Dr Sundance Bilson-Thompson

Fellowship location: School of Chemistry & Physics

Previous position: Postdoctoral Research Fellow; Perimeter Institute for Theoretical Physics, Canada.

Research focus: Topological invariants and particle states in the context of quantum gravity. Our current best attempts to describe the most fundamental physical phenomena are String Theory, which postulates that all particles are tiny vibrating bands of energy which exist in higher dimensions, and Loop Quantum Gravity, which postulates that space and time form a kind of finely-structured mesh rather than a smooth arena through which matter and energy propagate. Dr Bilson-Thompson will be working on the idea that in theories like Loop Quantum Gravity, this "mesh" structure of spacetime can naturally include tangles and that these can be classified in such a way that they correspond exactly to the particles (electrons, neutrinos, quarks,...) that matter is made of. This is an exciting project because it suggests that matter may be topological structures built into spacetime itself, rather than a seperate type of entity.

About Sundance: "I grew up in Melbourne, with frequent camping trips up the east coast. Whenever the school holiays rolled around (in those days there were three school terms per year, not four, so terms were longer but so were holiday breaks), while my dad was running his small business, my mum would pack us into her van and we'd cruise from beach to beach up the NSW and southern Queensland coast. I spent a lot of time in the passenger's seat reading books about dinosaurs, astronomy, maths, and puzzles, and then exploring rocks, weird plants, and the way wind and waves shaped the sand on beaches.

"I moved to South Australia to start university, doing my Bachelor of Science (with majors in theoretical physics and pure maths), my honours degree, and my PhD at the University of Adelaide. I also participated in many of the university clubs such as the Science Fiction Association, the Gymnastics Club, and the Mountain Club. My PhD was in lattice gauge theory, which is basically computer simulations of the strong nuclear force - the force that holds the nuclei of atoms together. I finished my thesis in 2002, and let the travel bug bite me again, taking a few months off to backpack around Japan, Europe, Egypt, Venezuela, and New Zealand, before starting my first postdoc in Seoul, South Korea. I developed a love of Korean food, and a reasonable fluency with the language. After a year, though, I found that I wanted to break out of the research field I'd been in since the start of my PhD, and work at answering the questions that got me interested in physics in the first place.

"I returned to Adelaide and started doing research in my spare time, which eventually led me to write a paper on the foundations of my current research project. Prof. Lee Smolin at the Perimeter Institute in Ontario read this paper and invited me to collaborate, and ultimately apply for a job in his research group, trying to combine my research interests with the research program of Loop Quantum Gravity. I spent three years in Canada, which was intellectually stimulating and challenging. But three Canadian winters was more than enough! At the end of my time there, my girlfriend and I set out on a six-month long bicycle journey across the eastern and southern United States, camping and couch-surfing along the way. While I love travelling, I was extremely pleased to be offered the second Ramsay Fellowship,

which has allowed me to make Adelaide my home again, and be close to my family and many of the activities (such as rock-climbing in the Adelaide Hills) that I enjoy.

"As a comparative newcomer to quantum gravity, my research follows a somewhat different direction to that pursued by most other researchers in the field. The Ramsay Fellowship has allowed me pursue a high degree of independence in my choice of research topics, while continuing to collaborate with colleagues from overseas, and expose students and younger researchers to the exciting research topics I learned about during my time abroad."