EFFICIENT MID-IR SUPERCONTINUUM GENERATION IN QUADRATIC NONLINEAR WAVEGUIDES (ESR2)

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Objectives

- SCG in near-IR pumped LN waveguides, bandwidth 0.5-4.0 μm
- Extended UV to mid-IR SCG in QPM LN waveguides, bandwidth 0.35-5.0 μm
- high-power (0.1 W) mid-IR SCG (2-9 μm) in ridge waveguides in, e.g., LiInS2

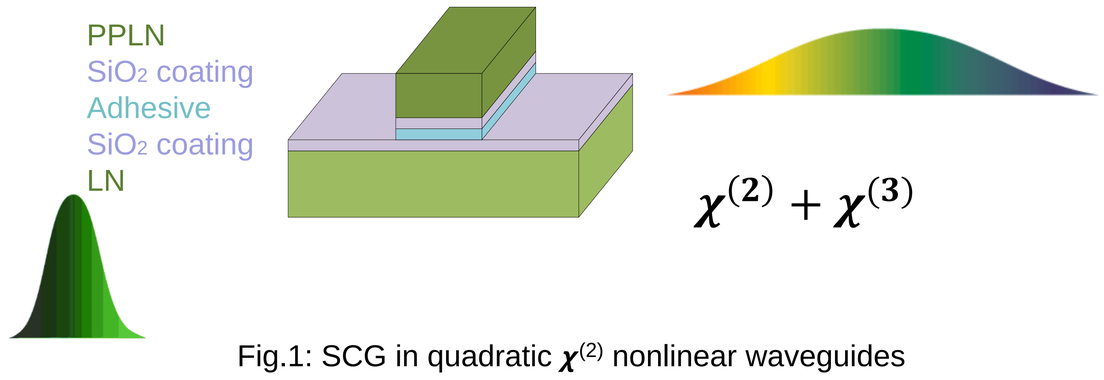

Fig.1: SCG in quadratic $\chi^{(2)}$ nonlinear waveguides

Summary of Results

- **MIR guidance**
  - transmission experiment shows the guidance of this waveguide in mid-IR up to 4.5 μm

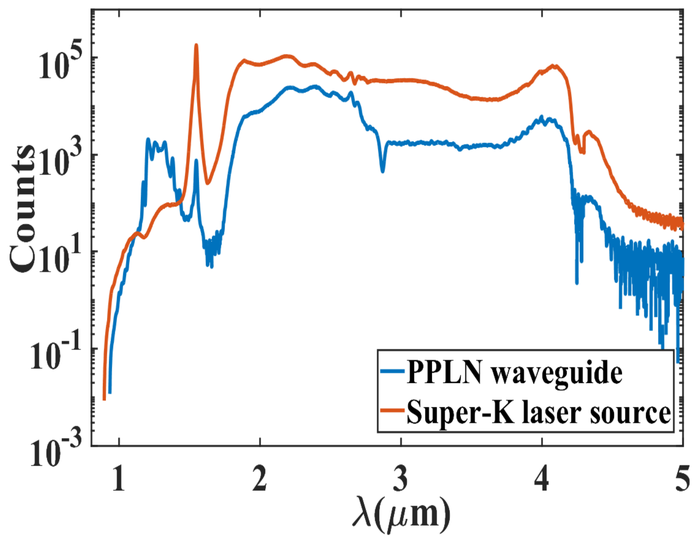

Fig.2: Measured transmission of the waveguide.

  - total dispersion is close to the material dispersion for shorter wavelengths, indicating good modal confinement.

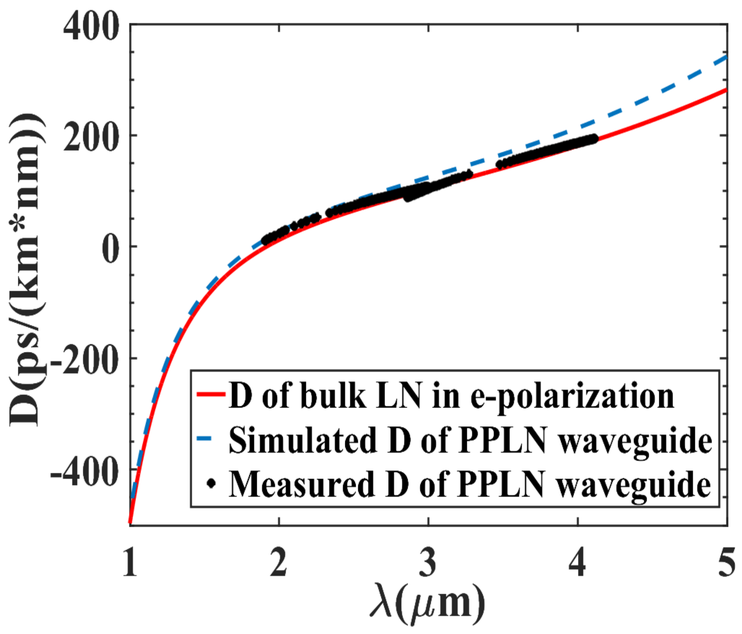

Fig.3: Measured dispersion relation and simulated group velocity dispersion

- **SC in Simulation**
  - With numerical dispersion relation, simulation of spectrum broadening with fs laser has been carried on a 26 um pitch PPLN waveguide. Spectrum broadening up to 3.5 μm and dispersive wave at 4.3 μm is observed.

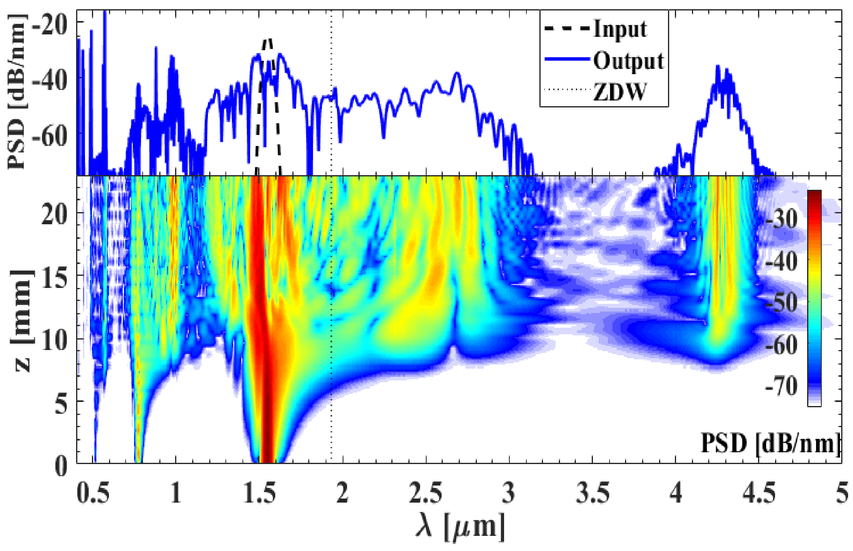

Fig.4: Numerical simulation of spectrum broadening in a 23 mm long, 26 μm pitched PPLN waveguide pumped by 125 fs laser with peak power of 10.4 kW at 1550 nm.

Progress towards objectives

- **Pump by OPA**
  - Further experiment to launch higher peak power into waveguide using OPA
  - SC extend to UV by pumping with tuneable wavelength OPA
- **Waveguide with other material**
  - Quadratic waveguide with LiInS2 or AlGaAs are planned to generate SC until 10 um

ECTS and Presentations

- **ECTS**
  - 22.5 has been finished
    - Nonlinear optics lectures in DTU
    - SC application lecture in DTU
    - Supercontinuum Training Event on 19-21 september, Besancon
    - Entrepreneurship training in Symposiumphotonic in Finland
    - Fiber drawing training at ITME in Warsaw
- **Poster presentations**
  - International OSA Network of Students, Copenhagen, Denmark, 5-9 June 2018
  - Symposium on Future Prospects for Photonics on Mid-Infrared Light Sources and Applications, Tampere, Finland, 12-14 December 2017. (poster presentation)

Secondments and Outreach activities

- **Secondments**
  - FOSS Analytical A/S
    - M33 – 1 week
    - Supervisor: Thomas Nikolajsen
    - Local ESR: ESR 14
    - Purpose: final application of MIR source
- **outreach activities**
  - Tutor in course 'Experimental Optics and Photonics Jun 17'
    - 48 hours, Copenhagen, Denmark

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SUPUVIR
SUPercontinuum broadband light sources covering UV to IR applications