[prb,preprint]revtex4-1 [noend]algcompatible newfloat

amsmath amsfonts graphicx images/

plain [fileext=loa, listname=List of Algorithms, name=ALGORITHM, placement=tbhp,]algorithm

document stellarPYL: System for Low-Cost Quantitative Stellar Spectroscopy and Analysis Brunston Poon brunston@berkeley.edu College of Engineering, University of California Berkeley, Berkeley, CA 94720, USA Geoffrey S. Mathews Department of Physics and Astronomy, University of Hawaii at Manoa, 2500 Campus Road, Honolulu, HI 96822, USA

Draft version for future AJP submission, dated

abstract Spectroscopy is a versatile tool for examining physical phenomena. At a secondary-school level, spectroscopy is frequently done using visual, qualitative analyses, e.g. by looking at the relative intensities of red and blue light to compare temperatures, or comparing observed emission spectra from gas-discharge lamps with given templates. Quantitative measurement of spectra allows for more in-depth study: in physics, to use Planck curves to determine temperature; in chemistry, for the analysis of emission and absorption spectra of elements; and, of course, in astronomy, for countless purposes including determining the elemental composition and temperature of a star.

Having astronomy students collect their own data for this analysis is generally preferred to giving students data to analyze. However, observational stellar spectroscopy incorporating quantitative data analysis in a secondary school environment is limited in accessibility due to the lack of a low-cost spectroscopy solution with a simplified workflow. In an effort to address this issue, we have developed an integrated stellar spectroscopy hardware/software system called stellarPYL, written using Python 3.4, numpy, Pillow, and matplotlib, intending for this suite to be readily available for implementation in secondary school curricula.

We present: the physical setup and data collection process, including design choices made to reduce cost and increase flexibility; the automated workflow and algorithms behind stellarPYL, including algorithms accounting for spectral trace orthogonality, and; methods for calibrating for a camera sensor with unknown spectral sensitivity. stellarPYL is available at —https://github.com/brunston/stellarPYL—, and will provide a platform for any school with a modest telescope to develop a similar facility for their own use.