

Colloquium speaker: Dr. Erwin Suazo (University of Texas Rio Grande Valley)

Title: On closed solutions for inhomogeneous linear and nonlinear Schrödinger equations and applications to optics

Abstract: The mathematical analysis of Partial Differential Equations (PDEs) has been fundamental to understanding how we can apply several PDEs to model real-life problems coming from physics, chemistry, biology and the social sciences. In this presentation we will discuss multi-parameter solutions of the inhomogeneous paraxial wave equation in a linear and quadratic approximation which include oscillating laser beams in a parabolic waveguide. Also, by means of similarity transformations we study exact analytical solutions for a generalized nonlinear Schrödinger equation with variable coefficients. This equation appears in literature describing the evolution of coherent light in a nonlinear Kerr medium, Bose-Einstein condensates phenomena and high-intensity pulse propagation in optical fibers. By restricting the coefficients to satisfy Ermakov-Riccati systems with multi-parameter solutions, we present conditions for existence of explicit solutions with singularities and a family of oscillating periodic soliton-type solutions. Also, we show the existence of bright-, dark- and Peregrine-type soliton solutions, and by means of a computer algebra system we exemplify the nontrivial dynamics of the solitary wave center of these solutions produced by our multi-parameter approach.