Nonlinear dynamics of driven optical resonators

Abstract: This course presents the theoretical foundations of nonlinear dynamics in driven optical resonators, with emphasis on fiber cavities and Kerr micro-resonators. Starting from cavity maps and propagation models, the course develops mean-field descriptions of dissipative nonlinear systems and analyzes temporal dynamics in driven cavities, including modulation instability, bistability, switching waves, pattern formation, and dissipative solitons. Connections between discrete and continuous models, stability analysis, and nonlinear dynamical behavior are discussed throughout the course, with applications to optical frequency comb generation in Kerr resonators.

Lecturer: Matteo Conforti received the Laurea degree in Electronic Engineering and the Ph.D. degree in Electronic Instrumentation from the University of Brescia in 2003 and 2007, respectively. Since 2014, he has been a researcher at the Laboratoire de Physique des Lasers, Atomes et Molécules (PhLAM). His main research interests include instabilities, solitons, rogue waves, shock waves, and nonlinear dynamics in optical resonators and fiber systems.