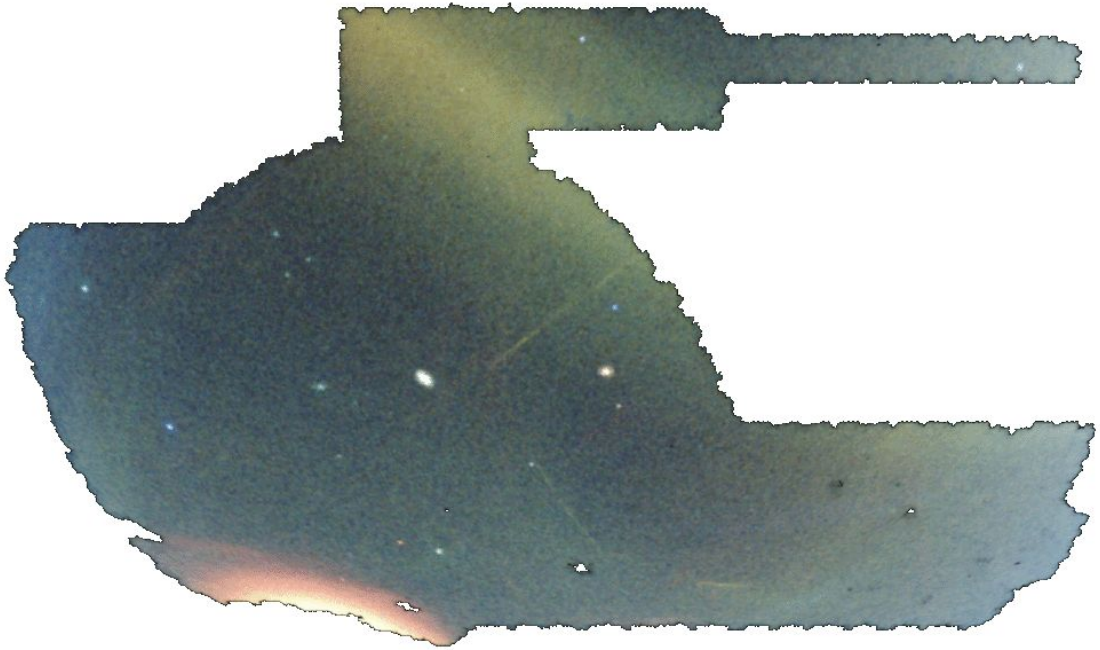
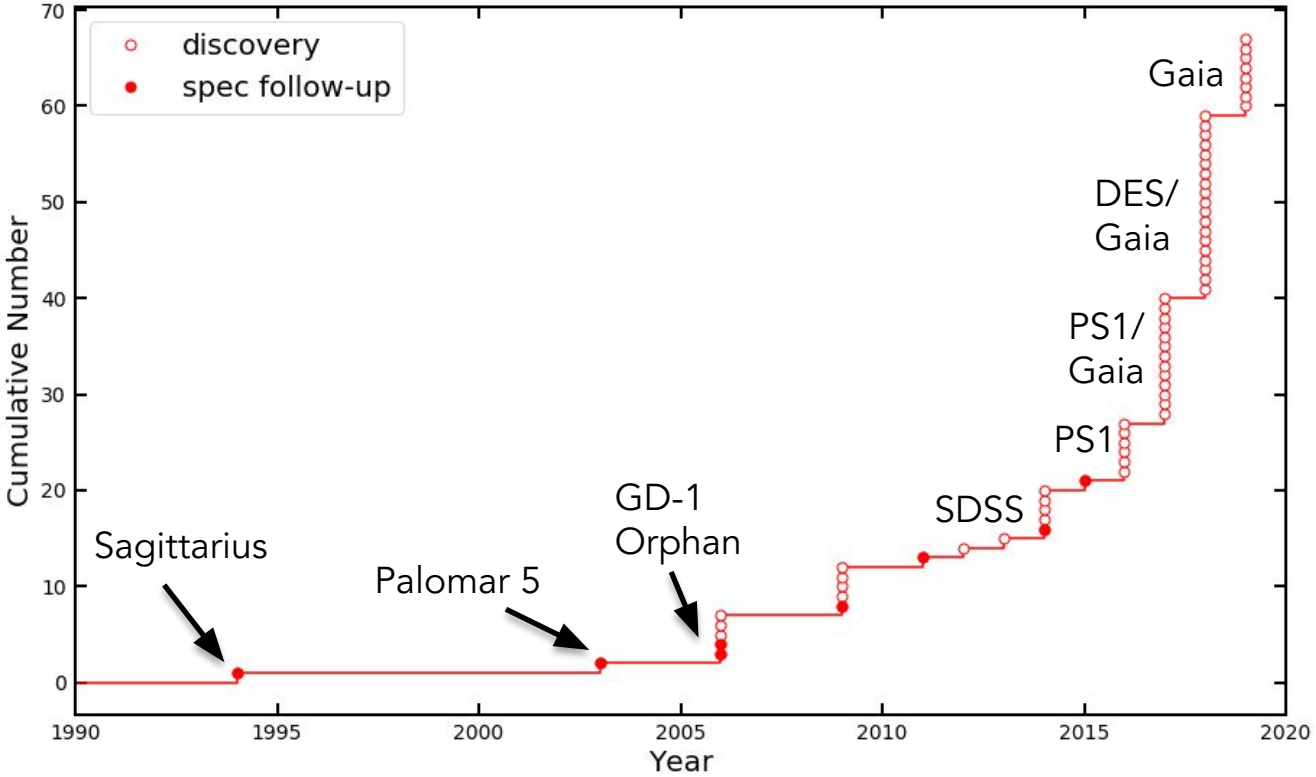
Observations of Stellar Streams with DES, Gaia, and LSST



Nora Shipp | University of Chicago

LSST Dark Matter Workshop, KICP, August 2019

Stream Discovery Timeline



Credit: Ting Li

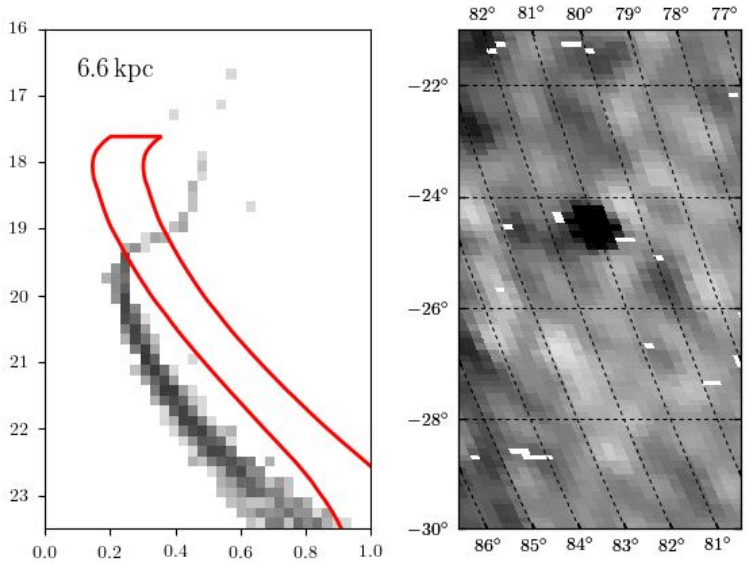
Detection of Stellar Streams

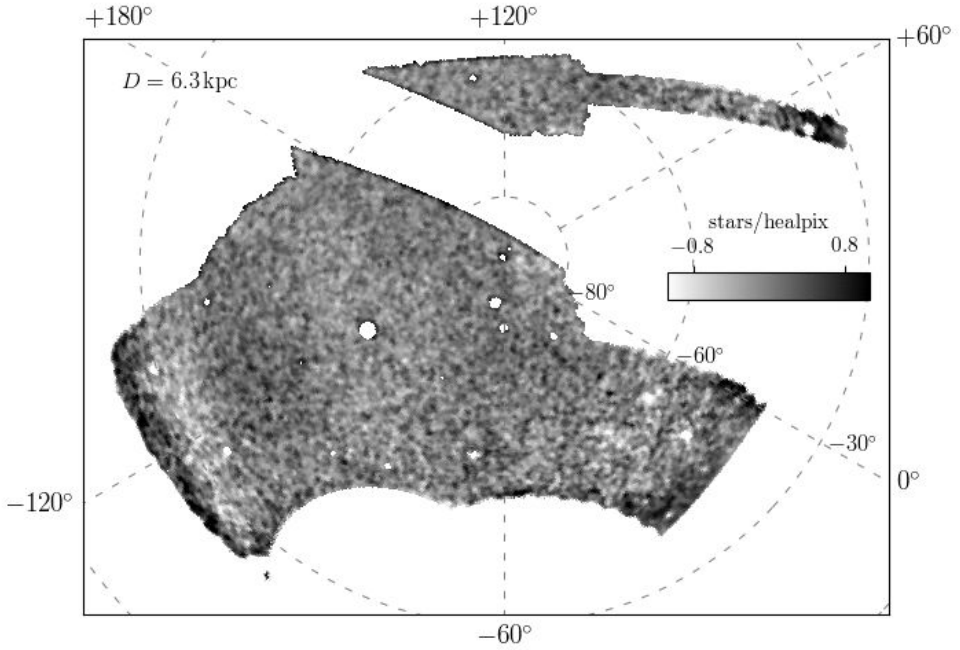
Stellar Streams Discovered in
the Dark Energy Survey

Shipp et al. 2018

arXiv:1801.03097

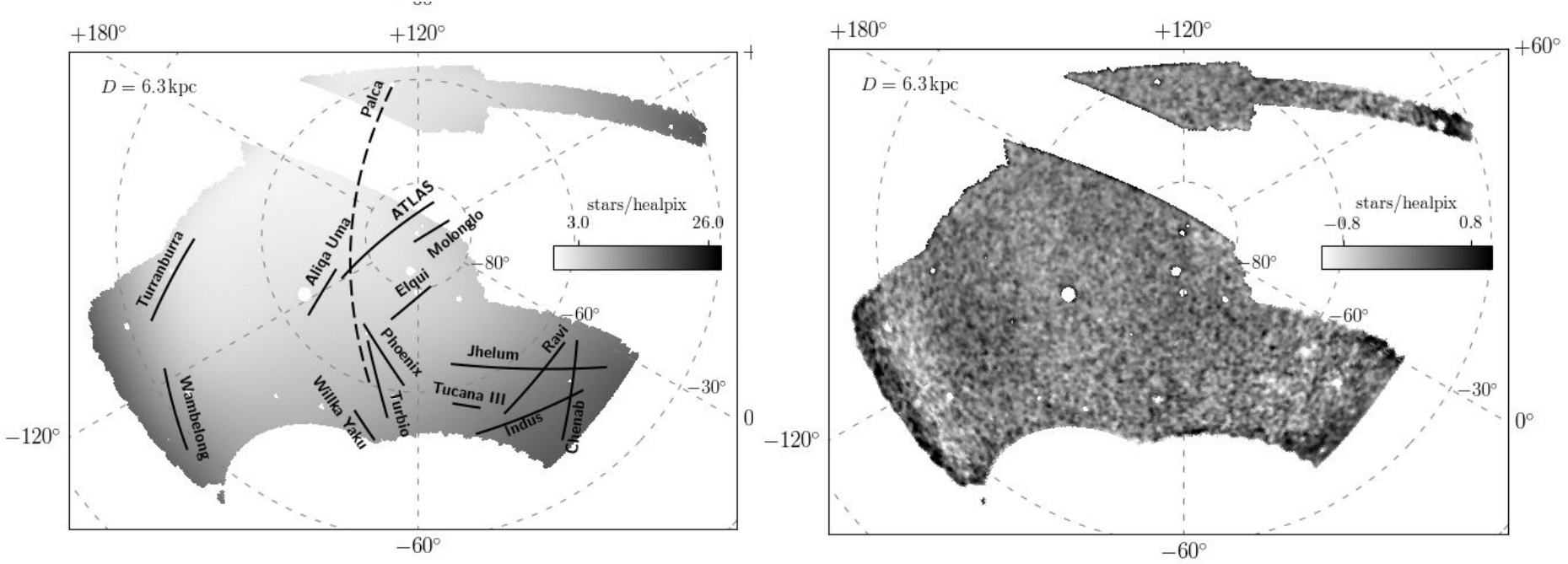
Stellar streams in the Dark Energy Survey





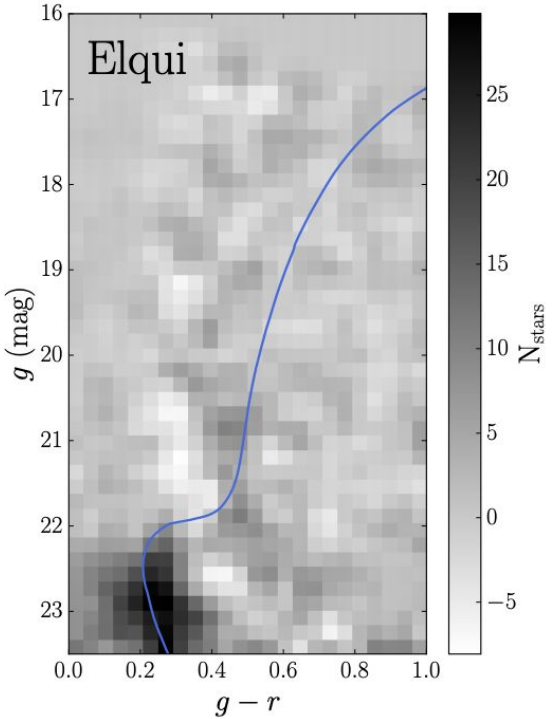
Shipp et al. 2018 arXiv:1801.03097

Stellar streams in the Dark Energy Survey



Shipp et al. 2018 arXiv:1801.03097

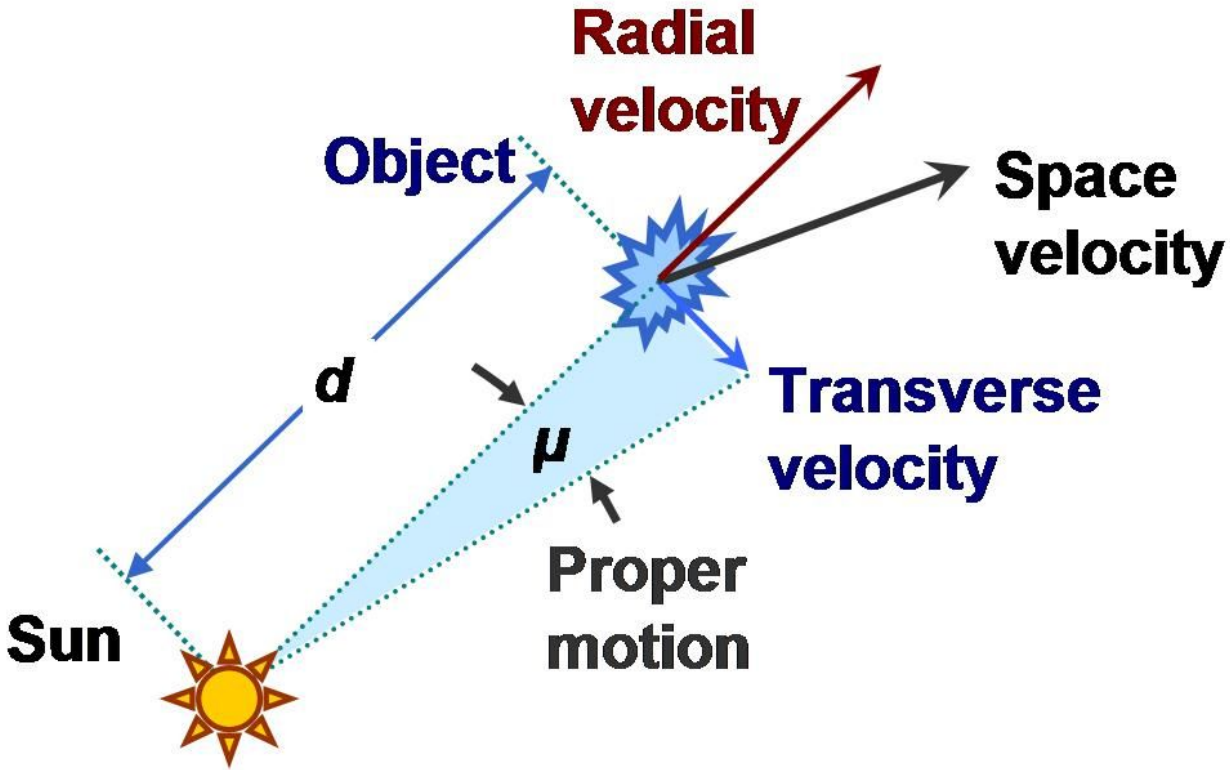
Stellar streams in the Dark Energy Survey



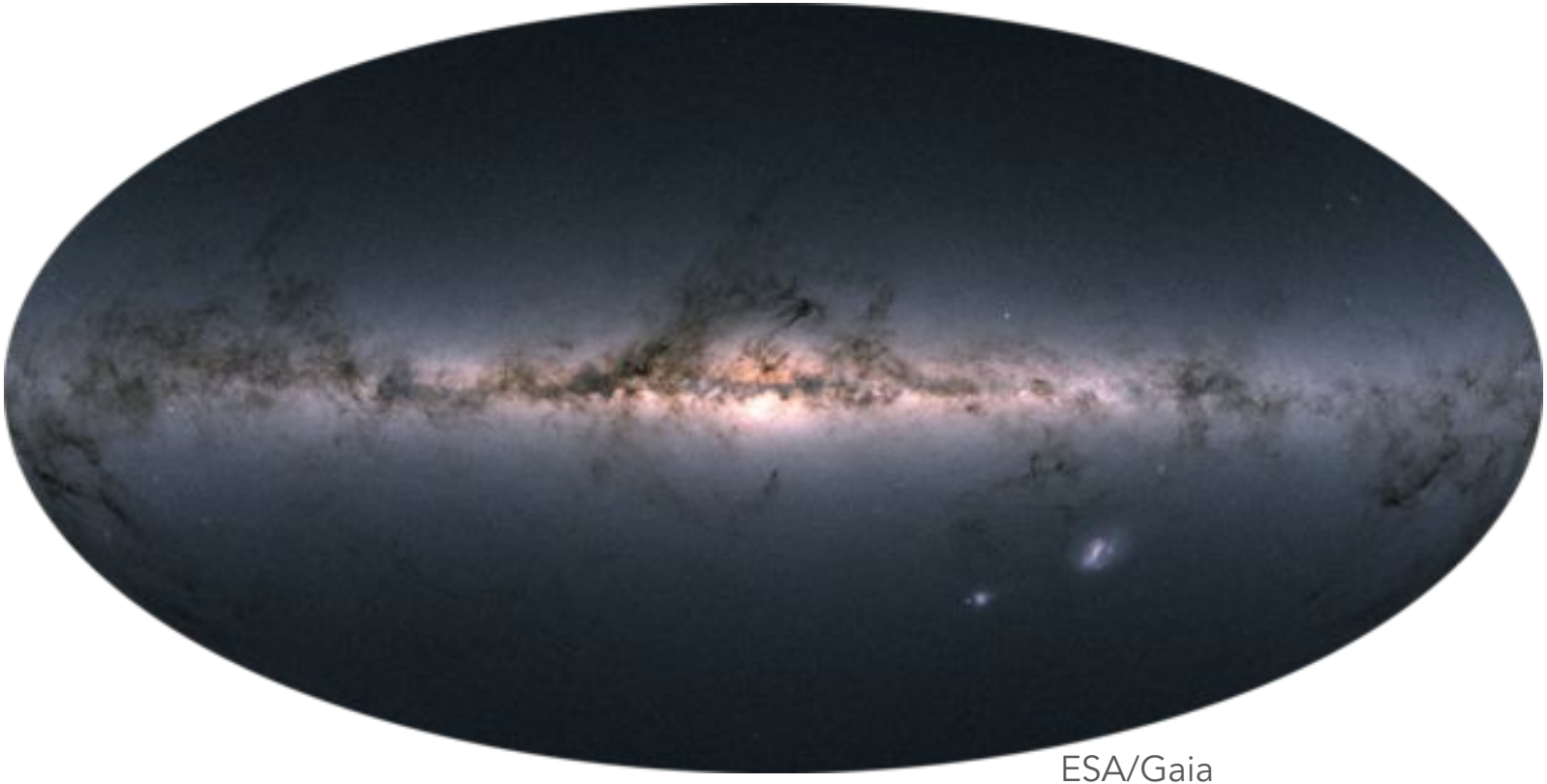
- Most distant DES stream at 50 kpc
- The fainter magnitude limit of LSST will allow for the detection of more distant stellar streams, as well as lower surface brightness streams

Shipp et al. 2018 arXiv:1801.03097

Kinematics of Stellar Streams



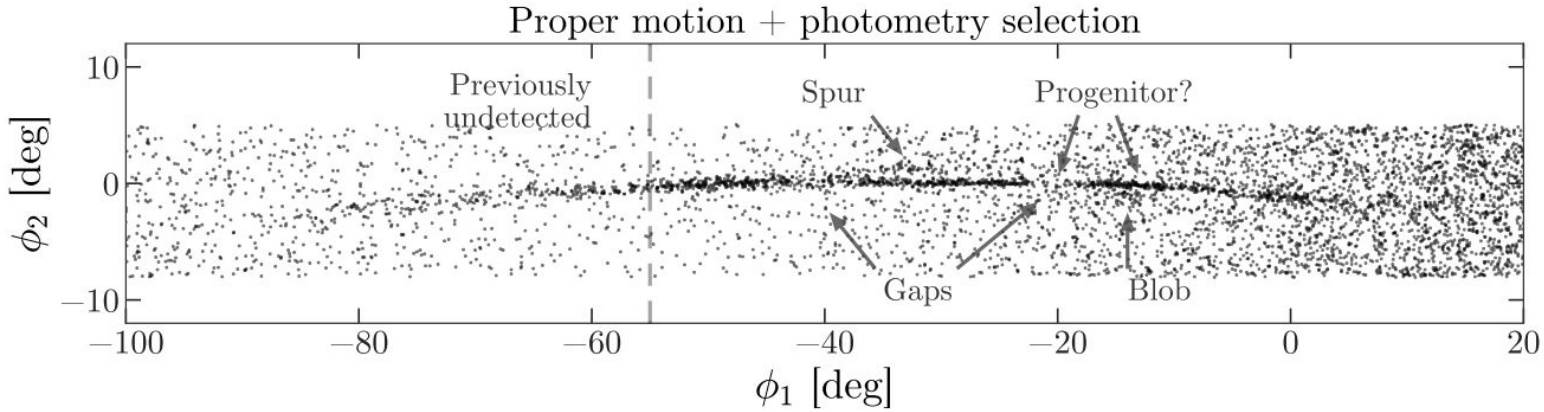
Proper motions with DES DR1 X *Gaia* DR2



ESA/Gaia

Gaps in Streams with Gaia DR2

Price-Whelan, Bonaca, 2018:



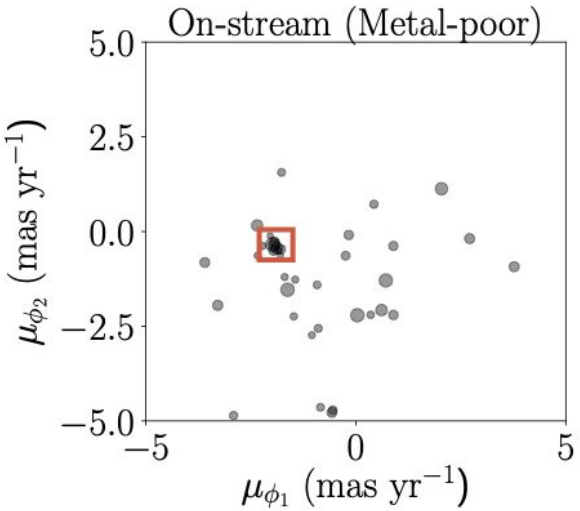
Proper motions with DES DR1 X *Gaia* DR2

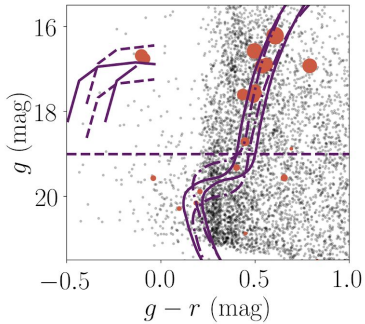
Proper Motions of Stellar Streams Discovered in the Dark Energy Survey

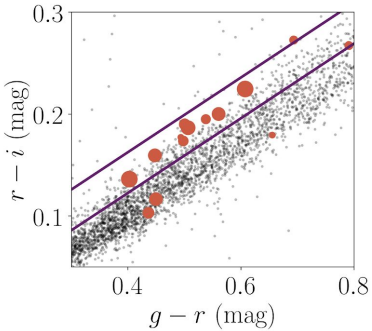
Shipp et al. 2019

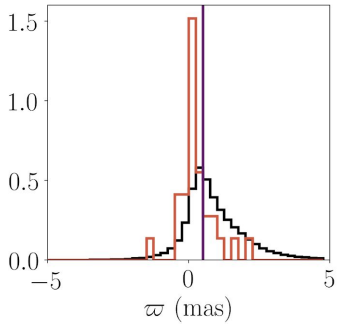
arXiv:1907.09488

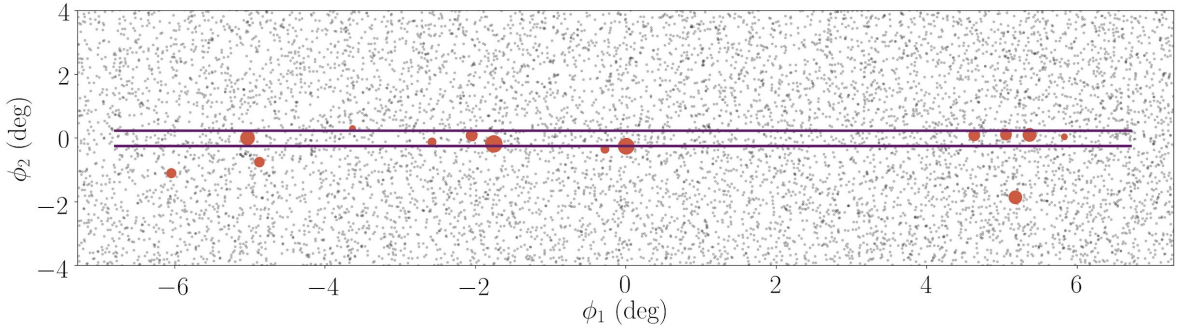
Proper motions with DES DR1 X *Gaia* DR2



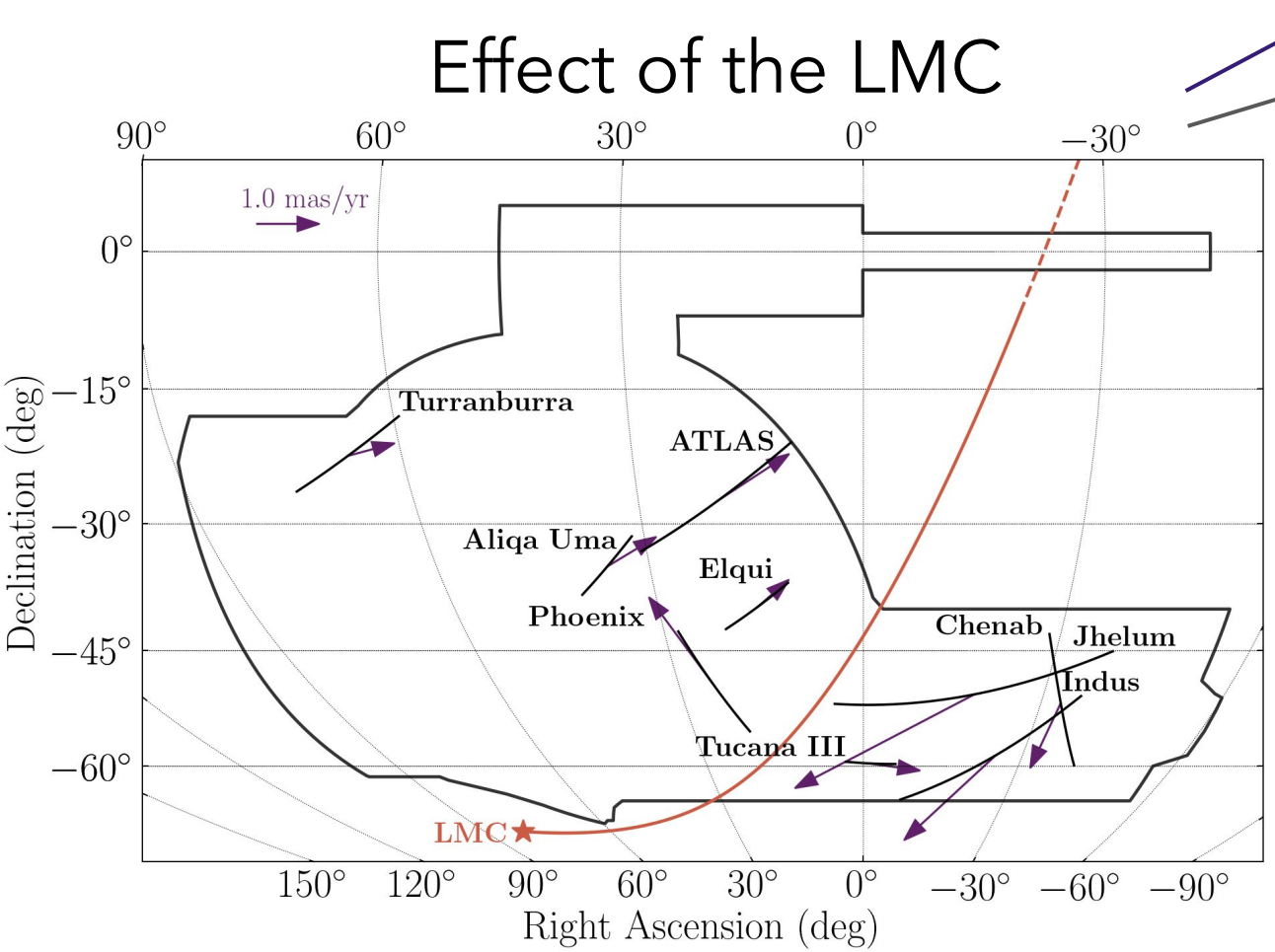




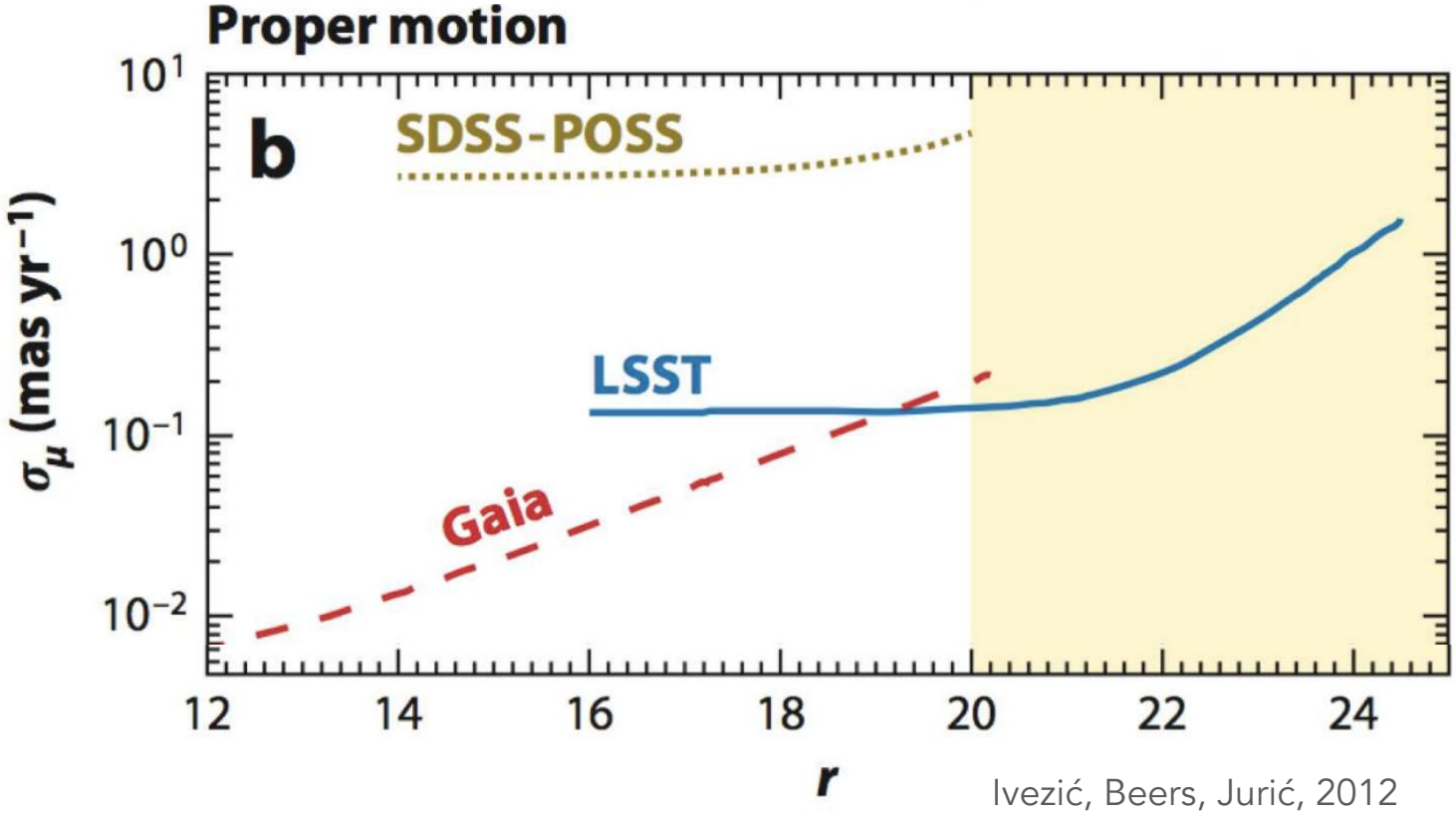




Effect of the LMC



Proper Motions with LSST



Ivezić, Beers, Jurić, 2012

Spectroscopy of Stellar Streams

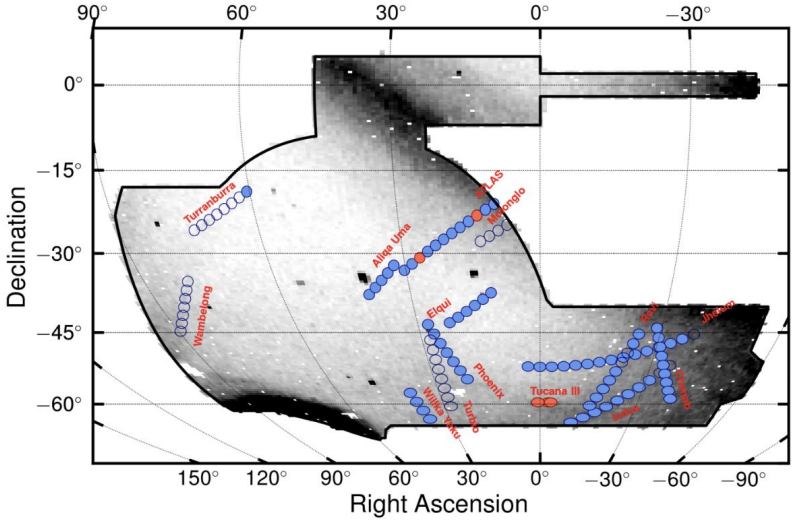
The Southern Stellar Stream Spectroscopic Survey (S^5): *Overview, Target Selection, Data Reduction, Validation, and Early Science*

Li et al. 2019

arXiv:1907.09481

S^5 - Southern Stellar Stream Spectroscopic Survey

- Using 3.9-m Anglo-Australian Telescope's 2-degree-Field fibre positioner and AAOmega spectrograph
- Completed observations of 12 streams (9 DES)
- Efficient target selection with DES DR1 photometry and Gaia DR2 proper motions



s5collab.github.io

Summary

- LSST will provide us with deep observations of stellar streams that can be used to constrain the minimum halo mass
- With LSST, we will be able to discover many more thin stellar streams at larger distances and fainter surface brightnesses
- LSST will provide proper motion measurements at fainter magnitudes than Gaia
- We will need to spectroscopically follow up LSST streams, ideally would have an MSE-like instrument in the southern hemisphere