Observational diversity and evolution of neutron stars

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Ever since the discovery of the Crab and Vela pulsars in their respective Supernova Remnants (SNRs), our understanding of how neutron stars manifest themselves observationally has been dramatically shaped by the surge of discoveries and dedicated studies across the electromagnetic spectrum, particularly in the high-energy band. The growing diversity of neutron stars includes the highly magnetized neutron stars (magnetars) and the Central Compact Objects (CCOs) shining in X-rays and mostly lacking pulsar wind nebulae. These two subclasses of high-energy objects however seem to be characterized by anomalously high or anomalously low surface magnetic fields (thus dubbed as 'magnetars' and 'anti-magnetars', respectively), and have pulsar characteristic ages that are often much offset from their associated SNRs' ages. In addition, some neutron stars act 'schizophrenic' in that they occasionally display properties that seem common to more than one of the defined subclasses.
I will review the growing diversity of neutron stars from an observational perspective, then highlight recent/on-going theoretical and observational work attempting to address this diversity, particularly in light of their magnetic field evolution, energy loss mechanisms, and supernova progenitors' studies.

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