

OVER 20 YEARS OF THE SHORTEST-PERIOD BINARY STAR SYSTEM HM CANCRI: ORBITAL  
DECAY AND MESA EVOLUTION – AM CVN

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HM Cancri (HM Cnc) is the shortest-period binary star system, with an orbital period of 321s (frequency of 3.11mHz) and the system is accreting in a double WD configuration. Since its discovery over 20 years ago, we have obtained time-series optical photometry to precisely quantify its orbital decay. We find a positive frequency derivative such that the system is inspiraling, however, the frequency derivative itself is decreasing with time. This is the reverse behaviour to purely gravitational-wave driven evolution and is very likely a consequence of mass accretion. We use the observed orbital decay to investigate system evolutionary models, imposing constraints on system masses and thus the future of the binary. Its ultra-compact nature makes HM Cnc a unique system to test double WD binary star system evolutionary channels and HM Cnc will be one of the first sources detected by the gravitational wave spacecraft LISA, serving as an impactful “verification binary” for instrument calibration.