

Fellow: Matthew Lake (JSPS Standard Award)

Host Institution: Research Center for the Early Universe (RESCEU), University of Tokyo

Host Researcher: Prof. Jun'ichi Yokoyama

Research Title: Cosmic Strings as a Probe of Extra Dimensions

My research in Japan focused on the modeling of cosmic strings; incredibly dense line-like lumps of energy, millions of light-years long, but with widths smaller than the radius of an atomic nucleus, which are thought to form in ultra hot conditions of the very early universe. The aim was to investigate potential correspondences between so-called “defect” strings (string models based on classical or quantum field theory), in four-dimensional general relativity, and extra-dimensional models of cosmic “superstrings” arising in string theory.

We were able to show, successfully, that extra-dimensional effects in superstring models can be mimicked by field-theoretic structure in defects, implying that extreme care must be taken in searching for extra-dimensional “signatures” in future observations of high-energy astrophysical phenomena.

Collaborations with Prof. Yokoyama and with another colleague at RESCEU, Prof. Teruaki Suyama, resulted in two publications in internationally recognized journals, *Physical Review D*, and the *Journal of Cosmology and Astroparticle Physics*.

Tips for research

- Allow yourself some time to “adjust” to a new environment. Don't try to match the working hours or schedules of your Japanese colleagues, or at least build-up to it gradually.
- Present your work as widely as possible within Japan and abroad (within the limits allowed by the JSPS restrictions), and get to know as many of the people working in your field as possible.
- Don't feel you have to pay attention in *all* the meetings. Being active will be appreciated, but almost everybody will fall asleep during a meeting at some point. It's often ok to work quietly on your iPad, so long as you're there.
- Try to take part in the JSPS Science Dialogue program. It's a good opportunity to practice presenting your work to a popular audience and to interact with “wider society” in Japan.

Tips for living in Japan

- Learn as much nihongo as you can. It can be hard, especially with research commitments, but it's worth the effort.
- Travel. Japan is a beautiful country with a very diverse landscape. From snow-covered forests in winter, in Honshu and Hokkaido, to tropical coral reefs off the coast of Okinawa, try to see as much of it as possible while you're there.
- Get help with bureaucracy (from someone who is *fluent* in Japanese!) and read the JSPS Regulations and Life in Japan for Foreign Researchers handbook thoroughly. Its dull, but it will save you time later.
- Make contact with (Japanese) people outside your institution and research area.

This can be difficult, but taking up a hobby, especially something related to Japanese culture such as calligraphy, Japanese cooking, or a martial art is an excellent way to start. It will also give you a greater insight into the people and culture as a whole.

- It may sound horribly practical, but the JSPS scholarship is extremely generous and the life of a postdoc can be extremely uncertain. Enjoy your time in Japan, but don't live it up too wildly. Try to put some money aside for leaner times of unemployment or less generous scholarships/salaries in the future.

The Japan General Relativity and Gravitation conference, hosted at RESCEU (I'm in there somewhere)



I would like to thank JSPS UK and JSPS Tokyo for giving me this excellent opportunity. Living and working in Japan was an amazing experience and I hope to return in the future to pursue further projects with Japanese collaborators.