Automating the Process of Fitting New Planetary Transit Data with Python

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The study of exoplanets has aided astronomers in understanding the behaviors of solar systems and continued the search for extraterrestrial life. Photometry, the measurement of light flux caused by a planetary object transiting a star, is one of the main methods to detecting exoplanets. Because of atmospheric variations and experimental uncertainty, the photometric data is modeled with a line of best fit. To create the fit for the data, a person must input values for seven parameters iteratively until the accuracy of the fit is satisfactory. This process is time-consuming and limits the accuracy of the model. This project presents a new program coded in Python that will automate the process for new transit data by allowing a user to input one set of estimated parameters. The program alters the inputted parameters repeatedly to create multiple fits, and then presents the parameters for the fit with the lowest residual data. Planets with high chances of transiting their parent star were chosen for observation. Two planets with previously confirmed transits and thirteen planets without confirmed transits were observed using four, 0.7meter telescopes. Data were analyzed using the current method of data analysis and with the program developed in this project. This program could serve as a practical application for astronomers that provide more accurate and efficient results. The purpose of the experiment is to see how environmental and chemical factors, such as caffeine, induce different stress responses based off of zebrafish behavior and cortisol assay results.