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Study of measured pulsar masses and their possible conclusions

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We study the statistics of 61 measured masses of neutron stars (NSs) in binary pulsar systems, including 18 double NS (DNS) systems, 26 radio pulsars (10 in our Galaxy) with white dwarf (WD) companions, 3 NSs with main-sequence companions, 13 NSs in X-ray binaries, and one undetermined system. We derive a mean value of M = 1.46 +/- 0.30 solar masses. When the 46 NSs with measured spin periods are divided into two groups at 20 milliseconds, i.e., the millisecond pulsar (MSP) group and others, we find that their mass averages are, respectively, M=1.57 +/- 0.35 solar masses and M=1.37+/- 0.23 solar masses. In the framework of the pulsar recycling hypothesis, this suggests that an accretion of approximately 0.2 solar mass is sufficient to spin up a neutron star and place it in the millisecond pulsar group. An empirical relation between the accreting mass and MSP spin period is \Delta M=0.43 (solar mass)(P/1 ms)^{-2/3}. UNlike the standard recycling process, if a MSP is formed by the accretion induced collapse (AIC) of a white dwarf with a mass less than Chandrasekha limit, e.g. 1.35 solar mass, then the binary MSPs involved in AICs is not be higher than 20%, which imposes a constraint on the AIC origin of MSPs.

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