CASPEN exchange programme exit report

Visitor: Axel Widmark, doctoral student, Stockholm University
Host: David W Hogg

I have visited the Flatiron Institute for two weeks, dates September 18 to October 2. I contacted Professor David W Hogg in the beginning of June and he agreed to host me. I wrote a proposal for what we could work. A few weeks prior to my visit we also met in person at a conference in Lund, where we briefly discussed possible research topics.

My original proposal was to work with stellar population statistics and Hierarchical Bayesian Modelling in general, and white dwarf binaries in particular. However, because working with white dwarfs and Gaia data is not possible until the next data release, we quickly opted for studying stellar binaries in general (not white dwarfs).

By the second day of my visit, a clear goal had been established: to make a full joint fit of a Gaia data subset, using a population model that includes binary systems (and possibly higher multiples of stars) in the framework of a data driven Bayesian Hierarchical Model. By the end of my visit this had been accomplished.

We now have such a statistical model and have been able to infer binary and trinary populations from a small subset of data. This is a powerful way to classify objects in the Gaia data as single stars, binaries, trinaries, and potentially higher multiples. What we hope to do next is to publish a short and conceptual paper where we present this simple model and its results. Going forward, we plan to incorporate these principles in a larger architecture of data driven models developed by David Hogg and collaborators.

More than anyone else, I have worked actively with Boris Leistedt (New York University), who is deeply involved in the project. Other people who have been more loosely involved are Lauren Anderson and James Davenport (University of Washington).

In addition to the project I worked on, it was very nice to take part in the everyday workflow at the Flatiron Institute. The atmosphere is inspiring, creative, and collaborative, which is something I will seek to emulate now that I'm back at my own institution. Specifically, I appreciated very much the regular work meetings and inter-disciplinary talks.

I had interesting exchanges especially with Elena D'Onghia and Matteo Cantiello. Elena D'Onghia (University of Wisconsin-Madison) gave a talk on measuring the density of the galactic disk in the solar neighbourhood, which is something I am currently writing an article about. We had an interesting discussion about the subject, which might lead to future collaboration. With Matteo Cantiello I discussed my ideas for white dwarf binaries, and he mentioned it would be interesting to do white dwarf population synthesis in the future, so perhaps there is potential for future collaboration also with him.

As far as publications go, the first paper on statistical models with multiple stellar systems will appear on arXiv in the next few months, possible before the year is over. Overall, my visit to the Flatiron Institute has been very productive and in my mind a great success.

Axel Widmark