Determining the Detectability of Planets Transiting Stars of Extragalactic Origin

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A great mystery in exoplanet science is whether planets can form in other galaxies. Claims of planets of extragalactic origin have been made but none have been confirmed by independent studies. With the Gaia DR2, stellar kinematic measurements were used to identify stars in the Milky Way's galactic halo which have motions that suggest they may have extragalactic origins. In this study, 1,080 evolved stars observed by the Gaia and TESS missions with properties suggestive of extragalactic origin were searched for planet transits. Designed software in Python was used to perform an injection-recovery test to understand the sensitivity of the TESS data to recovering a simulated planet signal. Although no planet transits were detected in this sample, the overall recovery rate of the TESS dataset indicated that ~75% of planet transits could be going undetected within the range searched. With a 0.38% upper limit on hot Jupiter planet occurrence and a comparison to previous studies of planet occurrence around comparable Milky Way stars, the limits found here on planet occurrence are consistent. However, it is predicted that finding a planet around this population of stars will be more difficult, as stars in the halo tend to be lower metallicity, and metallicity and planet occurrence tend to be strongly correlated. There is a possibility that not all of the observed halo stars originate from Gaia-Enceladus. Thus, statistical projections predict at least 10x the number of stars must be searched with similar precision to detect a planet of extragalactic origin.

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