# Deep Chandra Observations of Nebulae Produced by Three Supersonic Pulsars

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When pulsars move with supersonic speeds, the ram pressure exerted by the oncoming ambient interstellar medium exceeds the pulsar wind pressure, thus confining the pulsar wind to the direction opposite the pulsar motion, resulting in a bow shock nebula with an extended tail behind the pulsar. Deep Chandra observations of PSRs J1509–5850, J1747–2958 (the Mouse), and B0355+54 revealed both the small and large-scale structures of the pulsar wind nebulae (PWNe) produced by these pulsars. We observed contrasting morphologies of the compact PWN heads, resolved jets and extended tails, and measured the spatially-resolved spectra of these PWNe. We also attempt to make a connection between the pulsar geometries and the appearances of their PWNe. For PSRs J1509 and B0355 we discovered asymmetric misaligned structures similar to those seen in the Guitar and Lighthouse PWNe. These observations probe the physics of magnetized relativistic outflows including particle diffusion, collisionless shock structure, magnetized flow collimation, magnetized plasma turbulence, and reconnection.

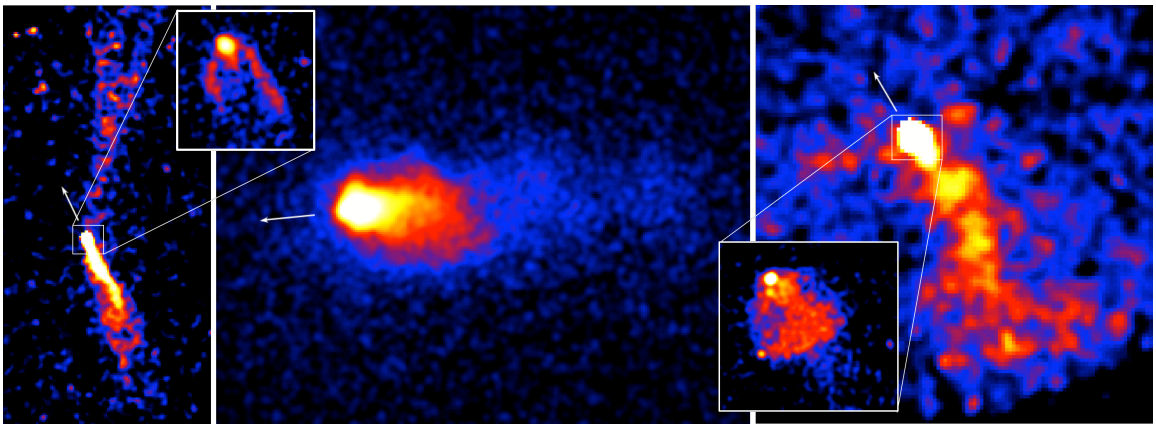

Figure 1: Chandra images of PWNe and tails produced by supersonic pulsars (from left to right: J1509–5850, the Mouse, and B0355+54). The arrows show the direction of proper motion.

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