

B8. Research Opportunity and Performance Evidence (ROPE) - Details of the Future Fellowship candidate's career, evidence of research impact and contributions to the field, including those most relevant to this application and evidence of leadership, mentoring and research training or supervision.

Amount of time as an active researcher I was awarded my PhD in Mathematics 12 years ago in 2011 at Flinders University of South Australia. During those 12 years, I have had no interruptions in research opportunity.

Research opportunities I am employed at UNSW as a Senior Lecturer in the School of Mathematics and Statistics.

Currently, I hold ARC DP 230100434 (insert money started in 2023, resulted in 14 publications). In 2018-2021, I held UNSW Scientia Fellowship (\$ 160,000, resulted in 35 publication publications and promotion to a permanent position). In 2015-2018, I held ARC DECRA (\$ 300 000, resulted in 29 publications).

From 2011 until June 2015 I was employed as a researcher under DP grants DP110100064 and DP120103263 awarded to F. Sukochev (resulted in 17 publications).

From 2007 until December 2010, I was a PhD student at Flinders University.

Research impact and contributions to the field I work in a broad area of Functional Analysis, more precisely, in (a) theory of singular traces (b) operator theory (c) probability theory (d) harmonic analysis (e) applications to mathematical physics. Below is an account of my research history and some of the most important contributions made in my career.

In 2021-2023, I published (in collaboration with S. Lord, E. McDonald and F. Sukochev) two-volume book "Singular traces" (vol. 1 "Theory" and vol. 2 "Trace Formulas"). This book is based on my previous journal publications and constitutes my contribution to the *Theory of Singular Traces*. In this area, I solved a long-standing problem by A. Pietsch on the spectrality of traces. My works in the area are published in e.g. in Crelle's Journal and Advances in Mathematics.

Starting from 2015, I published a number of articles in *Non-commutative Probability Theory*. In this area, I developed a new framework of distributional inequalities which allowed final solution to problems proposed by M. Junge and Q. Xu. Publication in this area appear e.g. in the Journal of Functional Analysis.

I intensively work in the field of *Non-commutative Geometry* (collaborating with A. Connes and N. Higson). My publications in the area appear e.g. in Communications in Mathematical Physics and the Journal of Functional Analysis. Among my achievements in this direction is the resolution of the problem proposed by A. Connes in 1994. This area of my research interests is closely related to the proposed Future Fellowship project.

Another area of my interest is *Operator Theory*. I obtained an ultimate resolution of the 60-year old problem by M. Krein on operator Lipschitz functions. My works in that area are published e.g. in the American Journal of Mathematics, Crelle's Journal and Proceedings of the London Mathematical Society.

I am also interested in the *Non-commutative Harmonic Analysis* (collaborating with R. Frank). My papers in this area are published e.g. in Transactions of the American Mathematical Society and in Mathematische Annalen. Some of my works in that direction are related to the proposed Future Fellowship project.

Another direction of my research is *Mathematical Physics* (collaborating with F. Gesztesy). My works in that area are published e.g. in the Memoirs of the European Mathematical Society.

I am one of the top contributors to the Journal of Functional Analysis (second in the last 3 years, top 10 in all times).

I am regularly invited to deliver keynote research talks in the top international conferences. In 2021, I was invited by Professor Connes to deliver a plenary lecture concerning my recent results at the international conference "Cyclic cohomology at 40" at Fields Institute. In 2023 I delivered a plenary lecture in the international conferences "Noncommutative Geometry, Index Theory and Representation Theory" in Kyoto. I put this paragraph to B7.

I am regular assessor for the submissions to the best international journals such as Journal of Functional Analysis, Advances in Mathematics, Duke Mathematical Journal and Transactions of the American Mathematical Society.

I frequently collaborate with a number of the highest calibre researchers in Australia and overseas (Europe, US, China). My list of collaborators includes Alain Connes (Paris), Kenneth Dykema (Texas A&M), Rupert Frank (Munich), Friedrich Gesztesy (Vienna), Nigel Higson (Penn State), Marius Junge (Illinois), Albrecht Pietsch (Jena), Fedor Sukochev (UNSW) and Quanhua Xu (Harbin).

Many of these research achievements underpin the research proposed for this Future Fellowship, and demonstrate my insight and ability in solving hard problems in mathematics using novel methods that often extend to new results in considerably more general contexts.

Leadership and mentoring I mentor the group of postdocs at UNSW: (a) Thomas Scheckter (Non-commutative Harmonic Analysis), (b) Teun van Nuland (Non-commutative Geometry and Mathematical Physics), (c) Shiqi Liu (Semi-classical Analysis).