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Hydrodynamics and radiation from colliding pulsar and stellar winds in a high-mass binary system

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X-ray binaries are systems consisting on a massive star and a compact object. If the compact object is a pulsar, both the star and the pulsar will have their own winds. When both winds clash, they produce a contact discontinuity which creates shocked flows that go away from the binary and are affected by the orbital motion of the system. These flows are a plasma made by charged particles and it is assumed to be ideal and in adiabatic conditions. Under these assumptions we can compute the hydrodynamic properties in particular of the shocked pulsar wind as well as its radiation by inverse Compton scattering. The model tries to explain the hydrodynamics and radiation close to the binary system, called the ”inner region”, and in the ”outer region”up to a certain distance from the star. The results show a shocked wind that bends as a spiral with a decreasing pressure, density and specific enthalpy as the shocked wind goes further away, while the Lorentz factor starts increasing but ends up decreasing. This, as well as the Doppler boosting, affects the observer luminosity along the orbit. The variation of the luminosity over a whole orbit gives us information about the inclination, the processes involved in the shocked pulsar wind and its emission, and the properties of both the massive star and the compact object.

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