

Integrability of the KP-Whitham equations

Mark Hoefer

Department of Applied Mathematics, University of Colorado, Boulder

Abstract

The Kadomtsev-Petviashvili (KP) equation is an integrable, (2+1)-dimensional nonlinear wave PDE that admits a four-parameter family of unidirectional, periodic traveling wave solutions. The quasi-linear KP-Whitham modulation equations of hydrodynamic-type were derived in 2017 by Ablowitz, Biondini, and Wang but are not known to be integrable. This talk will present ongoing research on the integrability of certain reductions of the KP-Whitham equations. The soliton and harmonic wave limits are shown to be integrable via the Haantjes tensor test, method of hydrodynamic reductions, and the method of characteristics. Additionally, all two-dimensional reductions of the KP-Whitham system are shown to be integrable. The integrability of the two-dimensional reductions requires compatibility with the conservation of waves equation. By doing so, the number of modulation equations is reduced. This is joint work with Gino Biondini and Alex Bivolcic of SUNY Buffalo, and Antonio Moro of Northumbria University, UK.