Proposed Project: The finite-gap integration of cyclically symmetric monopoles.

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, BE08].

Aims: To further develop the finite gap integration of monopole systems in the context of cyclically symmetric monopoles.

The spatial symmetries of a monopole reflect themselves in the symmetries of the spectral curve and the spectral curve covers a lower genus curve. Recently Enolski, D'Avanzo (my student) and I have been studying a cyclically invariant system and have made much progress but some issues remain outstanding. SISSA staff (for example Grava and Dubrovin) also have great experience with finite gap integration and the attendant algebro-geometric expertise in coverings and explicit calculations: discussion will be useful. There are also some interesting number theoretic constraints arising on the periods of the spectral curve and I wish to investigate these further.

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Curriculum Vitae .

HARRY W. BRADEN

Date:	March, 2006.
Family Name:	Braden
First Names:	Harry Whiting
Place of birth	Edinburgh, Scotland
Date of Birth:	February 10, 1957
Citizenship:	U.K./Australian
Marital Status:	Married (four children)
Work Address:	School of Mathematics James Clerk Maxwell Building University of Edinburgh Mayfield Rd, Edinburgh EH9 3JZ Scotland
Fax:	0131-650-6553
Telephone:	0131-650-5072
E-mail address:	`hwb@ed.ac.uk`
Education	
1975-1978	Sydney University BSc. 1st Class Honours and University Medal (*proc. acc.*)
1979-1983	Ph.D. Cambridge University Corpus Christi Research Studentship (1979-82) and Research Fellowship (1982-85)
Appointments Held:	
1983-1985	Cambridge University, DAMTP. Research Fellow
1985-1987	University of Nth. Carolina. Research Associate
Fall 1987	Dept. of Mathematics U.N.C. Visiting Lecturer
1988-1989	Durham University, Dept. of Mathematical Sciences. SERC Senior Research Assistant
1990-present	University of Edinburgh
Present Position:	Reader
Short/Longer Visits:	IHES Paris, ITEP Moscow, JSPS/Royal Society Kyoto, KTH Stockholm, Montreal Concordia, MPI Bonn, Newton Institute Cambridge.
Meetings Organised:	2006 Monopoles and Integrability 2005 The Bethe Ansatz and Integrable structures 1998 Integrability: the Seiberg-Witten and Whitham Equations 1991 Physics and Geometry
Major Research Interests:	Mathematical Physics
Principal Research Interests:	Integrable systems

Selected Papers:

- Charged Black Hole in a Grand Canonical Ensemble (with J.D.Brown, B. Whiting and J.W.York), *Phys. Rev.* **D42**, 3376 – 3385 (1990).
- Affine Toda Field Theory and Exact S-Matrices (with E.Corrigan, P.E.Dorey and R.Sasaki), *Nucl. Phys.* **B338**, 689 – 746 (1990).
- R-matrices for Elliptic Calogero-Moser Models, (with Takashi Suzuki), *Lett. Math. Phys.* **30**, 147 – 158 (1994).
- The General Analytic Solution of a Functional Equation of Addition type, (with V. M. Buchstaber), *SIAM J. Math. Anal.* **28**, 903 – 923 (1997).
- Seiberg-Witten theory for a non-trivial compactification from five to four dimensions, (with A. Marshakov, A. Mironov, A. Morozov), *Phys. Lett.* **448B**, 195 – 202 (1999).
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- Space-time Foam from Noncommutative Instantons, (with Nikita A. Nekrasov), *Commun. Math. Phys.* **249**, 431 – 448 (2004).
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- Classical R-Matrices and the Feigin-Odesskii Algebra via Hamiltonian and Poisson Reductions, (with V.A. Dolgushev, M.A. Olshanetsky and A.V. Zotov) *J. Phys.* **A36**, 6979 – 7000 (2003).
- The Curve of Compactified 6D Gauge Theories and Integrable Systems, (with Timothy J. Hollowood) *JHEP* **12**, 023 (2003).
- Functional Equations and the Generalised Elliptic Genus, (with K.E. Feldman) *J. Nonlinear Math. Phys.* **12 Supplement 1**, 74 – 85 (2005). *math-ph/0501011*
- Remarks on the complex geometry of the 3-monopole, (with V.Z. Enolski) math-ph/0601040