

# INTERACTIONS OF THE MAGNETOSPHERES OF STARS AND CLOSE-IN GIANT PLANETS

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Since the first discovery of an extrasolar planetary system more than a decade ago, hundreds more have been discovered. Surprisingly, many of these systems harbor Jupiter-class gas giants located close to the central star, at distances of 0.1 AU or less. Observations of chromospheric 'hot spots' that rotate in phase with the planetary orbit, and elevated stellar X-ray luminosities, suggest that these close-in planets significantly affect the structure of the outer atmosphere of the star through interactions between the stellar magnetic field and the planetary magnetosphere. Here we carry out the first detailed three-dimensional MagnetoHydroDynamics (MHD) simulation containing the two magnetic bodies and explore the consequences of such interactions on the steady-state coronal structure. The simulations reproduce the observable features of 1) increase in the total X-ray luminosity, 2) appearance of coronal hot spots, and 3) phase shift of these spots with respect to the direction of the planet. The proximate cause of these is an increase in the density of coronal plasma in the direction of the planet, which prevents the corona from expanding and leaking away this plasma via a stellar wind. The simulations produce significant low temperature heating. By including dynamical effects, such as the planetary orbital motion, the simulation should better reproduce the observed coronal heating.