

Huge and massive planets called hot Jupiters orbit tightly around their stars. They can be easily detected from the ground using the Doppler technique or photometric transit method. Despite being the first planets discovered around Sun-like stars, their formation is still not fully understood. Scientists are trying to figure out how these giants formed so close to their suns. Did they form in place or migrate from beyond the water frost line? And if they did migrate, what mechanism brought them so close to their host star? One clue lies in the architecture of their planetary systems.

Hot Jupiters are usually the only planets orbiting their stars or are accompanied by other massive planets or even brown dwarfs on wide and eccentric orbits. This suggests that these planets must have arrived at their tight orbits through a process known as high-eccentricity migration, where the gas giant's initially distant orbit is excited by close encounters with other massive planets or distant stellar companions. As a result, the orbit circularises and shrinks due to the star-planet tidal interaction. Unfortunately, this reconfiguration can cause destructive dynamical instabilities for low-massive planets in those systems, which can leave the hot Jupiters alone in their final orbits. However, recent discoveries of low-mass planetary companions of hot Jupiters suggest that not all those systems formed under violent scenarios, as previously thought.

In this project, we propose to search for low-mass transiting planetary companions of hot Jupiters on distant and circular orbits. We will use the transit detection method and analyse photometric time series data collected by the Transiting Exoplanet Survey Satellite to identify any transiting companions. The results of our search, regardless of being positive or negative, can assist us in imposing stricter limits on the occurrence rate of hot Jupiters in compact planetary systems. This would provide new insights into the origins of hot Jupiters.