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The decaying magnetic field of magnetars: evidence and inference

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Abstract. Magnetic field decay in neutron stars has been a long debated subject, since the early realization that radio pulsars were likely spinning neutron stars endowed with a 1E12 G magnetic dipole. This problem has however eluded all attempts of solution so far, mostly due to the scarcity of observational indications. Here I discuss the observational evidence for decay of the dipole magnetic field in magnetar candidates (Soft Gamma Repeaters and Anomalous X-ray Pulsars) and present a quantitative study of its main properties. I show that the decaying dipole does not have enough energy to power the persistent X-ray emission of magnetars. The latter must thus directly reveal the decay of an additional, stronger field component, presumably hidden in the interior of these neutron stars. Using existing models it is possible to characterize the salient properties of this internal field component and their implications for magnetar astrophysics. Finally, I sketch preliminary considerations on evolutionary links between magnetars and other classes of neutron stars with strong dipole field that do not show magnetar-like activity.