P-SC Simulation project:
Soliton fission and soliton dynamics as the underlying mechanism of supercontinuum generation in microstructure fibers.

Goal: Study, understand, and reproduce in simulation as much as possible of the exp/theory paper provided for this project.

Point of departure: *wrk_050_Supercontinuum_Microstructure_Fiber* provides a suitable template.

P-TH Simulation project:
Low-order harmonic (third and fifth) generation in femtosecond optical pulses propagating in chi-3 media

Point of departure: *wrk_08_Third_Harmonic_Generation* provides a suitable template.

P-CHI2 Programming project
Design of a CHI-2 medium nonlinear response plugin for the UPPEcore simulator

Aim: produce a simple exercise package for future use in this class. It should illustrate basics of second-harmonic generation, and in particular SHG from ultrashort pulse in "long" and "short" crystals.

Point of departure: Simulation template with a complete example of "my-Kerr-medium," *wrk_x20_User-Defined_Extensions_Medium_Response*, can be modified in a simple way, requiring only modest programming.

P-INC Programming project
Design an initial condition plugin for the UPPEcore simulator

Aim: Experimental pulses are often characterized in terms of spectral power and spectral phase. An initial condition implementation using such input data is needed for (g)UPPEcore simulators — eventually this would be included in the core simulator.

Point of departure: *wrk_x10_User-Defined_Extensions_Initial_Conditions* provides a simple-to-modify template for the interface with the simulator. Your task can therefore concentrate solely on the initial condition code.

P-SIM Simulator design project
Design a simple UPPEcore-like pulse propagation simulator

Point of departure: Linear propagator constructed for a homework assignment. Numerical solution strategy will be discussed in the class. Note that this is relatively more ambitious project.

P-RES Research project
Single-Shot Supercontinuum Spectral Interferometry for absolute measurement of optical nonlinearity in femtosecond pulses

Aim: SSSSI is a state of the art method to measure important nonlinear characteristics of gases. You task will be to study and understand this method in detail, and describe it to your peers. As an optional add-on, write a Matlab (or other) script to exctract nonlinear phase shifts form the interferograms.

Point of departure: Several papers will be provided by the instructor.