Chasing the Galactic structure using VLBI and Gaia

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Bessel S269:
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Katharina Immer (JIVE)
& Bessel team

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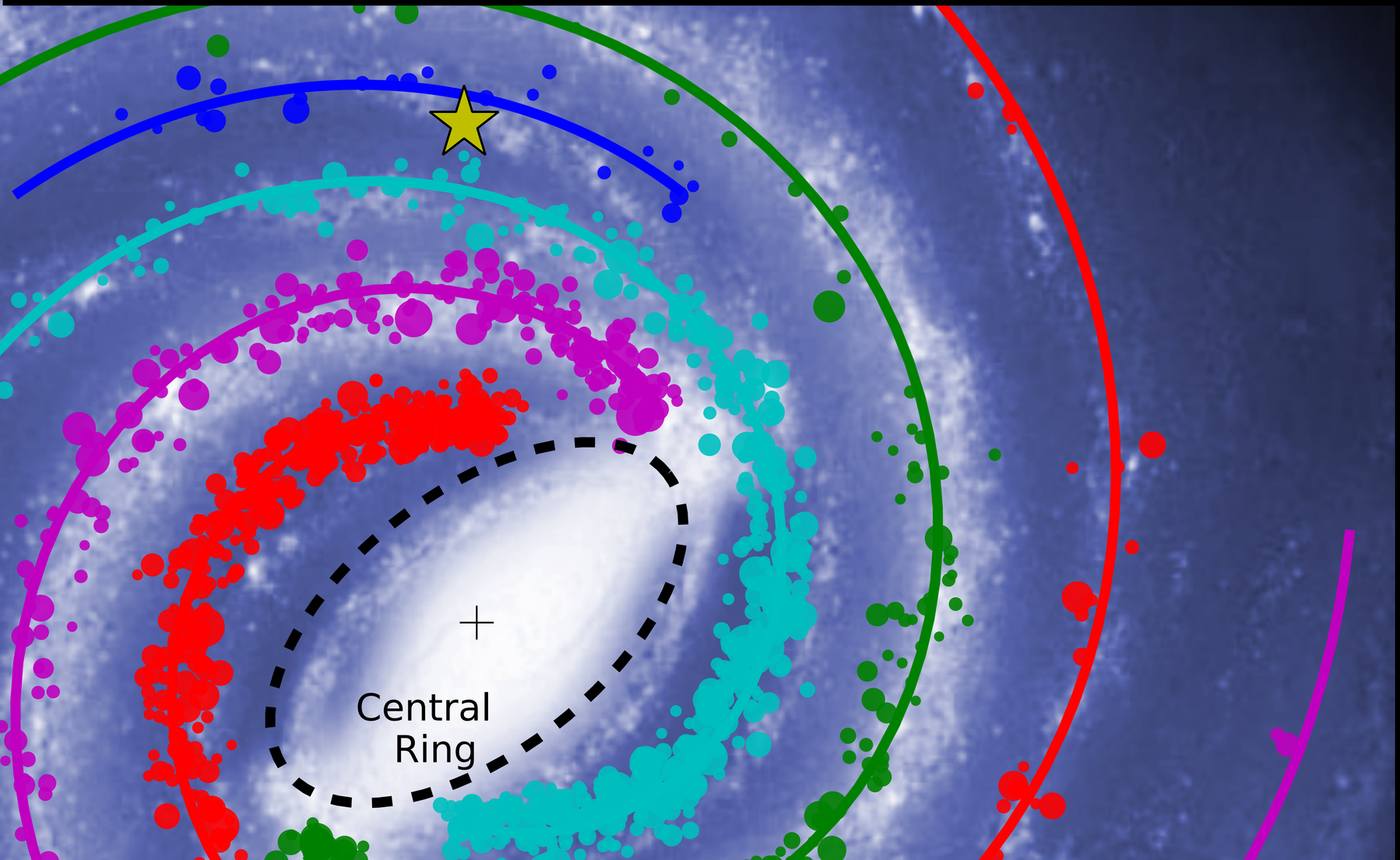
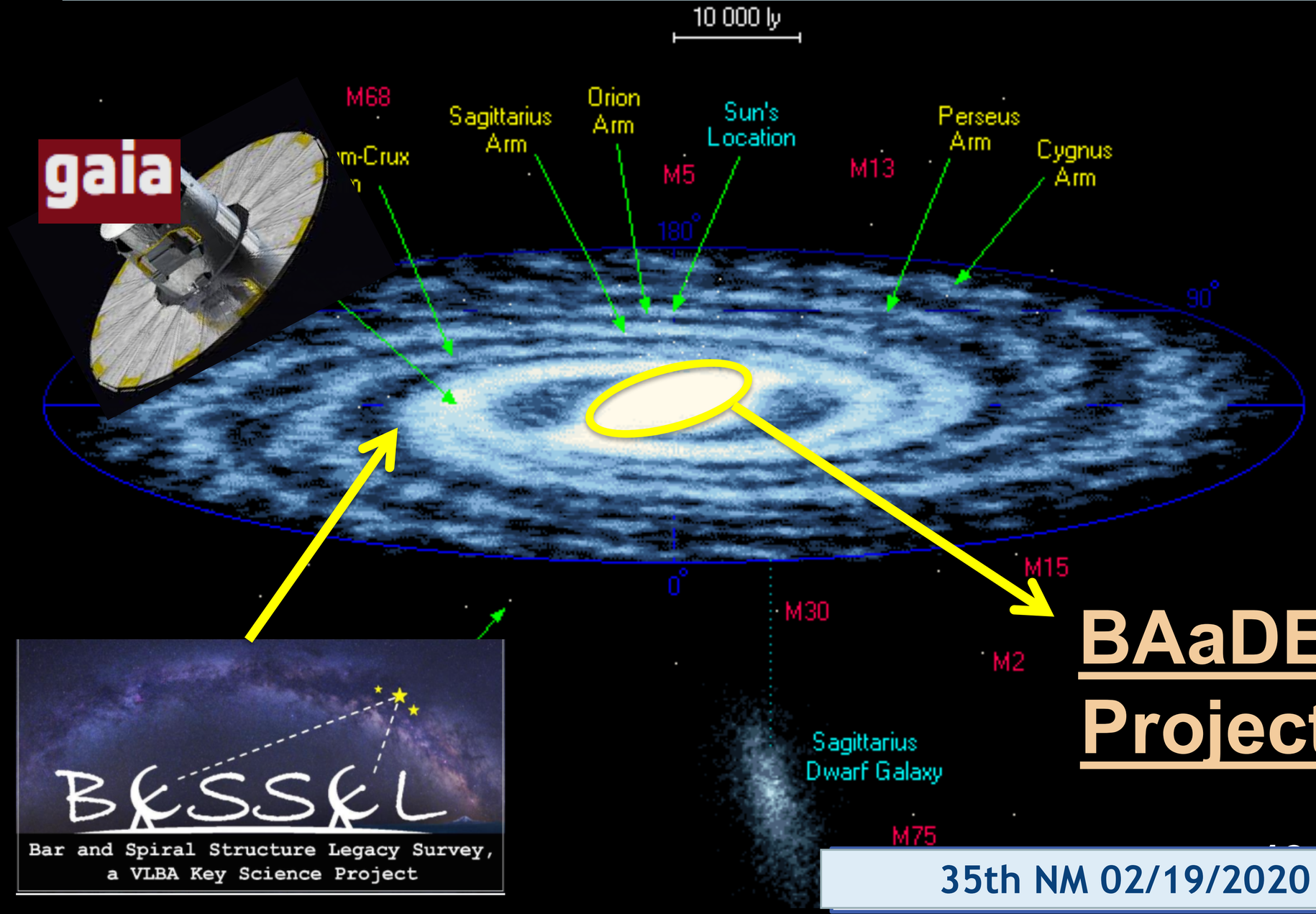
Ylva Pihlström (UNM)
Mike Rich (UCLA)
Mark Morris (UCLA)
& BAaDE team

Gaia:
Anthony Brown (Leiden/ESA)
Keith Tirimba (Florida)



Synergy between Gaia and radio campaigns

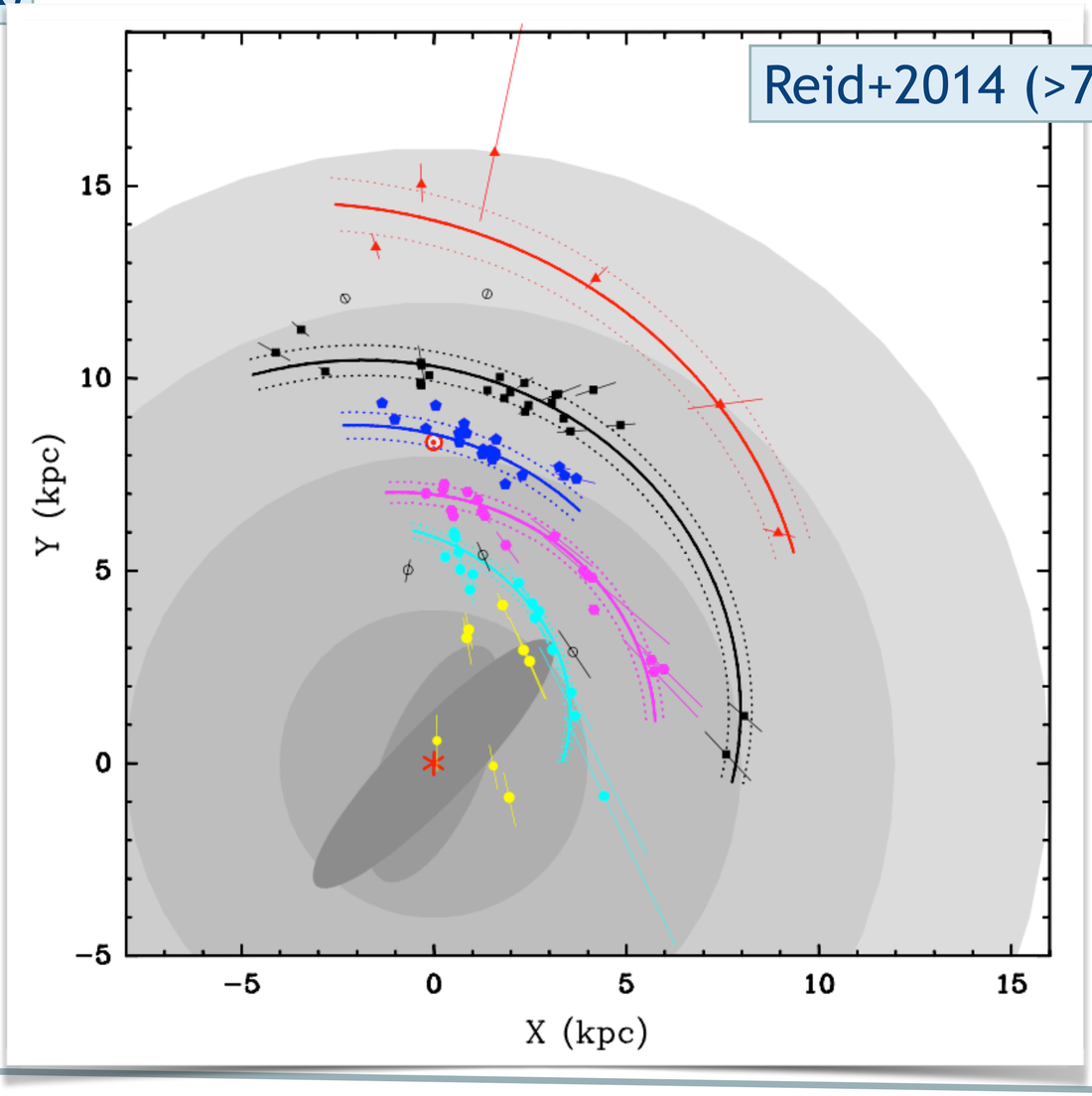


35th NM 02/19/2020

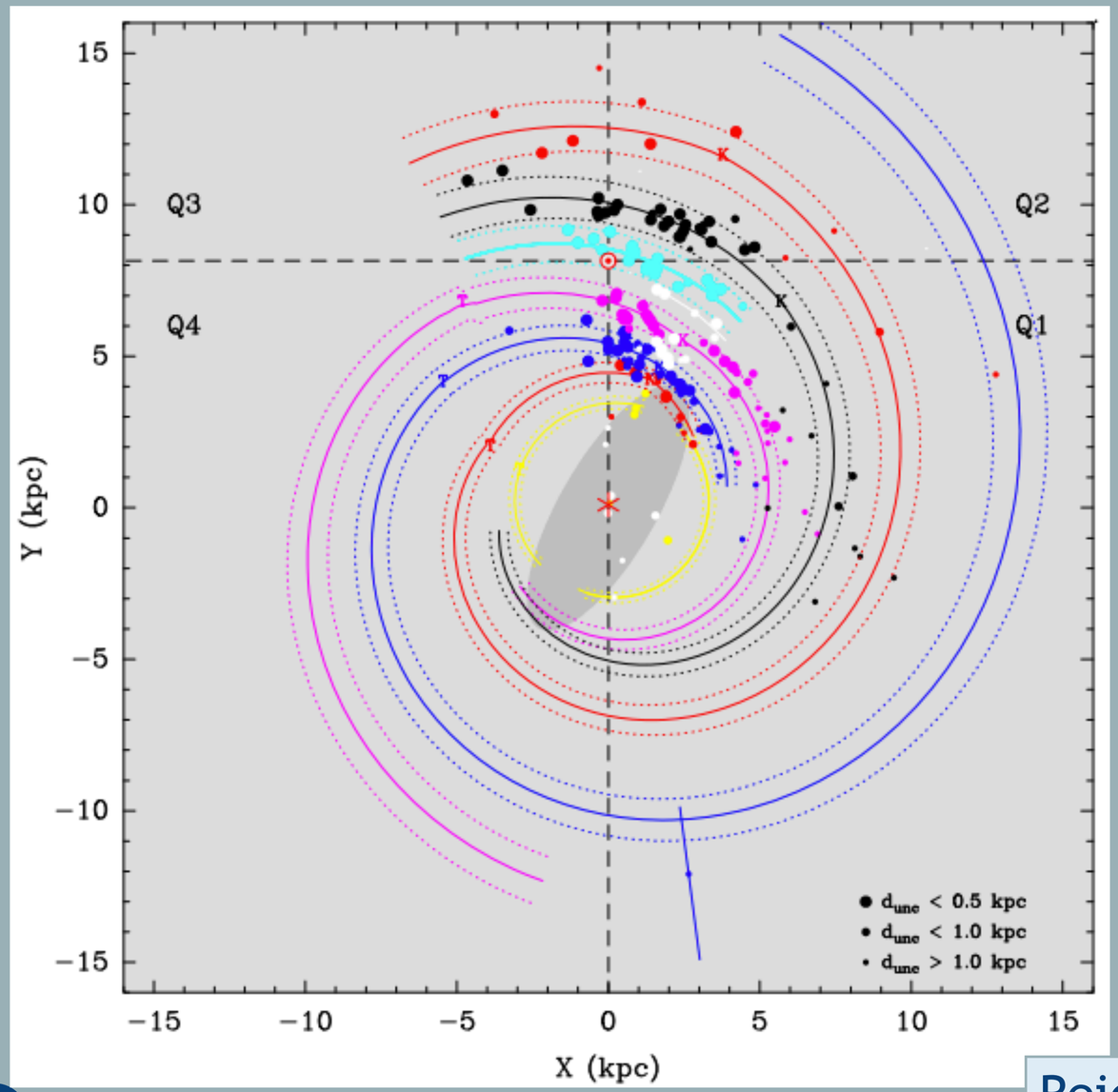
BeSSeL Survey Bar and Spiral Structure Legacy Survey

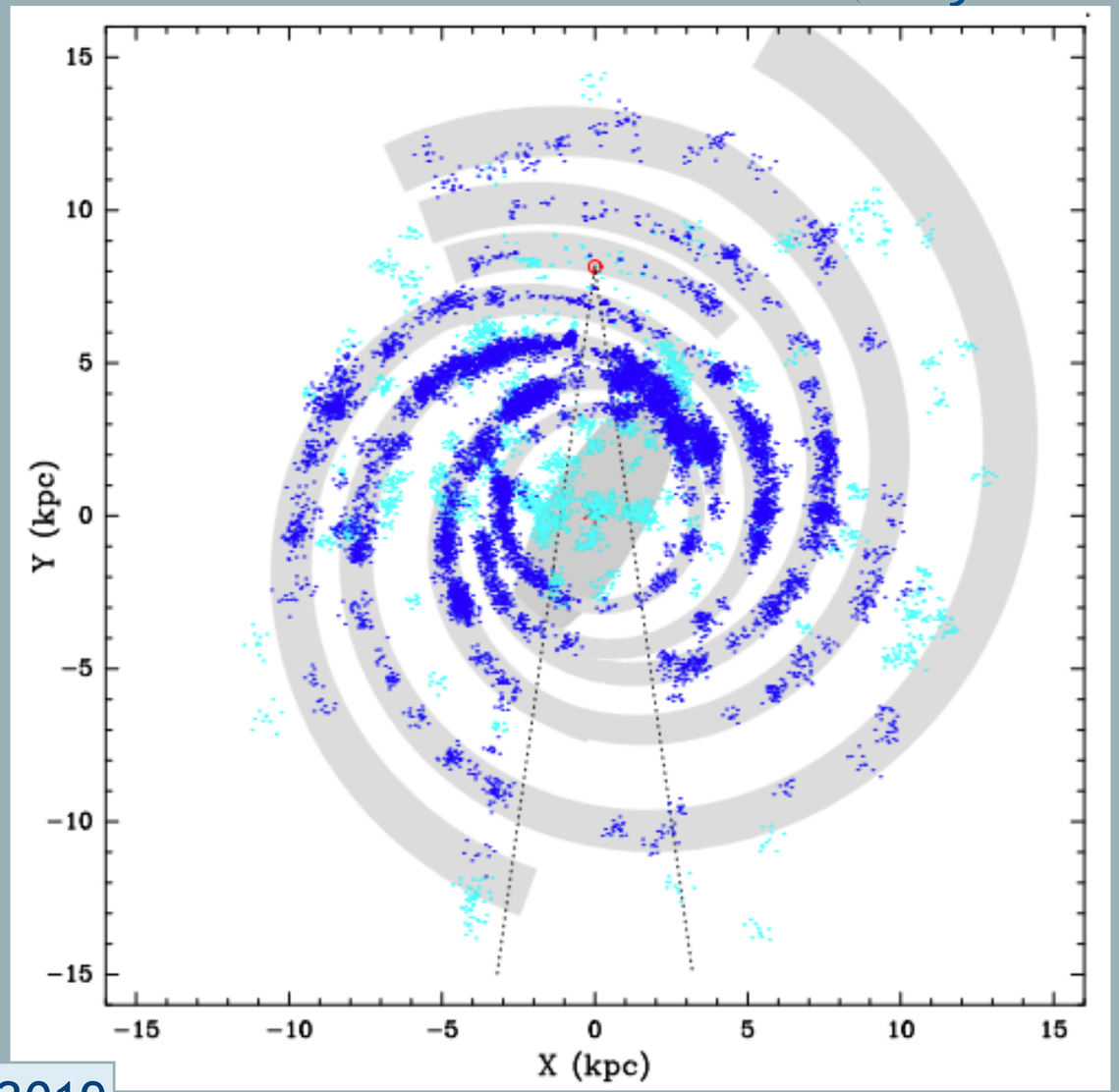
PI: M. Reid (CfA) and K. Menten (MPIfR)

- Masers in ~250 HMSFR:
  - H_2O (22 GHz)
  - CH_3OH (6.7 & 12 GHz)
- 6D with ~10μas accuracy
- Study the MW's spiral structure & kinematics
- ~5000 hours over 5 years



BeSSeL Survey





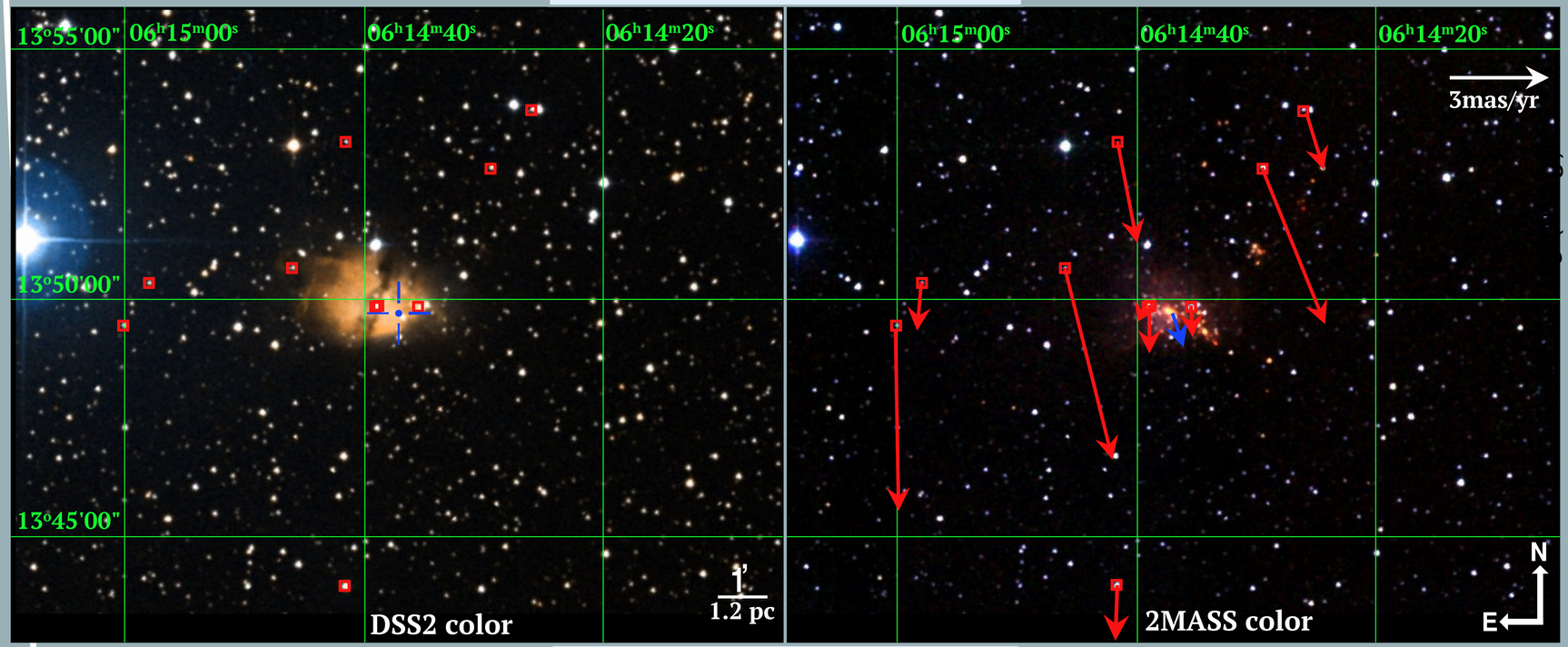
Reid+2019

Synergies with Gaia

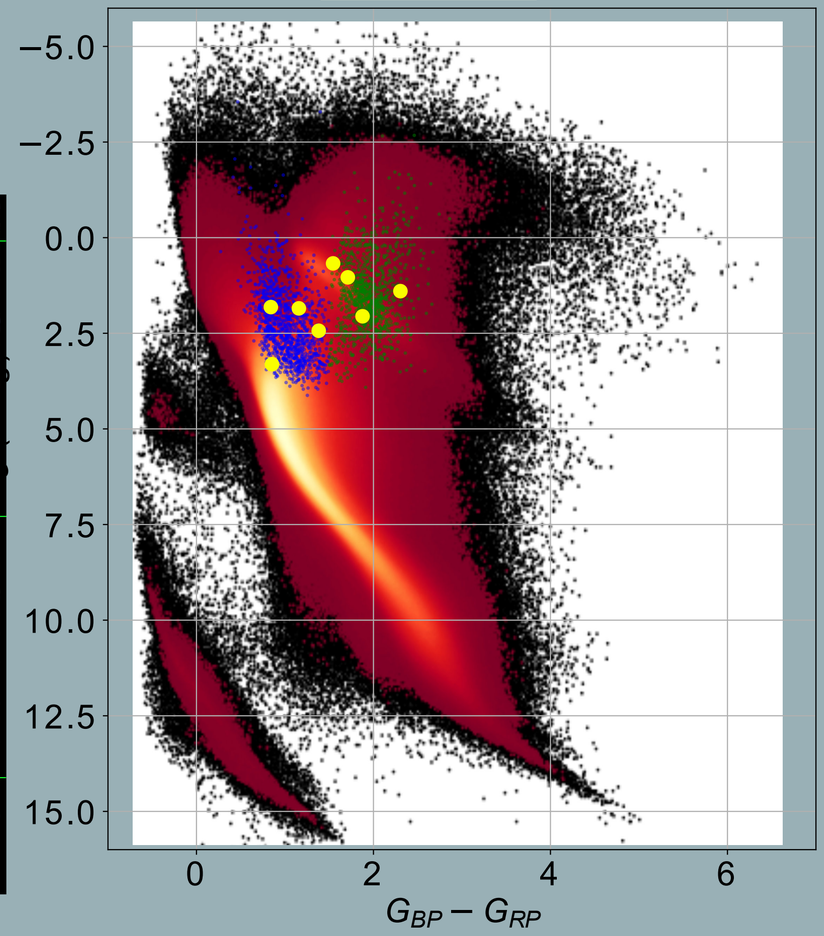
• Stellar Associations

• S269

π=0.241 ± 0.012 mas

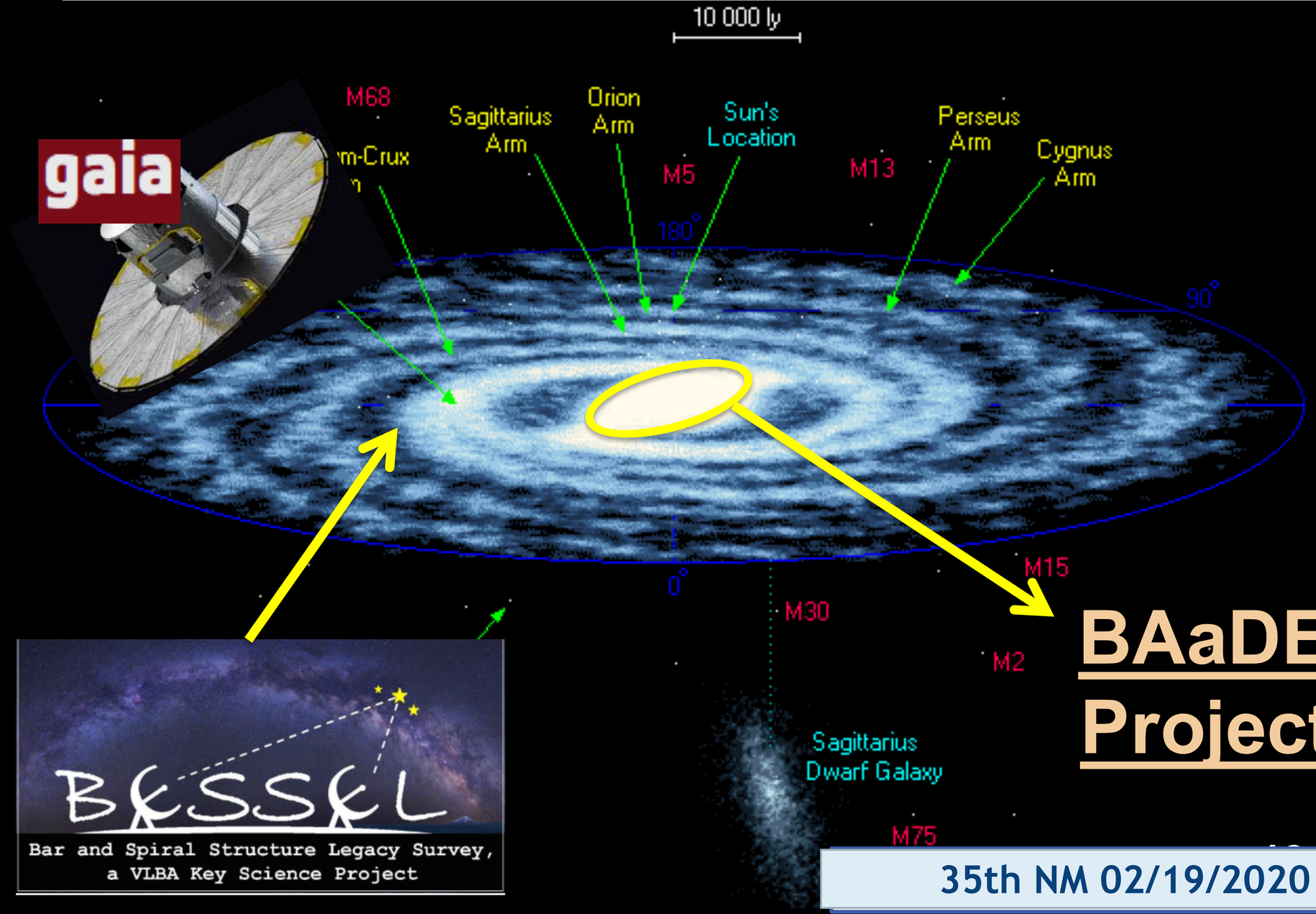


Quiroga Nunez+2019



Quiroga-Nunez in prep.

Synergy between Gaia and radio campaigns



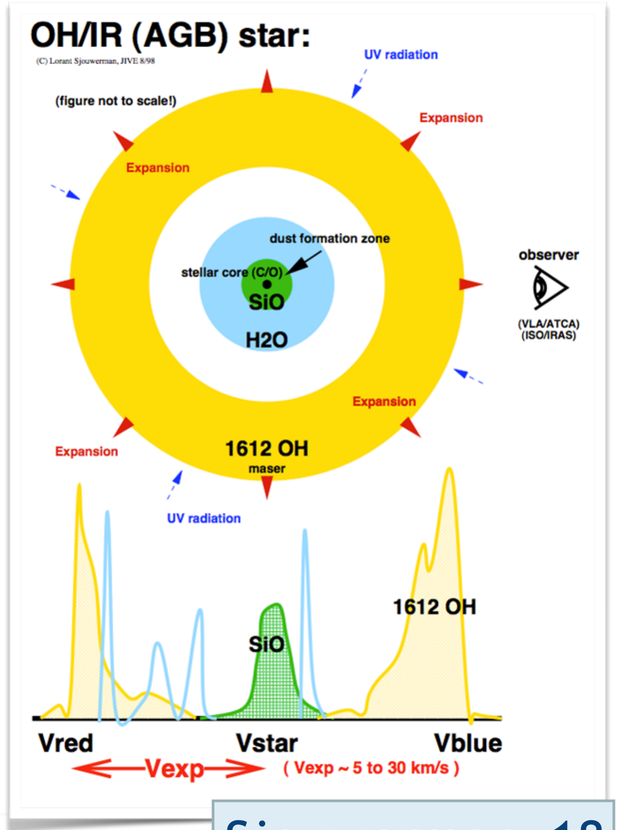
35th NM 02/19/2020

BAaDE project

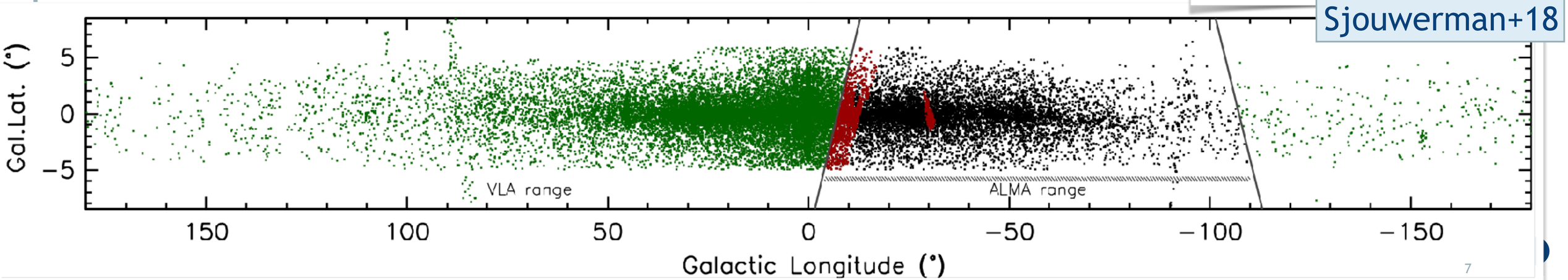
Bulge Asymmetries and Dynamic Evolution

PI: Y. Philström (UNM) and L. Sjouwerman (NRAO)

- Mira stars ->SiO masers
- IR selection based on MSX
- |b| < 5°
- 29,000 targets:
  - VLA 19,000 observed!
  - ALMA 2,300 obs. + future Cycles

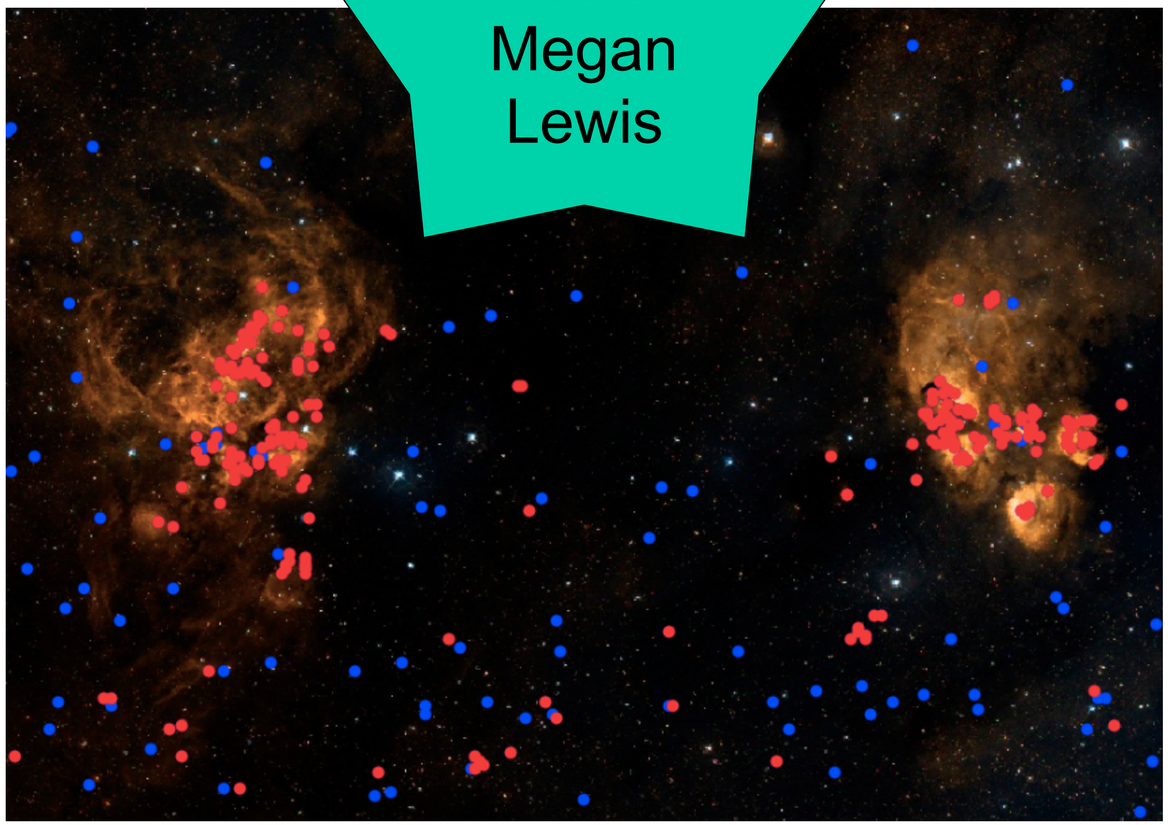


Sjouwerman+18



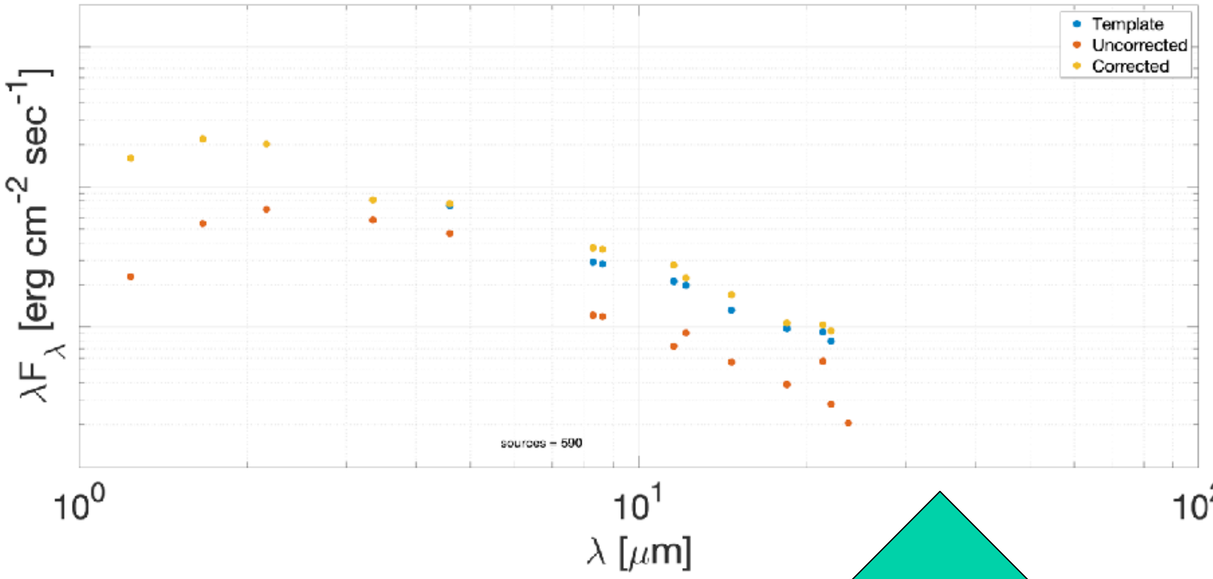
BAaDE project

Poster
Megan
Lewis



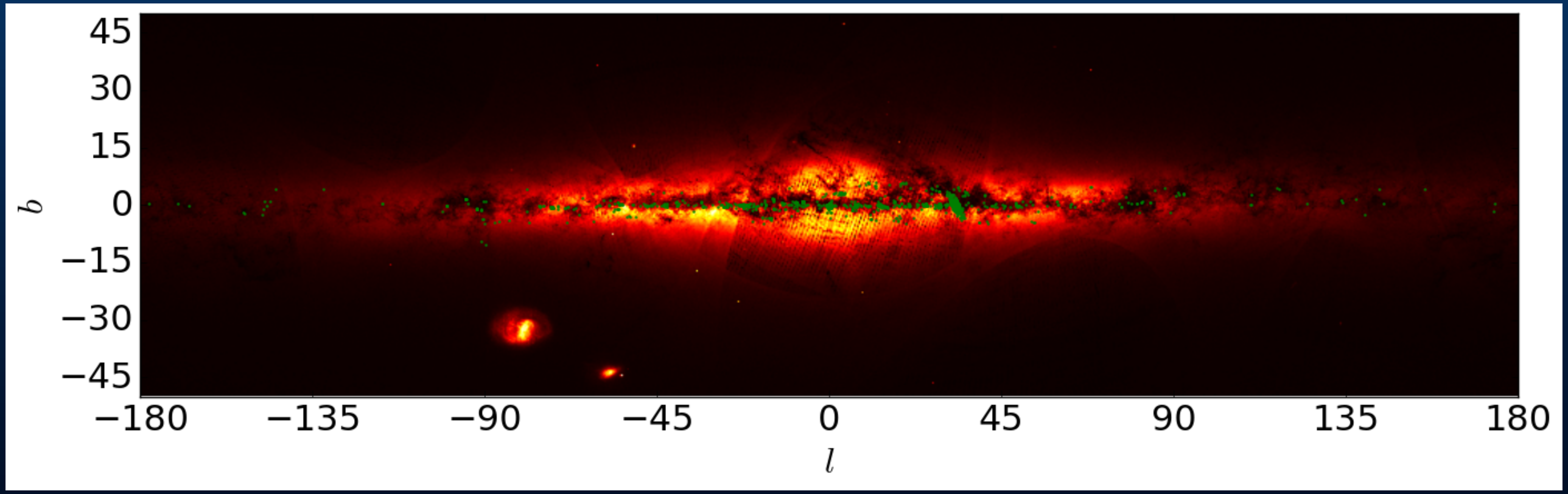
YSO, Carbon, Oxygen rich stars

SED fitting for AGB



Poster
Brandon
Medina


BAaDE Targets
2MASS
2 MICRON ALL SKY SURVEY
gaia


45
30
15
0
−15
−30
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b
−180
−135
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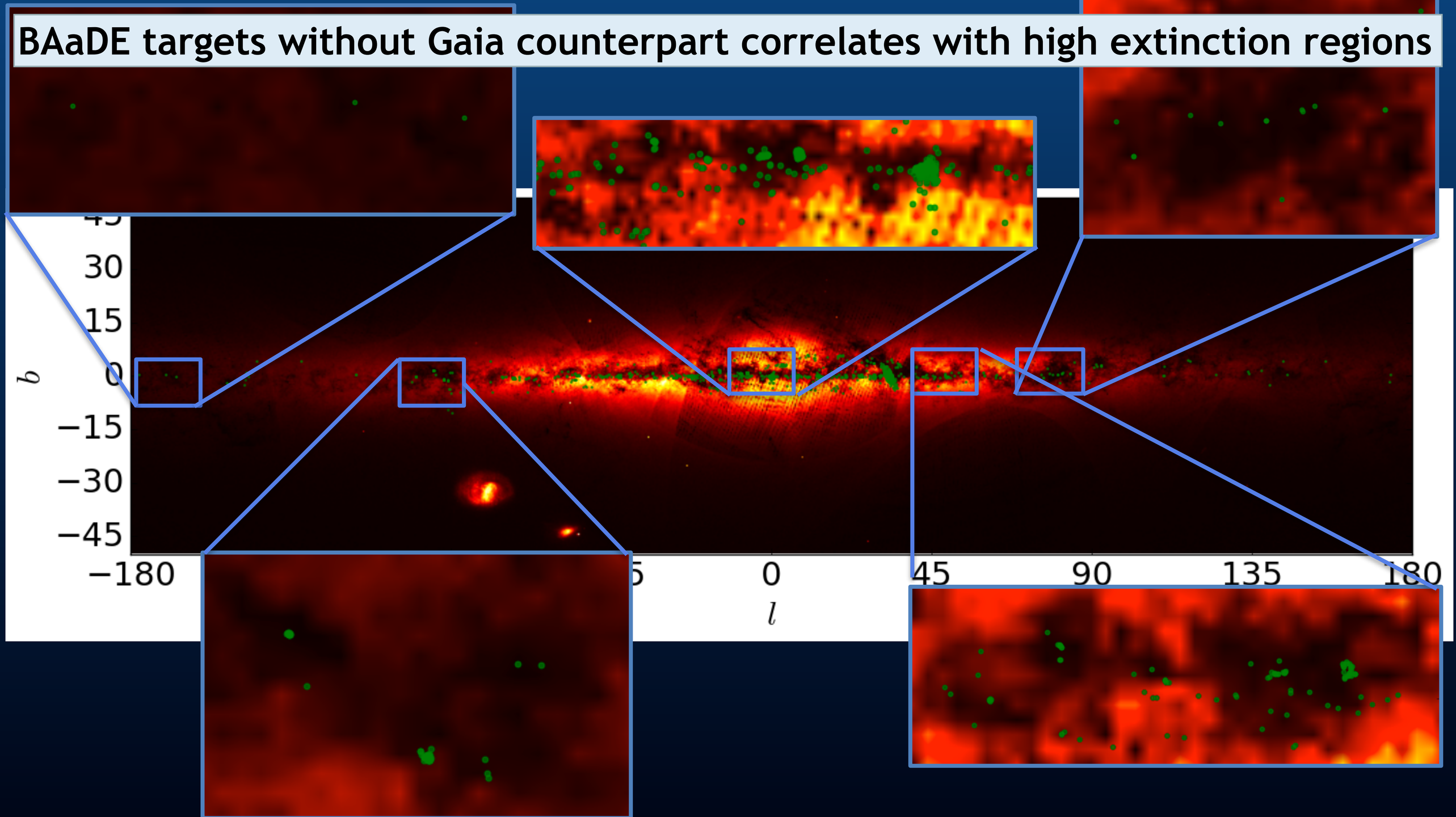
−45
0
45
90
135
180
l

BAaDE targets without Gaia counterpart correlates with high extinction regions



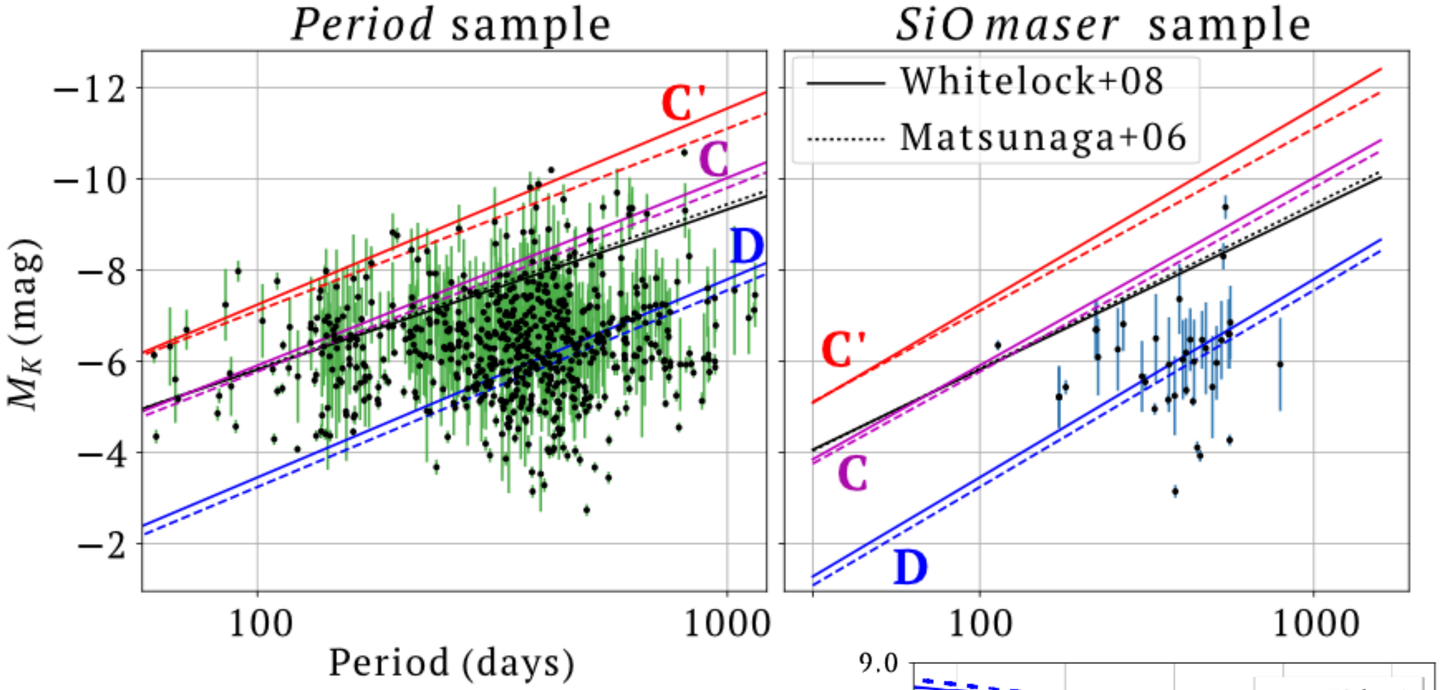
Characterizing AGB population around the Sun

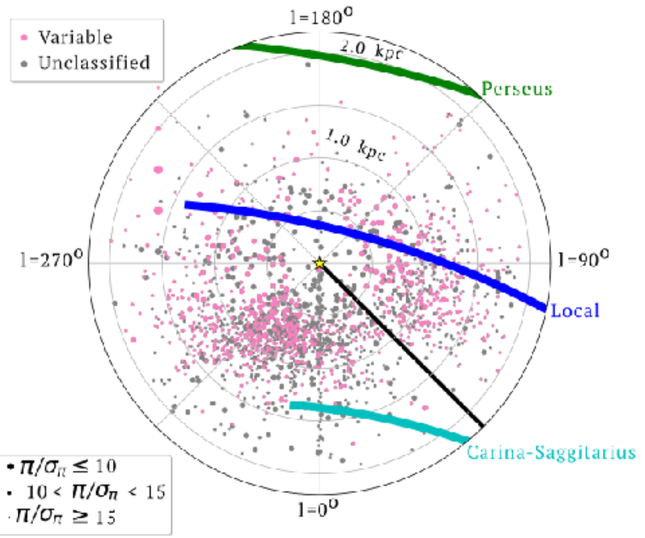
- BAaDE: 28,000 targets
  - 15,000 in 2MASS & Gaia
    - False positives!
  - 2,000 good distance

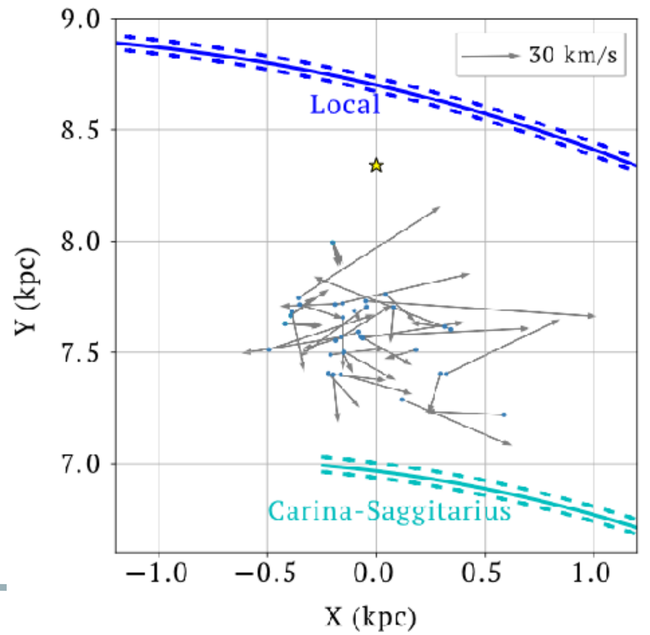
Work in progress: characterizing population

- BAaDE: 28,000 targets
  - 15,000 in 2MASS & Gaia
    - False positives!
  - 2,000 good distances
    - 50 SiO masers
    - 100% Mira in *Gaia*

Quiroga-Nuñez et al. in prep







Future

- Young massive stars (Spiral Structure)
  - Search for optical companions to confirm stellar associations.
  - New Southern telescopes can improve VLBI in HMSFRs (pre-SKA).

- Evolved stars (Inner Galaxy)
  - Study of evolved stellar populations in the Galactic Plane
  - SiO masers on VLBA (time allocated)
  - Supporting technique for Gaia

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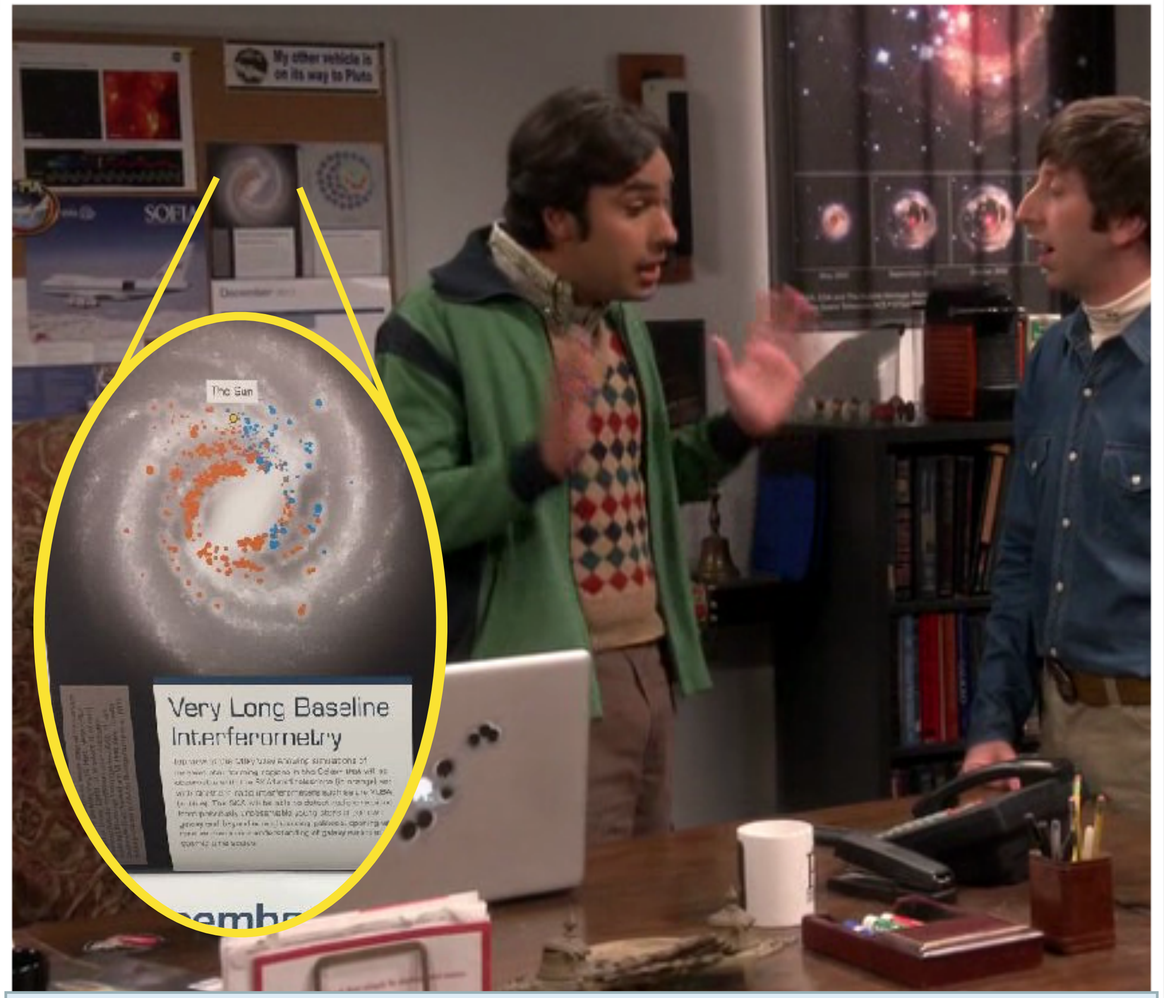

BeSSeL simulations featured on the SKA calendar on display in dr. Koothrappali's office Quiroga Nuñez+2017