Applied Mathematics Seminar

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Stabilizing Delay-Coupled Nanolasers via Polarization Lifetime Tuning

Coupled nanophotonic semiconductor lasers are a prototypical model for on-chip laser networks. Due to their small footprint and low power consumption they are promising light sources for a wide range of nanophotonic applications such as neuromorphic computing or secure optical communication. One crucial precondition for a successful photonic implementation is the knowledge about the borders of stability. Although a lot is known about the dynamics of delay-coupled macroscopic lasers,the question about how the small size of nano-lasers, i.e. the small photon lifetime, influences the stability under optical perturbations is still unanswered. Especially, if the dynamic degree of freedom of the microscopic polarization has to be considered (class-C laser model) .

We present an in-depth analysis of the dynamics for two non-identical class-C lasers with delayed coupling. Interestingly, a value of the polarization lifetime T2 can be found where the relative stability is optimal and better than in conventional lasers despite the fact that a second laser threshold to chaotic emission exists.

Wednesday, 06.10.2021 · 16:00 · online via MS Teams
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