Assignment of presentations

PHYS 607 – Nonlinear Fibre Optics

Prof. Luc Thévenaz, Prof. Brès – 9th of December 2022

Typical duration is 15-20 minutes per presentation, including questions, so the presentation should not include more than max. 10-12 slides. Since these presentations are a complement to the lecture, you are requested to attend the full session. Please **send a copy of your presentation** as "proof of exam".

I. **Nonlinear Schrödinger equation: solution, self-similar compression, and limitations - Wu Jiaye**
How to obtain numerical solutions, extreme cases with exotic dispersion profile.

II. **Soliton solution - Ji Xinru**
Demonstrate the soliton solution from the nonlinear Schrödinger equation.

III. **All optical regeneration - Alvarez Castaño Maria Isabel**
Explain the principle of the SPM based Mamyshev 2R regenerator and important design considerations for such regenerator.

IV. **Optical demultiplexing (sampling) - Koyaz Yesim**
Explain how XPM or FWM can be used for demultiplexing a time multiplexed data stream. Show that FWM based demultiplexing can result in a narrowing of the sampling window with respect to the initial sampling pulse under certain conditions. Compare the two approaches.

V. **Phase sensitive parametric amplification - Siddharth Anat**
Explain the principle and show it can lead to noise free amplification.

VI. **Raman amplification - Yildirim Mustafa**
Show the different pumping schemes (forward or backward pumping) with advantages and drawbacks and explain why the Raman amplification generates a low excess noise.

VII. **Brillouin amplification - Yang Yuting**
Describe and explain the paradox that Brillouin amplifiers show a large excess noise, but Brillouin lasers can generate extremely coherent light, much more coherent than the pumping light.

VIII. **Fibre gyroscope - Richter Felix Ulrich**
Explain the principle of operation for the optical fibre gyroscope based on a Sagnac loop interferometer and show how the optical nonlinearities set a limit to the accuracy. Explain the strategies to minimize these limitations.

IX. **Light polarisation controlled by light - Ünlü Buse**
Describe a couple of solutions to actively control the polarisation of a lightwave by another lightwave (e.g. using Brillouin, Raman and Kerr effects).

X. **Optical parametric oscillators - Brunetta Samuele**
Describe the functioning of an optical parametric oscillator based on the Kerr effect, explain the threshold and the tunability of such oscillator.

XI. **All optical regeneration (2R) based on parametric amplification - Hefti Olivia Mathilde**
Explain how either higher order FWM output or FWM saturation in a parametric amplifier can be used to regenerate (2R) a signal. Describe how noise (such as phase noise of the pump, sometimes intentionally used to increase Brillouin Threshold) influences the various techniques.

XII. **Non-reciprocity via self- and cross-phase modulation in optical resonators- Churaev Mikhail**