The Interplanetary Environment in Exoplanet Systems

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Recent discoveries of numerous close-in giant planets orbiting around normal stars have opened up the question of the nature and magnitude of the tidal and magnetic effects they may have on the atmospheres of the host stars. Many telltale signatures of the star-planet interactions have been observed. Enhanced Ca H+K emission that varies in sync with the planetary phase was first discovered in the HD 179949 system (Shkolnik et al., 2003), and indications of similar enhancements have been observed in HD 73256 and HD 189733 (Shkolnik et al., 2005,2008). A possible X-ray signature was also found in HD 179949 (Saar et al., 2008). A survey of X-ray emission from nearby stars with known planets also finds that stars with close-in planets have enhanced activity (Kashyap et al., 2008).

Recently, the interactions between a stellar and planetary magnetosphere have been modeled via direct MHD simulation by Cohen et al. (2009). Their results show that there is a natural mechanism which leads to an excess of X-ray emission in the stellar corona: the presence of a nearby planetary magnetosphere interrupts the stellar wind flow, essentially bottling it up in between the star and the planet; this leads to an increased plasma density, and a complex magnetic field structure near the surface. Both effects tend to increase surface magnetic activity on the star. These MHD simulations were however carried out in the ideal case, for a nominal planetary system and in a frame of reference where the planetary orbit is essentially locked to the stellar rotation. Here we discuss new results based on realistic MHD simulations of some specific planetary systems. We set the system parameters to match that of HD 189733 and CoRot-7b, and consider the effects of incorporating a rotating frame where the planet moves rapidly relative to the stellar surface, and has a magnetic field that is tilted relative to the plane of the motion.

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