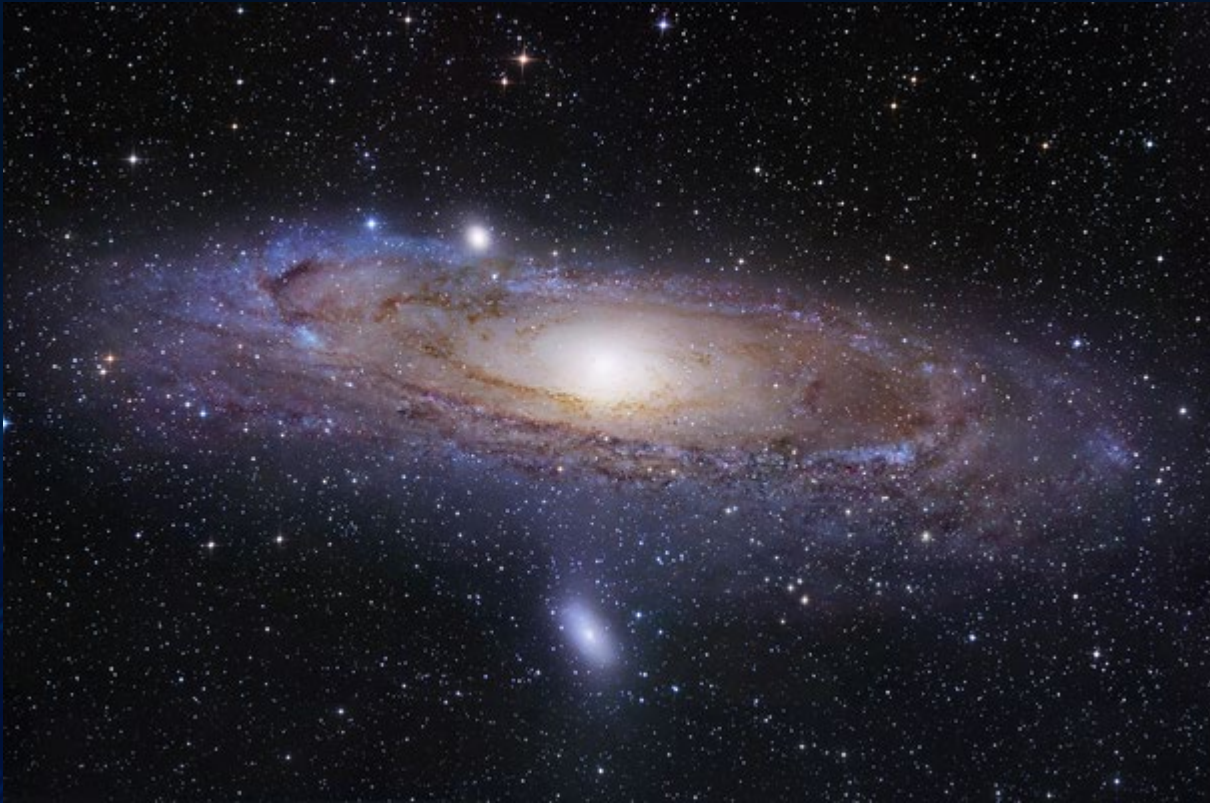


# Galactic Archeology?



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KW RASC  
WILLIAM MOORE  
MARCH 12 2021

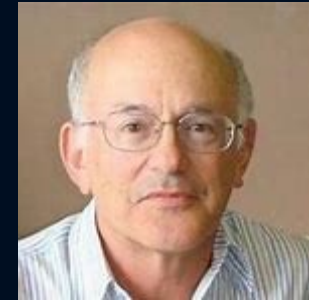
# Contents

- Origin Story
- Equipment and Techniques
- Discoveries
- Collisions past
- Collisions present
- Collisions future



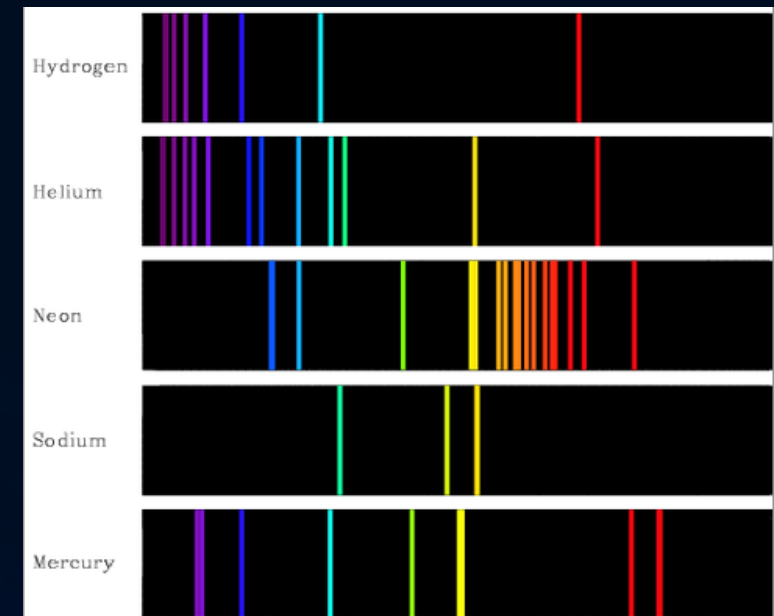
# Origins of Galactic Archaeology

- Pioneers of the field (2011)
  - Ken Freeman Australian National University (ANU)
  - Joss Bland-Hawthorn University of Sydney
- Australian Astronomical Observatory
  - Anglo Australian Telescope
    - High Resolution Multi-Object Spectrometer (HERMES) 2015
      - Siding Spring Observatory in New South Wales
    - Spectroscopic survey
      - Measure's direction, velocity, chemistry and temperature of millions of stars

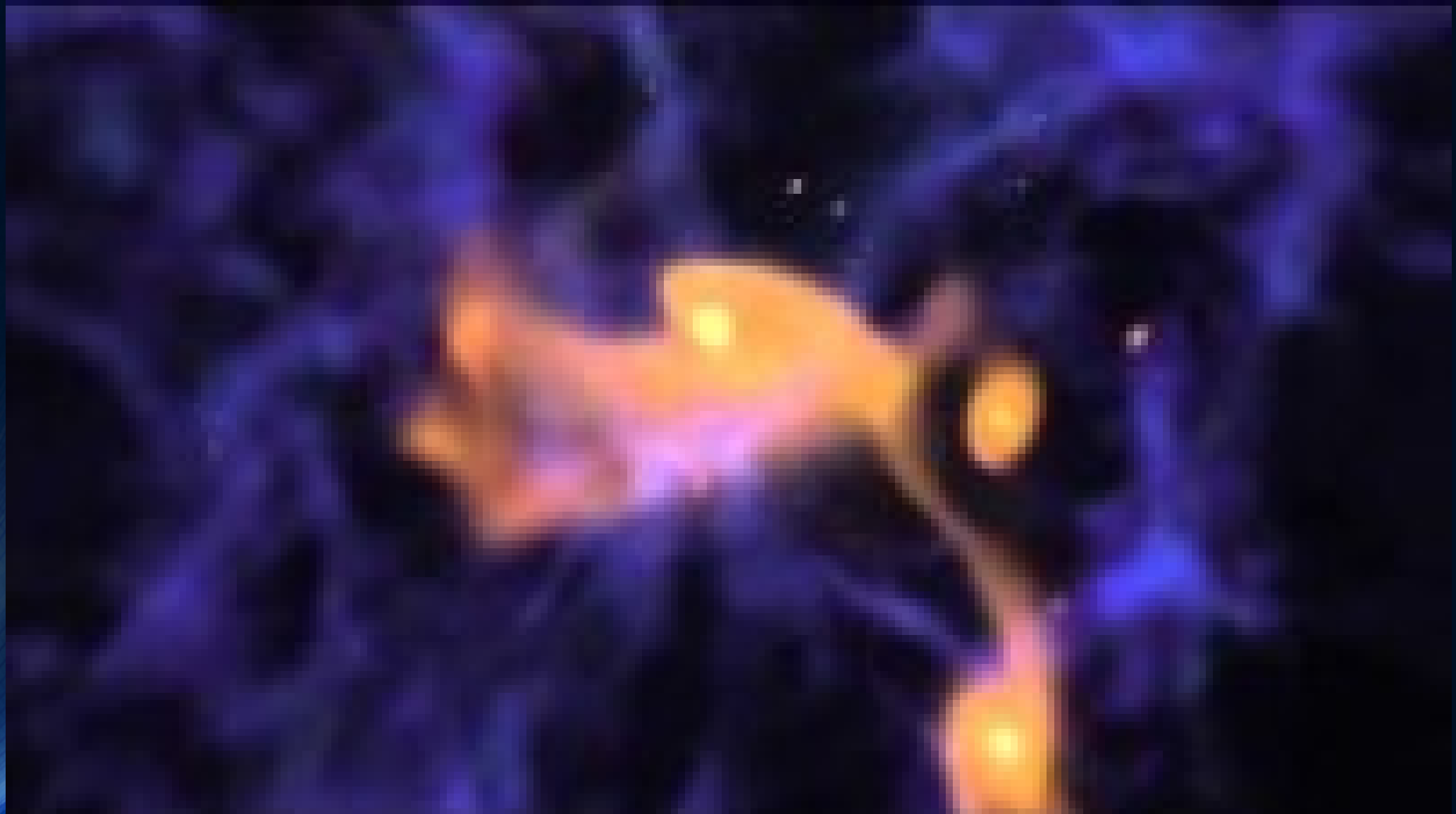


# GALactic Archeology with Hermes “GALAH”

- GALAH
  - *Kinematical clumping*, aka “stellar moving groups”
    - Inward falling dwarf galaxies accreted by the Milky way
  - Use stellar element abundance distribution
    - Identify stars with common birth sites
    - Also known as chemical tagging \*
    - Like a stellar DNA profile \*
    - Chemical differences is often less than one decimal
    - Differences in orbit direction and rotation \*



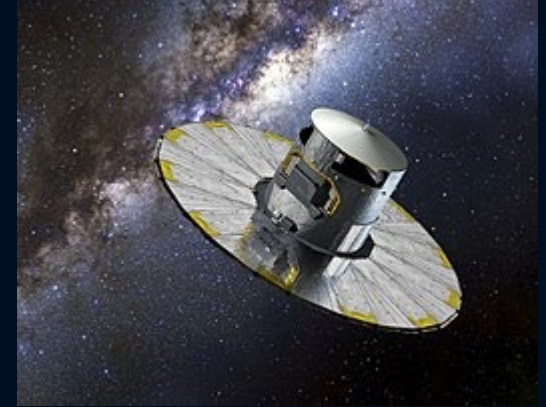
# Galaxy Formation



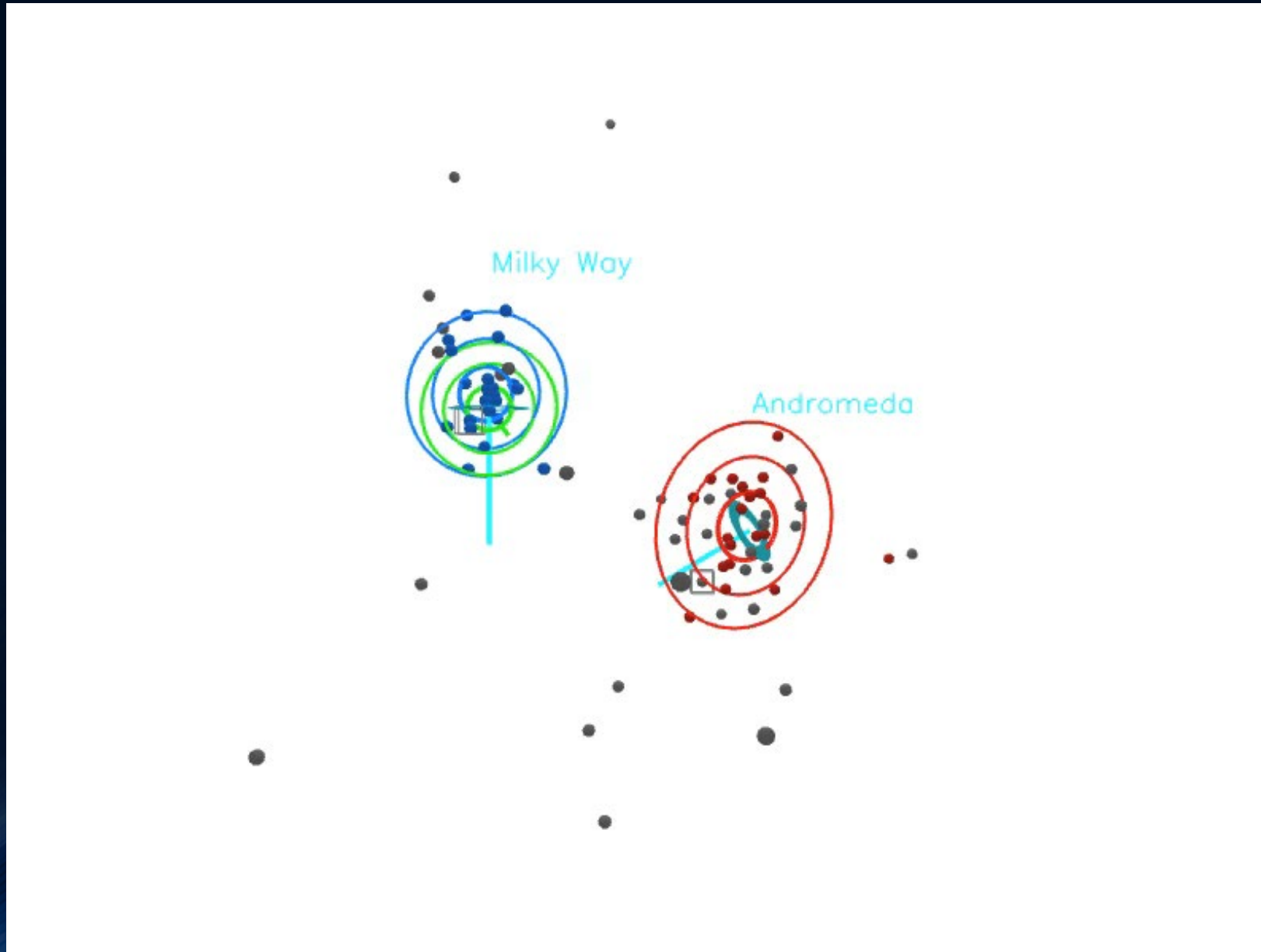


# Gaia, a Survey of over a Billion Stars

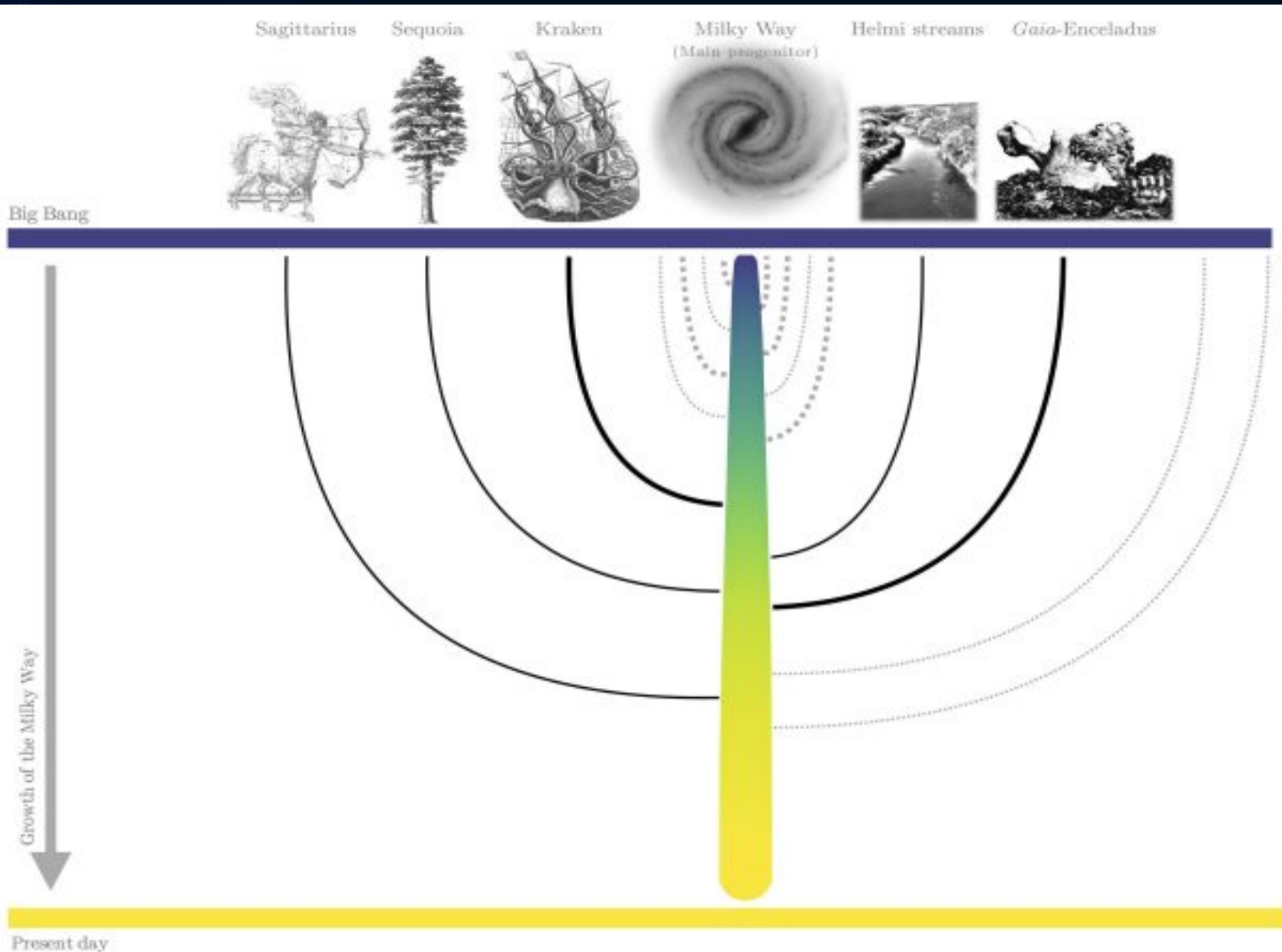
- Gaia is a European Space Agency (ESA) mission to chart the most precise three-dimensional map of our Galaxy, the Milky Way, and investigate its composition, formation, and evolution.
- Operational expectancy
  - 2013-2022



# Dwarf Galaxies around the Milky Way and Andromeda



# Milky Way Family Tree



## Milky Way Noteworthy Collision

- 11 billion years ago
- MW  $\frac{1}{4}$  mass

## Gaia- Enceladus

- 9 Billion

## Sagittarius

- Likely cause of our Sun's formation

150x Globular Clusters/Dwarf Galaxy's around the Milky Way

## Future merger Andromeda

- Likely already started



# Galactic Collisions and Stellar Formations

- Sagittarius Dwarf Galaxy (1990's discovered)
  - Passing causing galactic ripples in the Milky Way
  - Create Star Formation

## Collision/Passing

5-6 Billion years ago

2 Billion years ago

1 Billion years ago

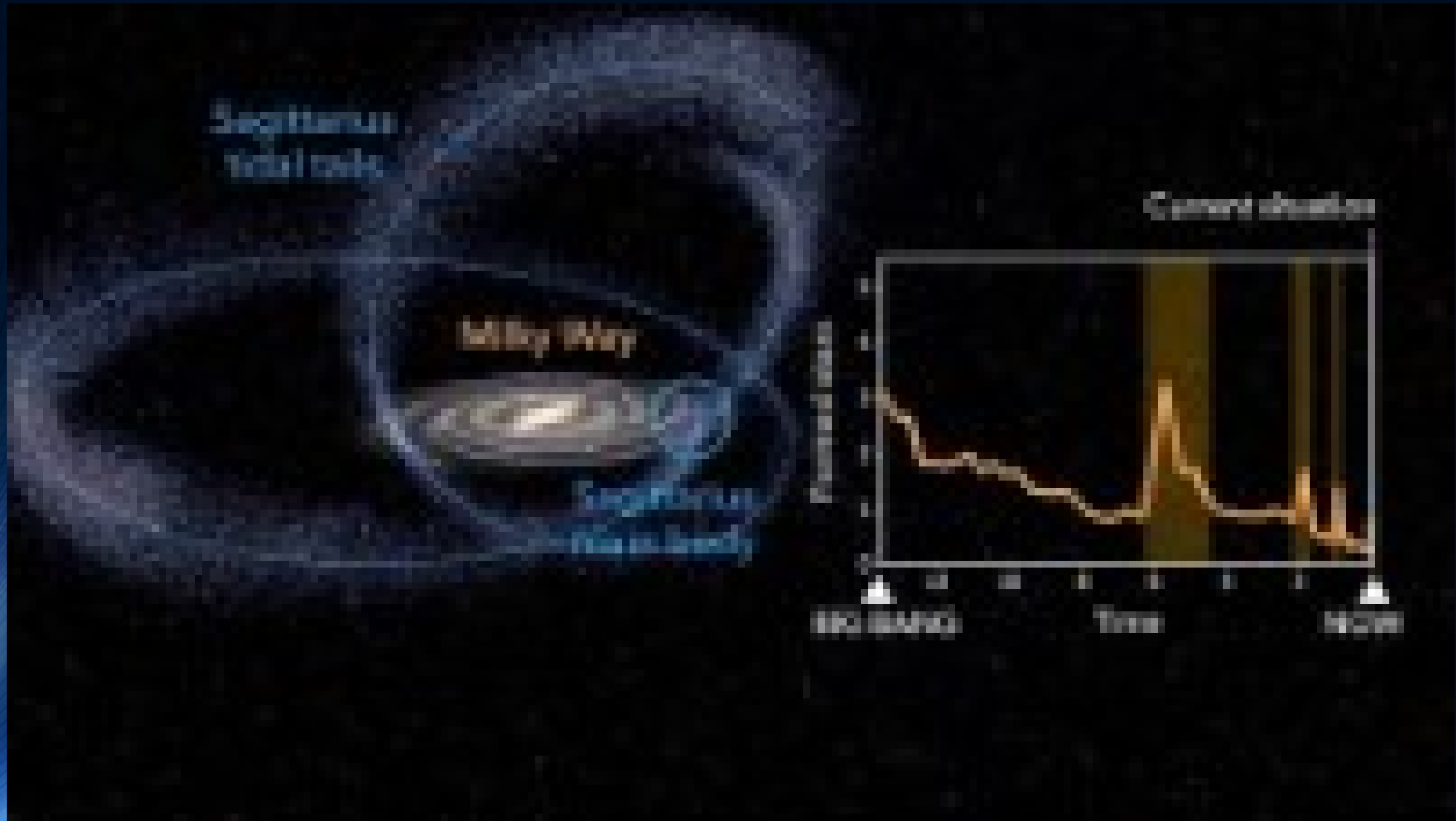
## Peak Star Formation

5.7 Billions Years ago (our Sun)

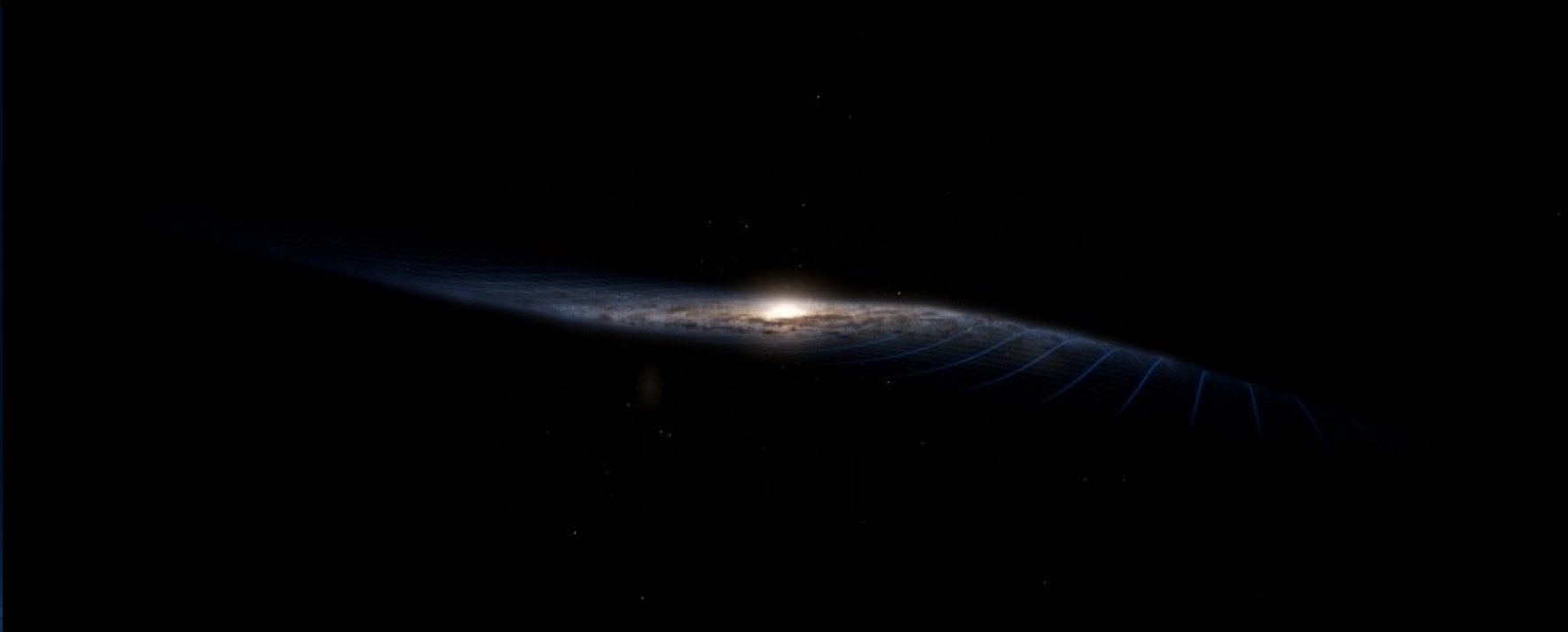
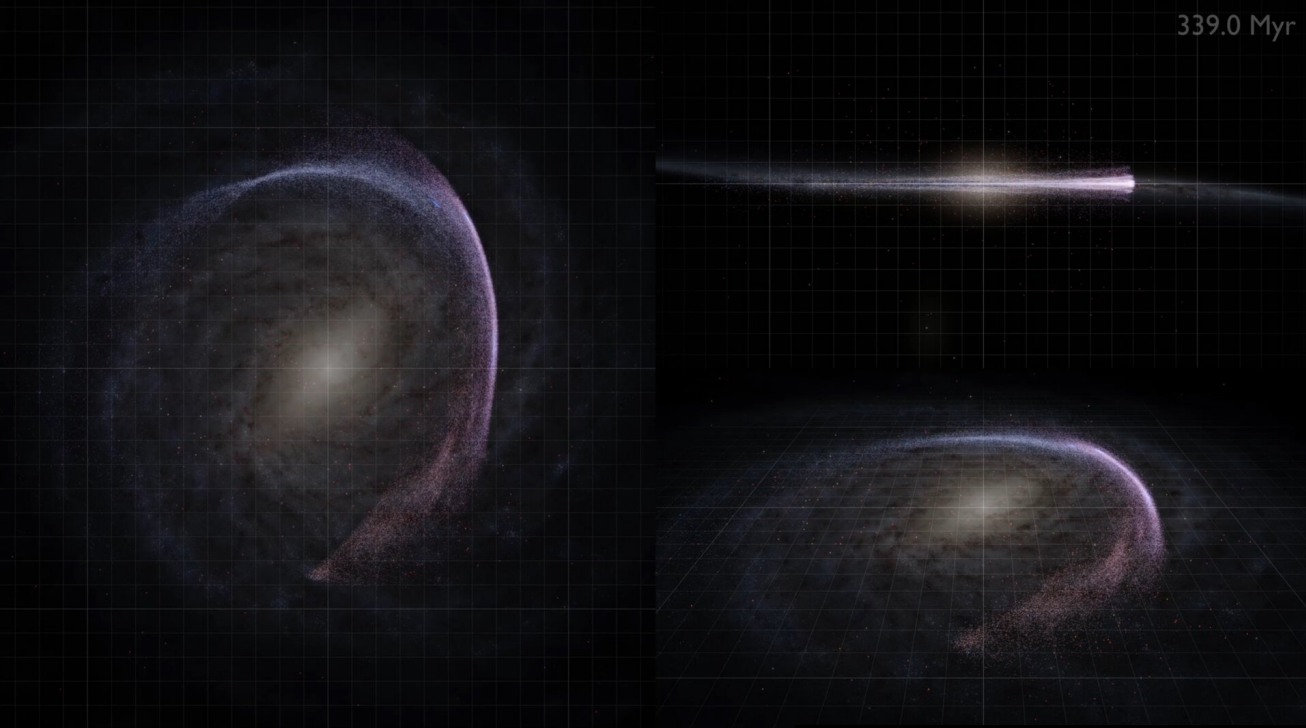
1.9 Billion Years ago

1 Billion Years ago

# Sagittarius Dwarf Galaxy Milky Way Merger



339.0 Myr





# Next up...Large Magellanic Galaxy

- 63,000 Light years away
- Large number of dwarf Galaxies
- Indicating 2x Dark Matter than initially thought
- Collision with Milky Way 2.4Byrs



Milky Way and Andromeda 4.5B yrs. 110km/s





Thank you for the opportunity  
to present my knowledge and thoughts  
on the topic of  
Galactic Archeology



# References

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