

PHYSICAL MATHEMATICS SEMINAR

MODELS AND DYNAMICS OF HIGH-POWER PULSED LASERS

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ABSTRACT:

In general, there are scarce analytical methods for the quantitative analysis of the nonlinear propagation of ultrashort optical pulses in fiber, which underlies the operation of femtosecond-pulse fiber lasers. Such methods are needed now as the current generation of fiber lasers promise to greatly enhance the performance of practical instruments. In general, a pulse undergoes large changes in its temporal shape, spectral shape, and phase or frequency as it traverses a fiber laser, which in turn pose severe challenges to mathematical models. Self-similar pulse evolution is remarkable because monotonically-evolving, asymptotic solutions of the governing wave equation exist, despite the periodic boundary condition of a laser resonator. Highly-chirped pulse solutions can also exist in the presence of strong dissipation, and these so-called dissipative solitons represent a new class of laser pulses that offers remarkable behavior and performance. Quantitative models for lasers based on these pulses will be developed from first principles. These models will be studied in appropriate parameter regimes where simplified nonlinear dynamical systems theory can be utilized. In all cases, stability of the pulse solutions is the crucial issue. The theoretical efforts are highly interdisciplinary: combining asymptotic and perturbation methods, scientific computation, and rigorous mathematical analysis with models that are based on, and validated by, experimental observations.

TUESDAY, OCTOBER 5, 2010

2:30 PM

Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 290

<http://math.mit.edu/pms/fall10>



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