中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Contribution ID: **18** Type: **Poster**

Comparing the Impact of G Magnitude Selection on Earth's Microlensing Detectability Using Gaia DR3

Gravitational microlensing is an essential technique for detecting small exoplanets, including Earth-like planets. Interestingly, from an alternative perspective, the Earth Microlensing Zone (EMZ) can be defined as the region where extraterrestrial civilizations could observe gravitational microlensing events caused by Earth. Updating the EMZ map is crucial for improving microlensing detectability predictions and refining the search scope for extraterrestrial intelligence (SETI) missions. In this study, we compute and analyze the microlensing probability, average caustic crossing time, and Earth microlensing discovery rate using stellar parameters from the *Gaia* Data Release 3 (DR3) catalogue. We compare the results for stars with G-band magnitudes of 17 and 20 to assess how different brightness thresholds impact Earth's detectability and construct the EMZ map using HEALPix at level 6. Our analysis reveals that the Earth discovery rate is highest along the Milky Way plane, particularly toward the Galactic Centre, due to the high density of potential observer stars. Furthermore, we find that using a fainter magnitude threshold ($G \leq 20$) significantly increases the number of events, with the total Earth discovery rate being approximately 10 times greater compared to the $G \leq 17$ case. This updated EMZ map, including different magnitude thresholds, is a helpful guide for future microlensing surveys. It also enhances the search for habitable exoplanets and extraterrestrial observers by offering a deeper understanding of Earth's detectability through microlensing.

Section

Solar System/Exoplanets

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Session Classification: Poster-Stars