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PHYSICS AND ASTRONOMY SEMINAR

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Islands no more: how do mergers affect galaxies and their satellites?

Large, disk-dominated galaxies like the Milky Way live in the center of vast ecosystems - dark matter, circumgalactic gas, and satellite galaxies. This ecosystem and the large galaxies in them grow hierarchically through merging. Yet, in our pictures of the evolution of galaxies like the Milky Way and the study of their satellites as probes of dark matter and small-scale cosmology merging generally plays a peripheral role. What do the mergers of these ecosystems and the galaxies in them do to galaxies like our own? Using powerful resolved-star datasets from HST and Subaru in concert with hydrodynamical models of galaxy formation, I will show evidence that galaxies like the Milky Way have experienced a diverse range of most important mergers, from systems like the Milky Way with a quiet merger history (until soon, when it will merge with the Magellanic Clouds) to the Andromeda Galaxy that suffered a nearly major merger around 2Gyr ago. Surprisingly, the properties of the Milky Way-mass galaxies are poorly correlated with merger history, suggesting that galaxy merging is not the only way that black holes and galactic bulges grow. Furthermore, to luminosity limits similar to faint classical dwarf galaxies, there is now evidence for a nearly order-of-magnitude range in the number of satellite galaxies of Milky Way-like central galaxies. While some of this variation scales with the mass of the central galaxy, the driver of most of this variation remains unclear. Intriguingly, we find that the number of satellites correlates tightly with the mass of the largest satellite ever accreted by the central galaxy (either already merged or still interacting) — a behavior not seen in state-of-the-art hydrodynamical galaxy formation models. In order to probe this behavior with superior number statistics, sensitivity to ultra-diffuse satellites, and order-of-magnitude fainter luminosity limits, next-generation surveys need to adopt wide-field resolved star techniques. Using deep ground-based Subaru datasets, I present our search methodology and candidate ultra-faint satellites in the M81 group. With such techniques, existing or near-future datasets from Subaru or the Rubin Observatory should reach complete to M_V~-6.5 (similar to current limits for Andromeda satellites), roughly doubling the number of known satellites galaxies in nearby groups. Star-galaxy separation is the limiting factor of current searches, and I illustrate also the dramatic improvements (reaching completeness of roughly M_V~-4) that can be achieved if nearby galaxy groups are surveyed for resolved stars using the Nancy Grace Roman Space Telescope.

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10:00 a.m. PST

For more information: https://www.sfu.ca/~jwa304/seminars.shtml