

NASSP Node: NWU

Level: Masters

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The mass of Milky Way satellite dwarf spheroidal galaxies

The Gaia space mission was launched in 2013 by the European Space Agency (ESA) and is expected to operate until 31st December 2025. Its primary mission is the astrometry of stars in the Milky Way (MW) galaxy. A more elaborate description can be found in [ESA Science & Technology - Gaia](#). The Gaia telescope is located at the Sun-Earth L2 Lagrangian point where it does astrometry, radial velocity and proper motion (PM) measurements of MW stars.

Gaia mission has the most accurate measurements of stellar position, radial velocities and proper motions in the Milky Way (MW) galaxy and some of its satellites. Using this data, the membership of stars to dwarf satellite galaxies in the MW has been revisited. Some of the dwarf spheroidal Milky Way satellite galaxies have also been observed with Gaia and we intend to measure the mass of these spheroidal galaxies using the Leonard-Merritt mass measurement method.

Assuming spherical symmetry of the dwarf spheroidal galaxies, we can use the dynamics of the stars to constrain their masses. The constraint/assumption that the dwarf spheroidal are spherically symmetrical allows us the opportunity to measure their mass. This also relies on the quantification of an accurate mass distribution of the spheroidal galaxies via photometry.

Using proper motion data we can constrain the 2-D velocity vectors of the individual stars in the galaxy. We can then use the vectors as test particles in the gravitational potential field of the star clusters. The gravitational potential of globular clusters is well represented by the King model and the Navarro-Frenk-White (NFW) potential. Using the Leonard-Merritt method with the King model, we can constrain the masses of the dwarf galaxy.

The method we shall use will be:

- Choose a satellite dwarf galaxy of the MW for which there is sufficient proper motion data in the Gaia archives.
- Use photometric data to determine light distribution.
- Match the King model to the light distribution.
- Calculate the mass of the galaxy using Leonard-Merritt method.