A Novel Method for Identifying Kepler Exoplanet Habitability Using Python-Based Analysis of Standardized Transit Light Curves and Calculated Parameter Values

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Much of the exoplanet transit data from the Kepler space telescope remains unanalyzed, especially in the search for habitability. To enable the investigation of Kepler exoplanets without the need for time-consuming visual observations, a program was developed using the Python programming language to produce valuable exoplanet analyses such as global and local view light curve graphs, standardized transit light curve graphs, tables of transit data, the values of three exoplanet parameters (radius, period, and semi-major axis), and the target exoplanet's habitability through parameter relationship graphs. A novel method is utilized to detect individual transits within data from the Mikulski Archive for Space Telescopes. The accuracy of the program was evaluated by calculating the percent errors of the three program-generated parameters compared to the confirmed values of these parameters in the NASA Exoplanet Archive for 50 distinct Kepler exoplanets. The average percent error for these 3 parameters was 30.4%, 20.8%, and 25.7% respectively, with a collective average percent error of 25.6% (n=50), demonstrating the efficacy of the novel transit detection method in determining exoplanet characteristics while only utilizing transit data. This program contributes to the search for habitable exoplanets by demonstrating how accessible transit data can be best investigated for accomplishing the necessary habitability analyses for each target exoplanet.

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