERIAL:**

Work package *wrk\_08\_Third\_Harmonic\_Generation* provides a suitable template.