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[*Abstract*]

Radiation Pressure Effects in Main-Sequence Stars for Interstellar Mission Applications

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Abstract: In this study, the dynamic effects of radiation pressure—varying with spectral type—on main-sequence stars and their potential applications for interstellar space missions are investigated. High-resolution spectral data from the UVES Paranal Observatory Project (UVES-POP), obtained using ESO's Very Large Telescope (VLT), were used to determine the effective temperatures, surface gravities, and luminosities of the target stars. Astrometric parameters from Gaia DR3 were utilized to derive distances and confirm the stars' positions on the main sequence. Mass-loss rates were calculated using the method of de Jager, Nieuwenhuijzen, and van der Hucht (1988), and stellar wind parameters were derived based on these rates. The resulting radiation pressure (Prad) values were modeled as the radiative force acting on an idealized low-mass light sail positioned near the stars. Consequently, the acceleration and orbital deviations of the light sail were evaluated in a comparative manner based on spectral type. The results suggest that main-sequence stars of different spectral types could serve as potential "propulsion sources" or "navigation waypoints" in future interstellar missions. In this context, the study is considered to contribute to the optimization of trajectories for light sail-based interstellar missions.

Keywords: Stellar radiation pressure, main-sequence stars, light sail, stellar winds, interstellar missions.

References

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