The Johns Hopkins University  
Whiting School of Engineering  
Department of Electrical and Computer Engineering

Study on Nonlinearity and Applications in Silicon Integrated Photonics

PhD Proposal Seminar by  
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Abstract:
With the exponential growth of data traffic in telecommunication, electrical interconnects based on copper traces and wires are nearly achieving the limitation of data transmission bandwidth requirements, and optical interconnects become extremely enticing due to the highly broad transmission bandwidth. Silicon integrated photonics has the potential to highly increase the data transmission bandwidth by developing on-chip optical interconnects and devices. Silicon photonics offers the main advantage of the compatibility of the mature complementary metal-oxide-semiconductor (CMOS) nano-fabrication technology.

Here we study on two different silicon based platforms: Hydrogenate amorphous silicon (a-Si:H) and silicon nitride. Hydrogenate amorphous silicon exhibits high nonlinearity, low deposition temperature and backend CMOS compatibility. Silicon nitride platform offers low linear loss and negligible nonlinear loss at telecommunication wavelength.

In this proposal, we have shown 3 different demonstrations based on the nonlinearity in Silicon integrated photonics. (1) Phase-sensitive amplification demonstration in a-Si:H waveguides (2) Mid-IR supercontinuum generation in a-Si:H waveguides (3) optical frequency combs in high-Q silicon nitride ring resonators.

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