

Magnetic fields of compact stars: how much do we really know?

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Stars that are not too heavy are destined to become white dwarfs or neutron stars. The violent processes that birth these compact objects can produce strong magnetic fields. Since these fields regulate almost all of the emissions the stars gift us, confronting theoretical models with observational data requires honesty in terms of what we know (and what we do not!). I will present a general overview of magnetic fields in compact stars: how they are modelled, which observations are key, results from simulations, and unsolved problems. For instance, the magnetic field strengths of neutron stars are typically inferred from pulse timing. Due to a combination of general-relativistic effects, the equation of state, magnetospheric weather conditions, and dynamical phenomena, I will argue there is a huge uncertainty on the inferred field strength when all is taken into account. Although this is a bit disheartening, it goes to show the richness of these astrophysical laboratories that hold hope to educate us about quantum chromodynamics, quantum electrodynamics, general relativity, and more.