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Tidal HI gas and star formation in the M81 Group

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The M81 galaxy group is surrounded by an HI debris field scattered by the tidal interactions of its galaxies, a situation that has obvious similarities to the Magellanic stream and illuminates the formation of in-situ stars in stellar halos during galaxy collisions. Using observations of stars across the M81 group from the Subaru Hyper Suprime-Cam, and observations of the neutral HI from the Very Large Array, we find that within this HI debris the density of young stars broadly correlates with the density of gas, as expected given the Schmidt-Kennicutt star formation law and the results of previous work. Yet, there are regions that have systematically different behaviors in distributions of stars and gas. We focus on two stretches of HI coming off NGC 3077: the Southern tidal bridge (between M81 and NGC 3077) and the Northern tidal bridge (from NGC 3077 in the direction of M82). The Southern bridge has a narrow strip of young stars down its center, and the Northern bridge is mostly devoid of stars. While the driver(s) for this kind of behavior remain uncertain, our analysis of star formation in galaxy group-scale mergers from the TNG50 hydrodynamical galaxy simulations shows that the differences between projected line-of-sight distances of the gas may be an important consideration.