Using Spectral Analysis to Calculate Space/Time Distribution

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In the search for Earth-like exoplanets that may harbor life, the most important factor is the elemental composition of the region of development. Exoplanets often form in planetary nebulae, the result of the death of a star of one to eight solar masses. To analyze the elemental composition of nebulae, spectral analysis was used. Spectral analysis breaks down the component wavelengths of the light being emitted by a nebula, creating graphs with peaks that represent the absorption lines from the spectral data. The ELODIE Archive was used to retrieve the data for eight planetary nebulae. The MIT Wavelength Tables were used to match each peak to an element. The area under the peak was calculated to measure elemental abundance. Using individual and total areas for each nebula, the proportions of each element were calculated. A ranking system was then used to determine the habitability. The seven factors of the ranking system were the six essential elements of life (CHNOPS), and the proportions of the six elements most abundant in Earth's atmosphere and crust. A Kruskall-Wallis test was used to determine the statistical significance of the ranking system. The Bow Tie Nebula ranked the highest in habitability of the eight analyzed. It had all six of the essential elements of life, which is ideal for single-celled life development. It also had 6.08% Nitrogen, 8.48% Oxygen, 3.17% Silicon, 1.14% Aluminum, 5.00% Iron, and 1.81% Calcium. These proportions are closest to those necessary for the development of an Earth-like exoplanet.