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An analysis of the M31 galaxy's population through RR Lyrae variables

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ABSTRACT

RR Lyrae variable stars can serve as powerful probes of their host stellar populations. Information such as distance, metallicity, reddening, and age can be gleaned from their pulsation properties. Therefore, studying them in the nearest spiral galaxies M31 and M33 will yield important information about the early history of these galaxies. The main goals of this study are: 1) To investigate the Oosterhoff type of RR Lyrae stars in M31 and M33 and compare them with the Milky Way to better understand the formation of these galaxies. 2) To investigate the early formation history of these two galaxies through knowledge of their RR Lyrae stars. In order to achieve these goals, we have analyzed 10 fields in M31 and M33 (6 fields in M31 and 4 fields in M33) using archival imaging from the Hubble Space Telescope. Published data for M31, M33, and several M31 dwarf spheroidal galaxies are also used to study the global properties of RR Lyrae in these systems.

From the properties of RR Lyrae stars, we found that the majority of M31 and M33 RRLs are of OoI while those in M31 dSphs are of Oosterhoff intermediate. The main parameter affecting these Oosterhoff types is likely to be metallicity. Metallicity also play a role in the lack of RRLs in the High Amplitude Short Period (HASP,defined as those with $P0.48$ and $A_V \geqslant 0.75 mag$) variables in M31 dSphs. This difference in the properties of RRLs between their parent galaxy and satellites, as well as the lack of RRLs in the HASP region in dSphs can also be observed in the Milky Way. Therefore, systems like these dSphs are unlikely to be the main building blocks of the M31 and Milky Way halo.