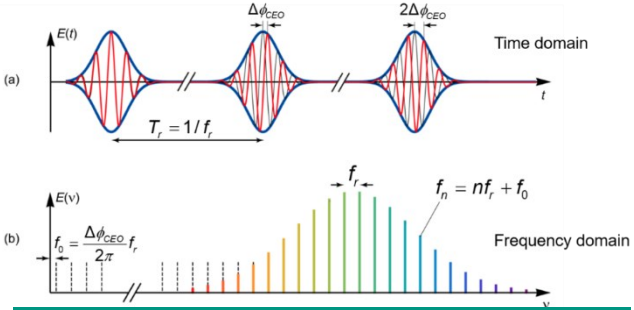
Bachelor / Master Thesis:

Broadband optical frequency comb generation using photonic integrated circuits with both second- and third-order nonlinearities

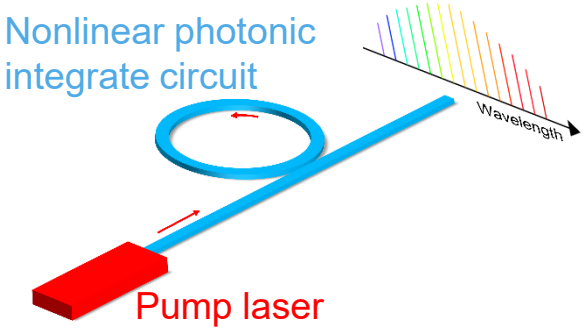
Introduction

Broadband optical frequency combs offer a multitude of narrow-linewidth, phase-locked optical tones, which can be used in a wide range of applications, such as broadband spectroscopy, massively parallel wavelength-division-multiplexing (WDM) optical communication, and high precision metrology [1]. Recently, photonic integrated comb sources that rely on either the Pockels effect (electro-optic comb) or Kerr nonlinearity (Kerr comb) have emerged as novel compact broadband light sources that can be efficiently manufactured in large quantities [2]. However, the spectral coverage of the resulting comb is still limited.

In this thesis work, you will investigate nonlinear photonic integrated circuits with combined second-order and third-order nonlinearities for generating broadband optical frequency combs. Such systems can be resonant or non-resonant structures using the thin-film lithium niobate (TFLN) or lithium tantalate (TFLT) platforms.



Optical frequency comb



Your tasks

- Perform the simulation of the comb evolution in the nonlinear photonic integrated circuits
- Design the nonlinear photonic integrated circuits
- Characterize the broadband comb generation

Dr. Huanfa Peng
huanfa.peng@kit.edu
Room 2.32-2
Bldg. 30.10
Tel. 0721-608-42480

Prof. Dr. Christian Koos
Christian.koos@kit.edu
Room 3.26
Bldg. 30.10
Tel. 0721-608-42481

[1] S. A. Diddams et al., “Optical frequency combs: Coherently uniting the electromagnetic spectrum,” Science, 369, 267, 2020.
[2] L. Chang, S. Liu, and J. E. Bowers, “Integrated optical frequency comb technologies,” Nature Photonics16, 95-108, 2022.