

# Report

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## 0.1 Introduction

Here I would like to report my recent visit at the KIPAC (Kavli Institute for Particle Astrophysics and Cosmology) at the SLAC National Accelerator Laboratory. For this purpose, I benefited the financial support from the CASPEN (Cosmology and Astroparticle Student and Postdoc Exchange Network) program which has the purpose to promote collaborations between several institutions across areas of mutual interest.

My name is Tanja Petrushevska and I have recently obtained a PhD at the Physics Department at Stockholm University and the Oskar Klein Centre. My research interests are the observational aspects of supernovae and transient objects in the sky. One of my main projects during my PhD was to search for very distant supernovae by using galaxy clusters as gravitational telescope. In November, I will start a postdoc at the University of Nova Gorica in Slovenia.

## 0.2 Project description

The main purpose of my visit was to collaborate on a project with Manuel Meyer, a postdoctoral scholar at KIPAC. The project aims to estimate the explosion time from core-collapse supernovae and search for a gamma-ray burst within the estimated explosion time in order to look for axion-like particles. Therefore, it represents a bridge between high-energy particle physics and observational astrophysics.

Why is this interesting? The largest portion (84%) of the matter in the Universe is cold dark matter, and its identity remains one of the most compelling open questions in astrophysics, particle physics, and cosmology. Undiscovered particles with still unknown fundamental properties might constitute the entire dark matter. One extensively studied candidate is the so-called axion-like particles. They could be detected through their decay into photons or an oscillation into photons in magnetic fields. Therefore, this project constitutes of looking for  $\gamma$ -ray burst from a sample of supernovae in Fermi satellite data. During the visit at KIPAC, I was able to bring forward the part of the project that involves the supernova data and analysis. I am confident that soon we will be able to publish our results.

### 0.3 Other activities

During my visit at KIPAC, I was invited to give a seminar. There, I had the chance to present my research. The title and the abstract of that seminar can be found here:

<https://kipac-web.stanford.edu/kipac-tea-tanja-petrushevska-univ-stockholm>

Furthermore, I had the opportunity to meet other people that work on interesting areas of research for me. For example, I met and discussed with Phil Marshall, who is a staff scientist at SLAC, primarily working on cosmology and galaxy evolution with strong gravitational lenses. He is also part of the Large Synoptic Survey Telescope (LSST), therefore this meeting was important as my research interests as postdoc will involve LSST.

### 0.4 Conclusion

To conclude, I believe that this visit which was partly made possible by the CASPEN program was very beneficial for me as a researcher and was essential to secure successful collaboration between two different institutions and fields, represented through our project.