Project Title: The use of AI for spectral diagnostics and line identification

Project Reference Code: Williamson-Loch-Auburn

Name of Project Leader: Eleanor Williamson and Stuart Loch

Host Facility: Auburn University

Internship Location: Leach Science Center

Host Facility Location: 380 Duncan Drive, Physics Department, Auburn University, Auburn, AL 36849

Project Description (roughly 300 words):
Low temperature plasmas are common throughout industry and academia, but the diagnosis of low temperature plasmas remains challenging. Spectroscopy has emerged as a valuable non-perturbative diagnostic tool, but while spectral data is straightforward to acquire, the analysis is more difficult. A particular challenge is identifying the spectral signatures from heavier elements such as Ni and Fe. AI shows promise to help this analysis process. The goal of the project is to use AI in conjunction with spectroscopy as a plasma diagnostic. The student will begin with pre-existing data and will collect more if time allows. They will be guided through the atomic theory, and will experiment with the use of various AI models on the data. The goal will be to develop an AI model that can both improve upon existing spectral line identification approaches and develop plasma diagnostics from the results.

Disciplines: Physics, engineering, mathematics

Importance:
Spectroscopy is commonly used for non-invasive diagnosis of plasmas, but the interpretation can be difficult. This work focuses on using AI to improve a spectral analysis pipeline.

Requirements:

- Preferred Major
  - Will accept any STEM.
- Class work
  - No background necessary.
- Programming knowledge
  - Project will involve considerable programming work. Some experience preferred.
- Software knowledge
  - N/A.
- Other

Biography (roughly 100-150 words):
Eleanor Williamson is a postdoctoral researcher at Auburn University. She holds of PhD degree in Physics from Auburn University and a BA in physics from Lawrence University. She works in both the experimental and theoretical domains of physics. Her experimental work focuses on spectroscopy and the use of atomic physics to guide spectroscopy. On the theoretical side, she has contributed to computational modeling of plasmas, specifically through the use of COMSOL software to model low

temperature plasmas. These two domains intersect when comparing the two, enabling more confidence in both. As part of her role as a postdoctoral researcher for the MPRL group, she has been engaged in the mentoring of a number of undergraduate and graduate students.

Stuart Loch is a Professor of Physics at Auburn University, specializing in atomic physics and plasma spectroscopy. His research focuses on theoretical and computational modeling of atomic processes, with applications to fusion plasmas and astrophysical environments. He collaborates with researchers at universities and national laboratories and has extensive experience mentoring undergraduate and graduate students in computational physics and atomic spectroscopy.

Is U.S. citizenship required to participate in this project? No

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Internship Coordinator/ HR manager: