

Background into Future PhD Research

The following research will be co-supervised by an international team of researchers that will include Dr Noel Smyth (Scotland), Prof Tim Minzoni (Mexico) and Prof Assanto (Italy)

Solitary waves are an unusual phenomena in many areas of physics, applied mathematics, oceanography, meteorology and other areas of science. The governing equations used to describe this wave phenomena is normally modelled Korteweg-de Vries equation, nonlinear Schrödinger equation and the Sine-Gordon equation.

While the interaction of solitary waves governed by equations exactly integrable by the inverse scattering method is, in principle, well understood, the same cannot be said of solitary waves governed by non-integrable equations.

Thus there needs to be an investigation into such interactions for a general class of nonlinear, nonlocal equations having solitary wave solutions.

Nonlinear, nonlocal solitary wave equations arise in a large number of application area, such as liquid crystals, colloidal media, thermal media and photorefractive media. In mathematical terms, systems of non-integrable, nonlinear partial differential equations in multiple space dimensions need to be studied.

Nematic liquid crystals have been the subject of extensive research due to their applications in display technology. Nematic liquid crystals and colloidal suspensions, can support particle like waves, such as the nematicon which is a solitary wave in a nematic liquid crystal. Their widespread physical applicability to their existence being due to a balance between the competing effects of nonlinearity and diffraction, independent of the fine details of the physics make them an important choice for photonic applications.

PhD training will be broad and incorporate the following areas

- analytic and asymptotic mathematical analysis
- numerical methods
- a full appreciation of the physical and experimental background.

This will give these students a solid background in applied mathematics and will stand them in good stead that will be advantageous to them in their forthcoming careers.

Dr Annette Worthy
School of Mathematics and Applied Statistics
Faculty of Informatics
University of Wollongong
Wollongong NSW 2500
Australia