

# Shanks Workshop: Mathematical Methods for Inverse Magnetization Problems Arising in Geoscience

Organizers: Doug Hardin, Alex Powell, and Ed Saff

March 1–3, 2016

Talks in Stevenson Center 1 (Mathematics Bldg):

- SC1312 (Tuesday and Thursday pm),
- SC1432 (Wednesday pm), and
- SC1320 (Thursday am).

<b>Tuesday</b>	SC1312	
2:35-3:25	E. Lima	The inverse problem in scanning magnetic microscopy
3:30-4:10	J. Leblond	Magnetic moments recovery issues for planar samples and bounded extremal problems
4:15-5:00	S. Chevillard	Asymptotic formulas for net moment recovery of planar magnetizations
<b>Wednesday</b>	SC1432	
3:30-4:05	C. Gerhards	Reconstructing Spherical Magnetizations
4:10-5:00	R. Parker	Rescuing naive least-squares for the seamount inverse problem.
5:05-5:45	M. Northington	Sparse reconstructions and $L_1$ regularization
<b>Thursday</b>		
11:10-11:50	D. Ponomarev SC1320	On recovery of magnetization moments using Kelvin transformations and Fourier analysis
2:35-3:15	L. Baratchart SC1312	Hardy-Hodge decomposition on manifolds and silent sources.
4:10-5:00	R. Parker SC5211	The inverse problem of seamount magnetism

**Speaker: Laurent Baratchart**

**Title: Hardy-Hodge decomposition on manifolds and silent sources**

**Speaker: Sylvain Chevillard**

**Title: Asymptotic formulas for net moment recovery of planar magnetizations.**

Scanning magnetic microscopes, such as SQUID microscopes can produce a map of the vertical component of the magnetic field produced by a thin slab of magnetized rock, on some region above the sample. Recovering characteristic features of the magnetization of the rock from these measurements is an important problem for geophysicists.

In this talk, we address the question of recovering the total net moment of the magnetization from such a map. We will present asymptotic formulas, which are accurate when the measurements are made on a fairly large square, compared to the support of the magnetization. These formulas come with rigorous error bounds, so, given actual measurements, it is possible to estimate the order of magnitude of the error between the true net moment and the one given by the asymptotic formulas.

**Speaker: Christian Gerhards**

**Title: Reconstructing Spherical Magnetizations**

We give a brief overview on problems arising in the reconstruction of spherical magnetizations. The focus is on presenting some results for thin spherical magnetizations based on earlier observations for planar magnetizations. In particular, we want to address some differences between between the spherical and the planar setting.

**Speaker: Juliette Leblond**

**Title: Magnetic moments recovery issues for planar samples and bounded extremal problems.**

**Speaker: Eduardo Andrado Lima**

**Title: The inverse problem in scanning magnetic microscopy**

**Speaker: Michael Northington**

**Title: Sparse reconstructions and  $L_1$  regularization.**

**Speaker: Robert L. Parker**

**Title: Rescuing naive least-squares for the seamount inverse problem.**

**Speaker: Dmitry Ponomarev**

**Title: On recovery of magnetization moments using Kelvin transformations and Fourier analysis**