

- Declaration: Oct 4, 2024
- Project supervisor: Krzysztof Pawłowski, pawlowski@cft.edu.pl
- Consultation 1: Oct 10, 2024 (Thursday!)
- Presentation: Dec., 13, 2024

A long time ago in a galaxy far far away ...

As early as in 1766, Cavendish discovered the hydrogen atom. In 1855 Andres Angstrom characterised part of its spectrum. Soon after, it turned out, that the same lines are in the light of the Sun. This indicates, that hydrogen is in the Sun.

Thanks to quantum mechanics, we can compute the spectra of different elements at different conditions, and use this knowledge to study the compositions of astronomical objects, their temperatures even their motion.

In this project, you will analyze the spectrum of a certain astronomical object, currently being studied by scientists at the Center for Theoretical Physics of the Polish Academy of Sciences.

Analysis of current observational data from cosmic space

Astrophysicists from the Center for Theoretical Physics PAS received the following observational data:

https://drive.google.com/file/d/11Ivv69QyEskDWtxf9okrD1HdUo36m2s2/view?usp=drive_link

You have to analyze them:

1. Identify at least one element that makes up this object. Determine which quantum numbers are associated with the transitions.
2. Identify lines that do not correspond to the element from part 1. Which elements might the unidentified lines correspond to?
3. Determine the temperature of this object.
4. Guess whether the object is moving toward us or away from us, and at what speed.
5. Search the literature to identify what type of object this could be (nebula, galaxy, star, white dwarf, galactic nucleus, accretion disk, etc.).
6. Search literature and interpret to learn about the application of atomic physics in the study of cosmic space. Can you tell us something interesting about 21cm?

Prepare a presentation aimed at introducing other PhD students to the topic of atomic physics applications in astronomy. The presentation shall outline the research problem, address above questions, and provide proposed solutions, supported by relevant calculations and a comparison with existing literature.