

Proposed Project: Finite-gap integration of monopole systems.

Background: Magnetic monopoles, or the topological soliton solutions of Yang-Mills-Higgs gauge theories in three space dimensions, have been objects of fascination for over a quarter of a century. BPS monopoles in particular have been the focus of much research. In a seminal paper, Ercolani and Sinha [ES89] sought to bring methods from integrable systems to bear upon the construction of solutions to Nahm's equations for the gauge group $SU(2)$. They showed how one could solve (a gauge transform of) the Nahm equations in terms of a Baker-Akhiezer function. Their approach complements the twistor theoretic approach of Hitchin [Hit83] but remains remarkably challenging to implement. Recently the proposer and V.Z. Enolski have developed this approach further [BE06].

Aims: To further develop the finite gap integration of monopole systems. In particular

- To pursue the reconstruction of the gauge and Higgs fields directly using integrable systems methods.
- To express the monopole moduli space and its metric in terms of finite-gap data.
- To consider the situation when the monopole spectral curve itself covers another curve.
- To better understand the number theoretic constraints arising on the periods of the spectral curve in the particular example of charge 3 monopoles.

SISSA staff have great experience with many aspects of this project: finite gap integration, algebro-geometric expertise in coverings and explicit calculations. In addition I look forward to wider ranging discussions.

REFERENCES

- [BE06] H.W. Braden and V.Z. Enolski, *Remarks on the complex geometry of the 3-monopole*, [math-ph/0601040](#)
- [ES89] N. Ercolani and A. Sinha, *Monopoles and Baker Functions*, *Commun. Math. Phys.* **125** (1989), 385–416.
- [Hit83] N. J. Hitchin, *On the Construction of Monopoles*, *Commun. Math. Phys.* **89** (1983), 145–190.