Proposal for Google Summer of Code 2020

Comparing TARDIS spectra generated with different atomic data sources

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1 Overview

Carsus has been under heavy development since last year, but there is still much work to be done before moving forward. Having this in mind, the first part of the coding period will be spent on improving the current Carsus features and solve top-priority issues.

Then I will focus on making contributions in order to make work easier when comparing spectra produced by mixing different atomic datasets.

2 Previous involvement with TARDIS

I've been collaborating with TARDIS since February 2019: first as a GSoC candidate, then as a student, and finally as a core developer. In the meantime, I got to known in depth the TARDIS development model and some of the organization future goals.

As a GSoC 2019 student my work consisted on reshaping Carsus by porting it to Python 3, writing parsers for a new atomic data source and implementing a more simple workflow to generate TARDIS atomic data files. Once the program finished, I kept involved with the TARDIS collaboration through many activities such as weekly hackathons, science meetings and delivering code regularly.

I presented a poster summarizing my work during GSoC 2019 at the *61th Annual Meeting of the Argentinian Astronomical Society* celebrated on September 16-20th in Viedma, Río Negro.

Then, I continued my work on Carsus pull request #152, which adds levels and lines from the Chianti database for the new workflow. Currently we are testing this feature, and we have plans to release a paper comparing spectra produced with different ensembles of atomic data sources.

In the last months I've been building pipelines on Azure to automate tasks like comparing reference data and release weekly versions of TARDIS on GitHub and Zenodo. Finally, I submitted TARDIS pull request #1104 as part of the GSoC application .

3 Timeline

Week 1. Improvements for the *GFALLReader* class

Week 2. Write Chianti colisional data reader class

Week 3. More work on the *TARDISAtomData* class

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Week 5. Rebuild the Carsus package documentation

Week 6. Write an atomic file comparer module

Week 7. Build a pipeline to create and compare atomic data files

Week 8. Run TARDIS simulations with mixed data sets

Week 9. Develop tools to standarize spectra comparison (plotting, etc.)

Week 10. Build a pipeline to compare spectra when atomic data is updated

Week 11. Increase test coverage, write doctrings

Week 12. Complete documentation

Extra objectives

- Improve Carsus general performance
- Grotrian diagram widget

4 Time commitment

I'll be working 30+ hours a week over the course of the 3 months program, being reachable 24/7 through the previously agreed channels.

My time zone is UTC-03:00 (Buenos Aires, AR).

5 About me

I'm a last year astronomy student at Universidad Nacional de La Plata and open source enthusiast, mostly interested in the fields of machine learning, high performance computing, cloud computing and software programming for astrophysics.

- Strong background in physics and astronomy.
- +3 years programming experience in Python. including numerical, scientific and machine learning libraries.
- +3 years programming experience in Fortran and C/C++.
- +10 years of experience with GNU/Linux and the open source software ecosystem.
- <1 year of experience with cloud technologies such as Microsoft Azure and Google Cloud Platform.