

YILIN MA

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EDUCATION

University of Sydney

Master of Philosophy

Thesis Title: Inverse Problems in Complex Geometry

Supervisor: Leo Tzou

Email: leo.tzou@sydney.edu.au

Expected: July 2021

University of Sydney

Bachelor of Science (Honours) in Pure Mathematics

Thesis Title: Applications of Fourier Analysis to Singular Stochastic PDEs

Supervisor: Benjamin Goldys

Email: beniamin.goldys@sydney.edu.au

July 2019

First Class Honours

University of Sydney

Bachelor of Science

July 2018

RESEARCH INTERESTS

I work in the area of partial differential equations with a particular emphasis on inverse problems. Over the past year my main focus had been on extending the regularity assumption of the Calderón problem for a potential in two dimensions. However, I am also interested in techniques which are based on ideas from microlocal analysis. Recently there have been numerous applications of microlocal analysis to nonlinear problems in mathematical physics. These vary across fields such as general relativity, dynamical system, spectral theory, integral geometry and even cellular biology. Inverse problems are also such examples. I am interested in expanding this list by finding further areas of mathematics in which microlocal analysis can generate effective tools.

RESEARCH EXPERIENCES

Inverse Problem for a Nonlinear Magnetic Schrödinger Operator on Riemann Surface

Completed October 2020

We continue the previous study on nonlinear inverse problems in the two dimensional case. We show that on a compact Riemann surface with smooth boundary, nonlinear magnetic Schrödinger operators with analytic constraints can be recovered from partial measurement on the boundary. This work is available on arXiv and is currently under review.

The Calderón Problem in the L^p framework on Riemann Surface

Completed July 2020

We solve the Calderón problem for a potential in L^p for $p > 4/3$ on compact Riemann surfaces with smooth boundary. We adapt the techniques of Bukhgeim on planer domains by using a classical result of Gunning-Narasimhan that every open Riemann surface admits a holomorphic immersion into the complex plane. In the process, we also extend an old result of Astala-Päivärinta on recovering the singularities of the potential onto the setting of Riemann surface. We are hoping to extend this result to the optimal case of L^p for $1 < p < 4/3$ as such results would be new even in planer domains. This work is available on arXiv and is under review.

Semilinear Calderón Problem on Stein Manifolds with Kähler Metric

Completed February 2020

We extend the recent results of semilinear Calderón problems with analytic nonlinearities onto a class of Kähler manifolds. We solve the full data problem for the case of complex dimension $d \geq 2$ and the partial data problem on Riemann surfaces. This work led to the publication of an article in the Bulletin of the Australian Mathematical Society.

Paradifferential Calculus and Solving the KPZ equation

Completed July 2019

We study the application of paradifferential calculus to construct a robust solution theory for the Kardar-Parisi-Zhang (KPZ) equation and related singular stochastic differential equations. The method is based on paraproduct and commutator estimates, which give meanings to a number of a priori ill-posed equations. This work led to the completion of my honours thesis.

PUBLICATIONS

Y. Ma: A note on the partial data inverse problem for a nonlinear magnetic Schrödinger operator on Riemann surface, preprint, arXiv:2010.14180, submitted.

Y. Ma: The Calderón problem in the L^p framework on Riemann surface, preprint, arXiv:2007.06523, submitted.

Y. Ma and L. Tzou: Semilinear Calderón problem on Stein manifolds with Kähler metric, *Bulletin of the Australian Mathematical Society*, **103**(1), 2021.

UNIVERSITY OF SYDNEY TEACHING ASSISTANCE

MATH1023 Multivariable Calculus	<i>Semester Two - 2020</i>
MATH1021 Calculus of One Variable	<i>Semester Two - 2020</i>
MATH1902 Linear Algebra (Advanced)	<i>Semester One - 2020</i>
MATH1021 Calculus of One Variable	<i>Semester One - 2020</i>
MATH1002 Linear Algebra	<i>Intensive January Session - 2020</i>
MATH1023 Multivariable Calculus	<i>Semester Two - 2019</i>
MATH1021 Calculus of One Variable	<i>Semester Two - 2019</i>
MATH1021 Calculus of One Variable	<i>Semester One - 2019</i>

INVITED TALKS

University of Sydney Zoom PDE Seminar	<i>September 2020</i>
The Calderón Problem with Unbounded Potentials in Two Dimensions.	(1 Hour)
Australian National University Zoom Analysis Seminar	<i>August 2020</i>
The Calderón Problem with Unbounded Potentials in Two Dimensions.	(1 Hour)
University of Sydney Mathematical Postgraduate Seminar	<i>March 2020</i>
Inverse Problems on Riemann Surfaces.	(1 Hour)
Analysis and Partial Differential Equations Joint Seminar Day	<i>February 2020</i>
Semilinear Calderón Problems on Complex Manifolds.	(20 Minutes)
The 63rd Annual Meeting of the Australian Mathematical Society	<i>December 2019</i>
Semilinear Calderón Problems on Complex Manifolds.	(20 Minutes)

AWARDS

Australian Government RTP Supplementary Scholarship	<i>March 2020 - April 2021</i>
Merit research scholarship awarded in supplement to the RTP Scholarship.	
Australian Government RTP Scholarship	<i>July 2019 - April 2021</i>
Merit research scholarship awarded to top ranked Australian and international graduates.	

ACADEMIC WEBSITE

Publications, presentation slides and recordings are available at <https://yilinmath.com>.