APR16-2015-000123

Abstract for an Invited Paper
for the APR16 Meeting of
the American Physical Society

LeRoy Apker Award: The Atmospheric Dynamics of Pulsar Companions

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Pulsars emit radiation over an extremely wide frequency range, from radio through gamma. Recently, systems in which this radiation significantly alters the atmospheres of low-mass pulsar companions have been discovered. These systems, ranging from ones with highly anisotropic heating to those with transient X-ray emissions, represent an exciting opportunity to investigate pulsars through the changes they induce in their companions. In this work, we present both analytic and numerical work investigating these phenomena, with a particular focus on atmospheric heat transport, transient phenomena, and the possibility of deep heating via gamma rays. We find that certain classes of binary systems may explain decadal-timescale X-ray transient phenomena, as well as the formation of so-called redback companion systems. In addition, we examine the temperature anisotropy induced by the Pulsar in its companion, and demonstrate that this may be used to infer properties of both the companion and the Pulsar wind.