Using A New Model for Main Sequence Turnoff Absolute Magnitudes to Measure Stellar Streams in the Milky Way Halo

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Abstract:
Statistical photometric parallax is a method for using the distribution of absolute magnitudes of stellar tracers to statistically recover the underlying density distribution of these tracers. In previous work, statistical photometric parallax was used to trace the Sagittarius Dwarf tidal stream, the so-called bifurcated piece of the Sagittarius stream, and the Virgo overdensity through the Milky Way. We use an improved knowledge of this distribution in a new algorithm that accounts for the changes in the stellar population of color-selected stars near the photometric limit of the Sloan Digital Sky Survey (SDSS). Although we select bluer main sequence turnoff stars (MSTO) as tracers, large color errors near the survey limit cause many stars to be scattered out of our selection box. We show that we are able to recover parameters for analogues of these streams in simulated data using a maximum likelihood optimization on MilkyWay@home. We also present the preliminary results of fitting the density distribution of major Milky Way tidal streams in SDSS data. This research is supported by generous gifts from the Marvin Clan, Babette Josephs, Manit Limlamai, and the MilkyWay@home volunteers.

Main Sequence Turn-Off (MSTO) Star Distribution:

In the original work done by Newby et al. 2013, the SDSS detection efficiency was accounted for, but the effects of stars shifting into and out of the MSTO color selection criteria, due to increasing color error with distance, was not accounted for. In our new model we account for this effect and a new total detection efficiency is calculated by multiplying the two detection efficiencies together.

Conclusions:
While we are currently having trouble calculating uncertainty values for our results, at first glance it seems we are capable of recovering all 18 parameters needed to characterize the three streams present in our data. This is possible on both a model exactly representative of that which we are fitting and a model in which we are trying to fit an incorrect background. The background model we typically attempt to fit to SDSS data follows a Hernquist density profile, while in the different background section, we generated the simulated data with a broken power law background (Ahkter et al. 2012) and fit it with a Hernquist background. Even with an incorrect background, our ability to characterize streams is minimally affected. The final piece of this research will be to calculate the errors for our fits and then recompare the results to their expected values.

References:
• Abazajian et al. 2009
• Ahkter et al. 2012
• Carlin et al. 2012
• Cole et al. 2008
• Cole PhD. Thesis
• Newberg and Yanny 2006
• Newby et al. 2011
• Newby et al. 2013
• Newby PhD. Thesis

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