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Echelle++, a Fast Generic Spectrum Simulator

We present the software package Echelle++, an open-source C++ code to simulate realistic raw spectra based on the Zemax model of any spectrograph, with a particular emphasis on cross-dispersed Échelle spectrographs.

Echelle++ generates realistic spectra of astronomical and calibration sources, with accurate representation of optical aberrations, the shape of the point-spread function, detector characteristics, and photon noise. It produces high-fidelity spectra fast, a very important feature when testing data reduction pipelines with a large set of different input spectra, when making critical choices about order spacing in the design phase of the instrument, or while aligning the spectrograph during construction.

Echelle++ also works with low-resolution, low signal-to-noise, multi-object, IFU, or long-slit spectra, for simulating a wide array of spectrographs. We chose to initially generate our own spectrograph model from the optical prescription in Zemax. Echelle++ can then be used independently, without access to commercial ray tracing software.

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