LOWER LIMIT FOR NPN's MASSES

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The lowest mass observed for a nucleus of a planetary nebula (NPN) is about 0.55 M_o (Weidemann and Koester, 1983, Schonberner, 1983). Hence, Lower mass WD's should have been produced without going through the phase of a visible PN ejection. Recently, Harpaz et al. (1987), have shown that very low mass WD's (up to 0.45 M_o) can be formed by a single star evolution from red giant branch (RGB) stars, due to mass loss along the RGB. It turns out that WD's in mass range of 0.46-0.55 M_o formed by a single star evolution should be formed from the AGB, without an observable PN.

We suggest that WD's with masses in this range are formed from the lower part of the AGB. During this phase the mass loss rates are about $1\text{-}5\text{x}10^{-7}$ M_o/Y. Harpaz and Kovetz (1981) have shown that a mass loss rate of $2\text{x}10^{-6}$ M_oY is a lower limit for the production of an expanding nebula which might be observed as a faint PN. Lower mass loss rate will yield very dilute gas clouds, which will not produce the ionized shells observed as a PN. Hence, only stars which turn into WD's from the upper part of the AGB ($L > 5000\ L_o$, $m_c = M_{WD} > 0.55\ M_o$) will be observed as NPN's while stars which turn into WD's from the lower part of the AGB ($M_{WD} = m_c < 0.55\ M_o$) will not produce an observable PN. The gap between stars, which turns into WD's from the RGB, without any PN ($M_{WD} < 0.45\ M_o$), and those that pass through the stage of a PN ejection ($M_{WD} > 0.55\ M_o$) is bridged by stars, which expel their envelopes while still on the lower part of the AGB, with dilute gas cloud around them, which is too sparse to be observed as a PN.

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