

Z107b Bifurcation of a stellar stream by a collision with a dark satellite or wandering black hole

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The stellar halo of M31 plays a crucial role in studying galaxy formation and evolution due to its proximity. Among many imprints from galactic collisions within the M31 stellar halo, Stream C and Stream D exhibit interesting features. These two stellar streams have almost identical widths with a few kpc and are parallel to each other with a three-dimensional spacing of about tens of kpc. Their line-of-sight velocities have negligible differences. The metallicities of both streams are very similar. In the following, we will refer to these two streams as “parallel stellar streams”. No scenario has yet been proposed to explain the formation of the parallel stellar streams. We suggest a hypothesis: a single stellar stream is bifurcated by interacting with a celestial body, such as a dark matter subhalo and a wandering supermassive black hole. The plausibility of this hypothesis is validated through N -body simulations. Numerical experiments on a wide range of parameters confirm that one stellar stream can be bifurcated by interacting with another object acting as a perturbation. The essential conditions for this bifurcation depend on a perturber’s mass, size, and orbit. While we have succeeded in developing the scenario for stream bifurcation, high-resolution spectroscopic observation of line-of-sight velocity and velocity gradient utilizing Subaru PFS is expected to limit the perturber model.