

Speaker: Dirk Hundertmark, University of Illinois

Title: Regularity and decay properties of dispersion management solitons

Abstract:

In optical fiber communications the technique of ‘dispersion management’ was invented in the 90’s to create stable pulses in glass fiber cables by periodically varying the dispersion along the cable. This idea turned out to be enormously fruitful in allowing for ultra high-speed data transfer through optical fibers over intercontinental distances. Record breaking transmission rates of more than 1 Tbits/s over an 18,000 kilometer optical fiber had been achieved using this technology and the technique of dispersion management is now widely used commercially.

The propagation of pulses through an dispersion managed glass fiber cable is described by the Gabitov-Turitsyn equation, which is a non-local version of the non-linear Schrödinger equation. This equation has been extensively studied numerically and on the level of theoretical physics due to its enormous practical relevance in the modeling of signal-transfer through ultra-high high speed glass-fiber cables, but rigorous results are rare. As a test: google ‘dispersion management’ and you’ll get an overwhelming amount of hits (ca 404,000 at the moment) but only very few are rigorous (I know of 6).

We describe very recent work on the decay and regularity properties of stationary solutions of the Gabitov-Turitsyn equation (the so-called dispersion management solitons). Our results include a simple proof of existence of solutions of the dispersion management equation, regularity of weak solutions and, most recently (ca 4 weeks ago), a proof of exponential decay of dispersion management solitons. This is joint work with Burak Erdoğan and Young-Ran Lee.