Accretion states and thermonuclear bursts in neutron star X-ray binaries

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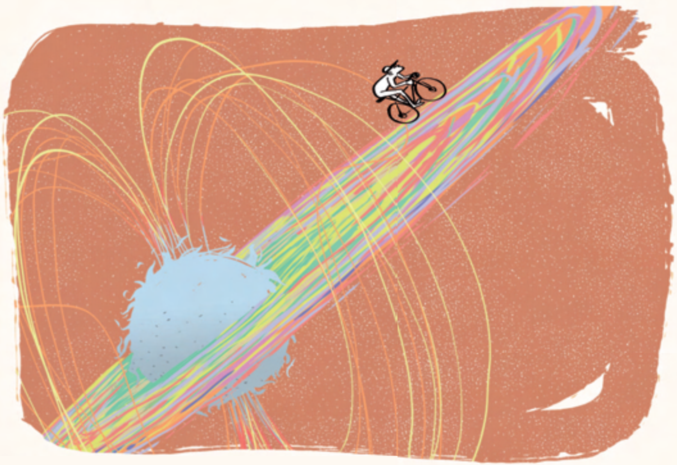
Every second tens of kilograms of extremely hot plasma fall onto each square centimeter of the surface of tens of neutron stars in our Galaxy. This is the consequence of a process known as accretion, by which matter falls onto a celestial body attracted by its gravity. Accretion onto a compact object, neutron star or black hole, is one of the most efficient ways of converting rest-mass energy into radiation and gives rise to extremely powerful X-ray sources. It provides a unique way to increase the spin rate and mass of the compact object after its birth and can also affect the surrounding interstellar medium by means of relativistic jets or outflows associated with the accretion process. There are different ways in which accretion onto a compact object can proceed. Different physical configurations of the accretion flow give rise to different accretion states, as witnessed by the changing spectral and variability properties of the X-ray emission. Another consequence of accretion onto neutron stars are thermonuclear explosions, which provide a direct view of their photosphere and a unique opportunity to constrain the properties of ultra-dense matter.

I present in this thesis a broad view of the high energy phenomena associated with neutron star low-mass X-ray binaries, based on the work that I have carried out at the University of Amsterdam during the past four years. I have focused on the X-ray emission of these systems, studying the luminosity of their different accretion states, a number of peculiar thermonuclear bursts and rapid variability phenomena associated with the innermost regions of the accretion flow.



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