Research Project at Rudolf Peierls Centre for Theoretical Physics

- Project in particle physics concerning theorized extension to the Standard Model known as the “axion”
- Based on fitting and analysis of X-ray data collected by Chandra satellite on the Perseus cluster
- Based on theorized conversion mechanism between pure axion and photon states within strong magnetic field as well as corresponding fitting models for observed data, place bounds on axion mass and constant coupling parameter
Chandra and the Perseus Cluster

X-ray observation of the Perseus Cluster taken by Chandra

Fitted power spectrum extracted from Chandra observations
Numerical results

Survival probabilities of photon for a certain magnetic field profile given an axion mass of $10 \times 10^{-12}$ eV

Bounds placed on coupling constant $g$ given various values of axion mass
A Rewarding Experience

- Successfully achieved goal of project - bounds for axion mass vs. coupling constant were found at 67%, 95%, and 99% confidence levels
- In the process of finishing paper to be published in the Monthly Notices of the Royal Astronomical Society (MNRAS)
- Was able to work with the Conlon group, a brilliant and enthusiastic group of graduate students and post-doctorates under the direction of Prof. Joseph Conlon

- Also did a fair bit of travelling
Impact on the Organization

- In the process of finishing paper on results
- Project was an extension of original project by Conlon group that focused mainly on placing bound on the coupling constant for the case of zero axion mass using the same procedure
- Axion research using Chandra X-ray observations by the Conlon group continues
Impact on my Future

- Made lasting connections with Professor Conlon and colleagues in the Conlon research group
- Have a much clearer idea of what theoretical physics research is like; more excited to pursue future in physics academia
- Professor Conlon offered valuable insight on current landscape of theoretical physics with regards to various subfields
Oxford, Oxfordshire, England
Adventures in England
Conclusion

- Extremely rewarding experience
- Performed original theoretical physics research with a world-class institution
- First time actually living in a foreign country on my own and became quite charmed by English and British society and culture
- Was able to travel far and wide in England

- Considering living and working in the United Kingdom in the future