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Chemical Fingerprints of AGB Mass Transfer in Open Clusters

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Blue straggler stars (BSSs) are thought to form from binary interactions, particularly mass transfer, mergers, and collisions. If a BSS forms from mass accreted from a thermally-pulsing asymptotic-giant-branch (AGB) star, it can bear distinctive surface abundance markers as a result of s-process nucleosynthesis that occurred in the evolved donor star. We present an abundance study of BSSs in two open clusters, NGC 7789 (1.6 Gyr) and M67 (4 Gyr), looking for signatures of AGB mass transfer, using high-resolution optical spectra obtained at the WIYN 3.5m Observatory. We place them in the context of the previously studied open clusters NGC 6819 (2.5 Gyr) and NGC 188 (7 Gyr). We find remarkable similarities in the positions on the color-magnitude diagram of barium-enriched BSSs in NGC 7789, M67, and NGC 6819, and we find an anticorrelation between the degree of Ba enhancement in the BSSs with respect to cluster age. We also find that 40±16% of the Ba-enriched BSSs are in spectroscopic binary systems with orbital periods less than 10,000 days, indicative of the frequent occurrence of wind mass transfer or wind Roche-lobe overflow. It is probable that AGB mass transfer is the dominant mechanism of BSS formation in open clusters older than about 1 Gyr.

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