

# Amplification of evanescent waves - novel dynamical regimes with exciton-polariton condensates and optical couplers

Kristian Rayanov

Optical couplers consist of waveguide pairs in close proximity such that evanescent waves tunnel between them. When embedded in an active medium, amplification of the evanescent becomes sensitive to the phase difference of the light field in the two waveguides. Remarkably a similar mechanism is at work for exciton-polariton condensate centres in close proximity to each other [1]. Here the field is made of the macroscopic wave function of the condensate. In all cases the phase-sensitive amplification increases the intensity and induces a nonlinear response, originating from a Kerr nonlinearity in the optical case, and mean field treated many-body interactions in the condensate case. The nonlinear response in turn reshapes intensity with nonamplified modes.

We observe a plethora of stable dynamical states, including limit cycles, quasiperiodic attractors, and even chaotic attractors. We study the domains of existence, bifurcation scenarios (including Andronov-Hopf and period doubling) and work on implications of the novel states on switching properties of optical couplers, and on the radiation spectrum in the case of exciton-polariton condensates.

## References

- [1] I. L. Aleiner, B. L. Altshuler, and Y. G. Rubo. Radiative coupling and weak lasing of exciton-polariton condensates. *Phys. Rev. B*, 85:121301, March 2012.