welcome to the European Microkelvin Collaboration

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO 42**	
Project Title:	**Soliton solutions within the vortex filament model using full Biot-Savart equation**	
Lead scientist:[1]	**Title:**	Ph.D., Lecturer
	First name:	Hayder
	Last name:	Salman
	Home institution:	University of East Anglia
Host scientist:[2]	**Title:**	Dr. (Tech)
	First name:	Risto
	Last name:	Hänninen
	Home institution:	
Project scientist:[3]	**Title:**	Lecturer
	First name:	Hayder
	Last name:	Salman
	Scientific Field:	Theoretical & computational fluid dynamics
	Home institution:	School of Mathematics, University of East Anglia
	Is your home institution MICROKELVIN partner?	No
	Business address:	Norwich, NR4 7TJ
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	Country:	UK
	Telephone:	+441603591666
	Fax:	
	E-mail:	"Hayder Salman" <H.Salman@uea.ac.uk>
	Curriculum vitae (18 lines max): ***Professional Appointments*** -since Nov. 2009: Lecturer, School of Mathematics, University of East Anglia, UK -Feb. 2007: Research Associate, DAMTP, University of Cambridge, UK -Apr. 2003: Research Fellow, School of Mathematics, UNC-Chapel Hill, NC, USA -Feb. 2002: Research Associate, Mechanical Engineering, MIT, Cambridge, USA -Feb. 2001: Research Associate, Brown University, RI, USA ***Educational Background*** -June 2001: PhD, Loughborough University, UK -Feb 2001: MEng, Imperial College, London, UK	
	Five most recent publications:	
	1- H.Salman, N.G.Berloff, Physica D **238**, 1482 (2009).	

1 The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.

2 The host scientist is supervising the work of the visiting project scientist at the infrastructure.

3 The project scientist is the person who will be visiting the infrastructure.

	2- H. Salman, N.G. Berloff, P.H. Roberts. *in Quantum Gases:* Finite Temperature and Non-equilibrium Dynamics, (2013).		
	3- H. Salman, Phys. Rev. A **85**, 063622 (2012).		
	4- H. Salman, J. Comp. Phys. submitted.		
	5- H. Salman, "Breathers on Quantized Superfluid Vortices", Phys. Rev. Lett. submitted.		
Other participating scientists:[4]	**Name:**	**Position:**	**New User:**

[4] Please list all participating user group members. Expand the table, if necessary.

2. Project Information

Name of host infrastructure:	**O.V. Lounasmaa Laboratory, Aalto University**			
Access provider / Infrastructure Director:	**Name: Matti Krusius**		**E-mail address: mkrusius@neuro.hut.fi**	
Planned project dates:	**Start date:**	12/08/2013	**Completion date:**	26/08/2013

Project description (12 lines max):

One major part of the Microkelvin programme is related to the dynamics of quantized vortices especially in the zero temperature limit. In this limit the Kelvin wave cascade is expected to play an important role in energy dissipation. The Kelvin wave cascade is preceded by a self-reconnection driven regime in which localised large amplitude disturbances dominate the dynamics. For example, during a reconnection event, a vortex first becomes strongly distorted in the vicinity of the reconnection site. In that case, the deformation is rather described as a by-product of solitions interacting, or even breathers as uncovered by the recent work of the named scientist (Dr. Salman). Both, solitons and breathers, are localized disturbances with a well defined propagation velocity. In classical fluid mechanics, solitons are highly investigated objects. However, within the vortex filament model, several soliton solutions have been found using only the local induction appoximation (LIA). Our target is to find the exact soliton solutions numerically using the full Biot-Savart law.

Scientific objectives of the project (12 lines max):

We will find the family of soliton solutions using the (non-local) full Biot-Savart equation within the vortex filament model. The solition solutions should be found for various energies and momenta associated with these large amplitude excitations. The results will be summarized and compared with the previously found (local) LIA solutions in scientific publications (e.g. Physics of Fluids).

Technical description of work to be performed (20 lines max):

The main task is to modify the Biot-Savart algorithm to allow us to converge to soliton solutions with the vortex filament model. Formally this corresponds to finding the zeros of a vector-valued function of several variables. The solutions with the local induction approximation (LIA) can be used as an initial guess, which should help with the convergence of the proposed algorithm.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure? No ☒
If yes, please specify:

Is this proposal submitted to any funding programmes? No ☒
If yes, please specify:

The completed Application Form should be submitted to MICROKELVIN Management Office (**Sari.Laitila@aalto.fi**, fax +358-9-47022969)