

Title

A Search for Magnetic Star-Planet Interaction from the TOI-540 System

Abstract

The magnetic interaction of a planet with its host star (star-planet interaction, SPI) can result in observable radio emission that traces the magnetic field strength of an exoplanet. This kind of interaction is responsible for the observed "Jupiter-Io" effect in which bright periodic radio emission is observed in phase with the orbit of Io. Radio SPI studies thus offer an exclusive way of understanding exoplanet composition and formation, independent of visible/IR observables. The principal challenge to radio SPI studies is the dearth of systems within an optimal parameter space and distance to show detectable flux with existing instruments. However, the recent discovery of TOI-540 b, an Earth-sized exoplanet hosted by a nearby M5 star just 14 pc away, raises a special opportunity to expand the small sample of targets for detailed radio SPI studies. It is the one of the most ideal systems discovered to date for the detection of radio SPI given its physical parameters: short planetary and rotational periods, a late spectral type in the fully convective regime and a large planetary radius, as well as several indicators of magnetic activity. Its southern declination makes MeerKAT the only instrument capable of searching for magnetic SPI from this unique source.