Contributed Talk

Splinter Exoplanets

A search for bow shocks around hot gaseous planets

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During the last years of exoplanet studies many planets with large radii, high masses and close orbits (the so-called hot Jupiters) were shown to have hydrogen rich atmopheres. It is generally assumed that hot Jupiters experience significant mass-loss through planetary winds, which transport neutral hydrogen into the expanded thermosphere. In the interaction region (bow shock) cold planetary material mixes with hot ionized gas from the stellar wind and a considerable excitation of neutral hydrogen occurs. This interaction region is located 5-10 Jupiter radii ahead of the planet so that it will manifest as an absorption signal before the beginning of the planetary transit.

To investigate the bow shocks we use optical transit spectra. The planetary atmosphere and the bow shock will manifest themselves as excess absorption in certain spectral lines. By analysing the time-dependence of the line depth we attempt to find planetary absorption features. Because we expect the atmophere to be composed primarly of hydrogen we focus on the Balmer series. Unfortunately, these lines are also affected by the stellar activity level. To exclude stellar activity patterns we also analyse the behaviour of strong chromospheric emission lines, e.g. Ca H and K as well as the Ca IRT triplet. Additionally we apply a telluric correction to our data.

So far we were unable to confirm any pre-transit absorption features. This allows us to deduce an upper limit of the strength of the planetary hydrogen absorption of about 5 milliangstroms. This finding is in contrast to Cauley et al. (2017), who suggest that a pre-transit signal of about 10 milliangstroms might be present in spectra of HD 189733b.

With the exception of HD 189733, significant pre-transit absorption signals in general have not been found. This implies that even strong stellar UV irradiation of a quiescent F or A star is not capable to excite enough hydrogen. For later spectral types our analysis is hampered by the fact that stellar activity signatures overlay weak planetary atmospheric absorption signatures.