Soutenance de thèse

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Supercontinuum generation in the silicon nitride platform

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Abstract :

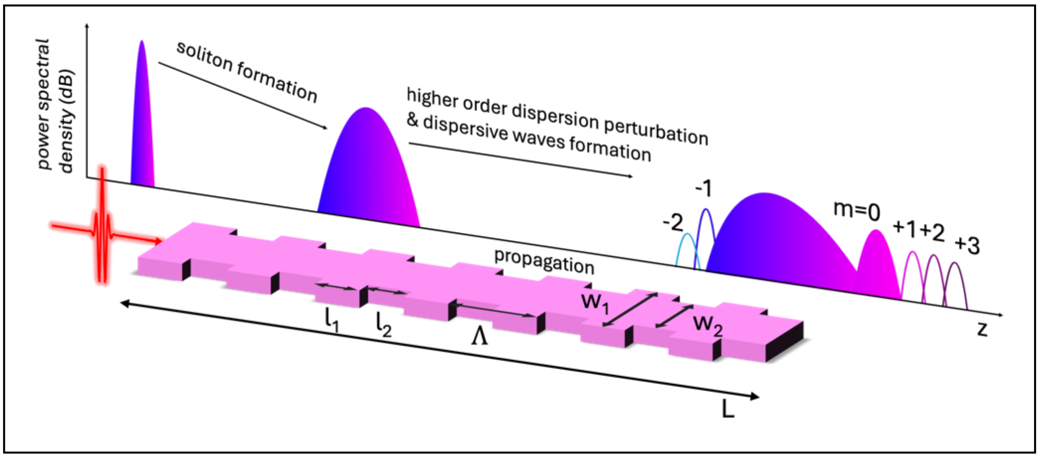
Nowadays various light sources in different wavelength ranges and serves an important role both for modern industries and people's daily lives. The crucial way towards light source in targeted wavelength range lying on nonlinear optics, which centered on strong light interacting with matters and trigger frequency conversion.

This research focuses on advancing nonlinear optics within silicon photonics to address the growing demand for energy-efficient, integrated, and portable light sources. Silicon photonics, leveraging materials like silicon (Si) and silicon nitride (Si_3N_4), offers key advantages such as high nonlinearity, scalability, and compatibility with semiconductor fabrication processes. The thesis emphasizes the development of supercontinuum generation (SCG) within integrated Si_3N_4 waveguides, aiming to create customizable and power-efficient broadband light sources for applications in medical diagnostics, spectroscopy, and metrology.

Key achievements include:

1. **Waveguide Fabrication and Characterization**: Optimization of waveguide design to minimize propagation loss and control dispersion.
2. **Quasi-Phase-Matching Innovation**: Introduction of dispersion modulation via waveguide width variation, providing enhanced control over spectral broadening.
3. **Self-Similar Pulse Compression**: Proposal and simulation of pulse compression techniques, achieving sub-200 fs pulse durations in a compact waveguide platform.

This work paves the way for fully integrated, on-chip SCG systems, offering tailored spectral broadening for a range of applications in visible and near-infrared wavelengths.



Concept of quasi-phase-matched dispersive waves generation in Si_3N_4 waveguide with group velocity dispersion modulation.