

# arcesetc: ARC Echelle Spectrograph Exposure Time Calculator

Brett M. Morris<sup>1</sup>, Trevor Dorn-Wallenstein<sup>1</sup>, Emily M. Levesque<sup>1</sup>, Charli Sakari<sup>1</sup>, Doug Gies<sup>2</sup>, Katherine Lester<sup>2</sup>, Yuta Notsu<sup>3</sup>, and Allison Youngblood<sup>4</sup>

<sup>1</sup> Astronomy Department, University of Washington, Seattle, WA, USA <sup>2</sup> Physics-Astronomy Department, Georgia State University, Atlanta, GA, USA <sup>3</sup> Department of Astronomy, Kyoto University, Sakyo Ward, Kyoto, Kyoto Prefecture 606-8501, Japan <sup>4</sup> NASA Goddard Space Flight Center, Greenbelt, MD, USA

DOI: [10.21105/joss.01126](https://doi.org/10.21105/joss.01126)

## Software

- [Review](#) ↗
- [Repository](#) ↗
- [Archive](#) ↗

Submitted: 12 December 2018

Published: 14 December 2018

## License

Authors of papers retain copyright and release the work under a Creative Commons Attribution 4.0 International License ([CC-BY](#)).

## Summary

The ARC Echelle Spectroscopic (ARCES) Exposure Time Calculator, or **arcesetc**, is a simple exposure time calculator for the ARCES instrument on the Astrophysical Research Consortium (ARC) 3.5 m Telescope at Apache Point Observatory for stellar spectroscopy. Users can supply **arcesetc** functions with the spectral type of their target star, the V band magnitude, and either: the desired exposure time in order to determine the counts and signal-to-noise ratio as a function of wavelength; or the desired signal-to-noise ratio at a given wavelength to determine the required exposure time.

We estimate the count rates for stars as a function of wavelength by fitting 15th-order polynomials to each spectral order of real observations of a star of each spectral type. These polynomial coefficients and some wavelength metadata are stored in an HDF5 archive for compactness and easy of reconstruction. Then upon calling **arcesetc**, the archive is opened and the spectral order closest to the wavelength of interest is reconstructed from the polynomial coefficients, for a star of the closest available spectral type to the one requested.

At present, the 79 stellar spectral types included in the **arcesetc** library span from mid F to mid M stars on the main sequence, a variety of M giants, a handful of O and B, and and a white dwarf and a Wolf-Rayet star. Contributions from the community are welcome to expand the library to include other spectral types.

**arcesetc** was built from the Astropy package-template, and thus includes self-building documentation and continuous integration (The Astropy Collaboration et al., 2018).

## Acknowledgements

We acknowledge guidance from Suzanne L. Hawley, and the invaluable framework and dev team behind the astropy package-template.

## References

The Astropy Collaboration, Price-Whelan, A. M., Sipócz, B. M., Günther, H. M., Lim, P. L., Crawford, S. M., Conseil, S., et al. (2018). The Astropy Project: Building an

inclusive, open-science project and status of the v2.0 core package. *ArXiv e-prints*, arXiv:1801.02634.