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Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond

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We explore in detail the time-dependent simulation for the evolution of the magnetized main sequence (MS) stars to magnetised white dwarfs (WDs) using the Cambridge Stellar evolution code: STARS. In order to do so, we have appropriately modified the said code by introducing magnetic effect and cooling. We investigate further the possible existence of stable, massive, super-Chandrasekhar WDs, inferred from the observations of peculiar over-luminous type Ia supernovae (such as SNLS-03D3bb). Magnetic fields greatly contribute to the existence of massive WDs, both through classical and quantum effects, as shown by our group's previous theoretical calculations. In this work, we explore the classical effects of magnetic fields on the structure of the MS stars, the evolution of the star on the HR diagram and finally, WDs. We investigate the stability of magnetic WDs, both below and above the Chandrasekhar limit. We obtain the possibility of existence of super-Chandrasekhar WDs and new mass limit(s), depending on the magnetic field geometry, mass accretion from its companion and cooling rates.

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