CASPEN exit report
April 23 — May 4
Host institution: University College London
Host: Boris Leistedt

The main focus of this visit has been to explore the second data release of Gaia (DR2), which was made public April 25. Boris Leistedt and I have previously worked together with Gaia data on a project that was initiated during my CASPEN funded visit to the Flatiron Institute in New York (September 2017). That project was about inferring multiple stellar systems in photometric and astrometric surveys (arXiv:1801.08547). For DR2, we were planning to build on this project.

In a related project with Hiranya Peiris, we are looking to infer properties of the white dwarf population of the Milky Way using astrometric information from Gaia and photometric information from SDSS. With DR2, astrometric distance measurements for white dwarfs are available for the first time.

During my visit to UCL, Boris Leistedt and I explored Gaia DR2, with emphasis on the white dwarfs in the catalogue. Much work was spent understanding the limitations of the data set. Because the white dwarfs are dim objects, at the verge of detection for the Gaia telescope, the white dwarfs of the DR2 catalogue suffer from strong selection effects and other systematics. It is crucial to include such systematics in a statistical model, for stellar populations in general but for white dwarfs especially. With such difficulties in mind, we have discussed the possibility of inferring a sub-population of white dwarf binary systems, and have started developing a statistical framework in which to do so.

In terms of binary white dwarfs, it is not yet clear what can be inferred given the available data. There are great prospects for other science questions pertaining to white dwarfs using this method, such as inferring the distributions of effective temperature, surface gravity, the relative fractions of white dwarf phenomenological classes (the main difference being hydrogen or helium rich atmospheres), and difference in properties between disk and halo white dwarf populations.

Apart from working on these projects, I have had interesting discussions with other people at the UCL, for example with Andrew Pontzen about large-scale structure and galaxy formation. I also gave a presentation at the UCL, titled "Measuring the dynamical mass of the galactic disk using Gaia data", based on a previous project of mine (arXiv:1711.07504). The audience was very active in listening and posed many insightful and interesting questions.

Going forward, I expect to publish articles on white dwarfs in the near future. A first article describing the statistical method, written with Hiranya Peiris and Daniel Mortlock, is expected to be finished soon. Further articles, more focused towards questions of physics, I would expect to appear on the arXiv later this year.

Axel Widmark