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Magnetar Formation via Accretion Induced Collpase of White Dwarfs

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Magnetars, which are neutron stars with a surface magnetic field strength of order 10^14 G, are the most magnetic objects in the universe. However, their formation channels are not yet fully understood. We present the first two-dimensional axisymmetric MHD simulations of accretion-induced collapse (AIC) of rotating white dwarfs (WDs). Unlike previous studies of AIC that imposed an ad hoc magnetic field configuration on an initially non-magnetized hydrostatic WD, our initial conditions are self-consistently constructed by solving the MHD equilibrium equations that contain a mixed toroidal and poloidal component. Our findings show that with initial surface magnetic field strength constrained by isolated WD observations, the protoneutron star can reach a field strength consistent with magnetar observations. Our results suggest that the AIC of a magnetized white dwarf could be a possible channel for forming a magnetar.

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