

Galactic Archaeology

In the Era of Large Surveys

Deepak

Adiunkt (Post-Doc)

Nicolaus Copernicus Astronomical Center, Warsaw

January 23, 2025

Annual Meeting 2025

Joined CAMK as Post-Doc in September 2024 to work on OPUS-LAP project "The old Milky Way : a holistic approach to an accurate analysis of metal-poor stars"

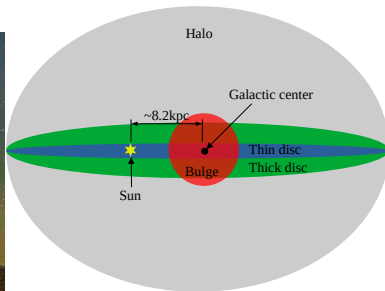
Refereed articles in 2024 (before joining CAMK)

- *Stellar substructures in the Galactic disc and halo : Properties, origins, and evolution*
Deepak, 2024, J. Astrophys. Astr., 45, 25. doi : 10.1007/s12036-024-10011-1
- *A study on the metallicity gradients in the galactic disk using open clusters*
Joshi Y. C., **Deepak**, Malhotra S., 2024, FrASS, 11, 1348321. doi : 10.3389/fspas.2024.1348321

Galactic Archaeology : WHAT ?

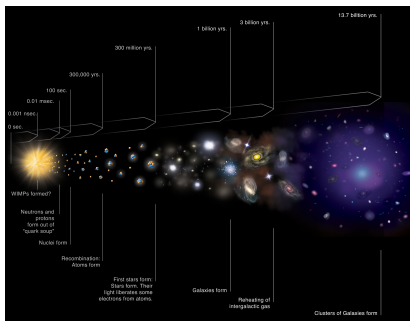


(Image credit : Dorje Angchuk, IAO, Hanle, Ladakh, India.)

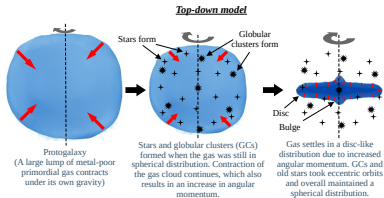


Source : Deepak (2023), *Chemodynamic studies of the Galaxy*, PhD thesis, Pondicherry University, Puducherry (*degree awarded by PU under MoU with Indian Institute of Astrophysics, the parent institute of my PhD work!*)

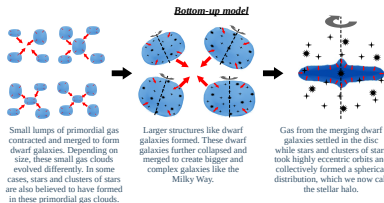
Question - I : Evolution of the Galaxy : From the Big Bang to present complex structure



(Image credit : NASA/CXC/M.Weiss)

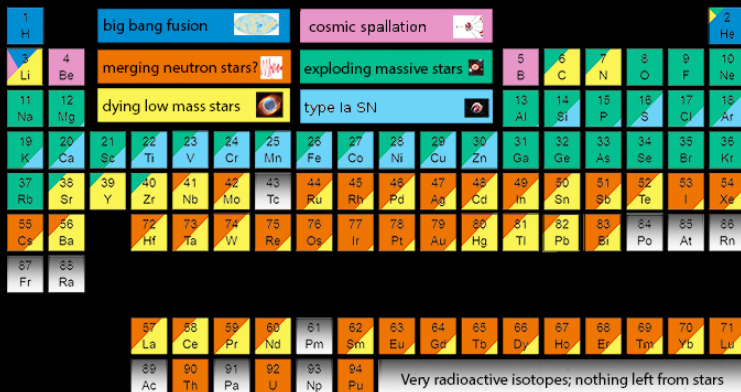


Time (in billions of years)



Source : Deepak (2023), *Chemodynamic studies of the Galaxy*, PhD thesis, Pondicherry University, Puducherry

The Origin of the Solar System Elements

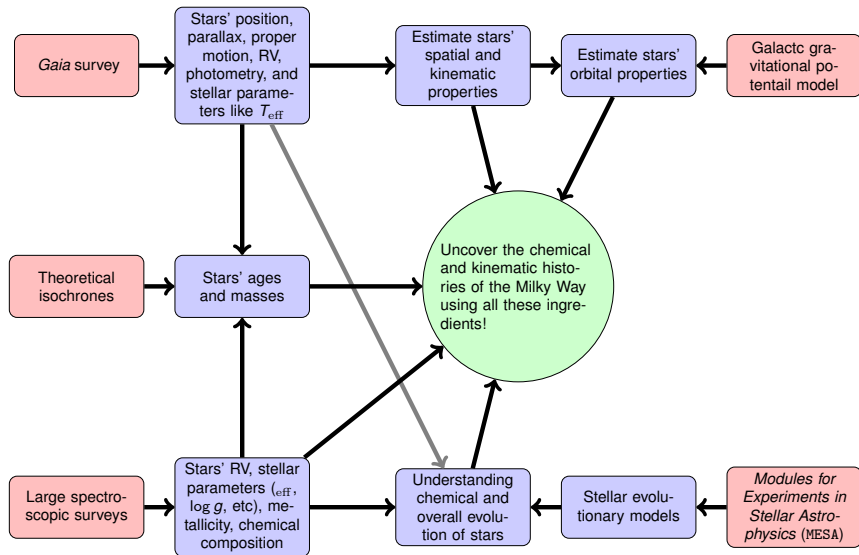


Graphic created by Jennifer Johnson
<http://www.astronomy.ohio-state.edu/~jaj/nucleo/>

Astronomical Image Credits:
 ESA/NASA/AASNova

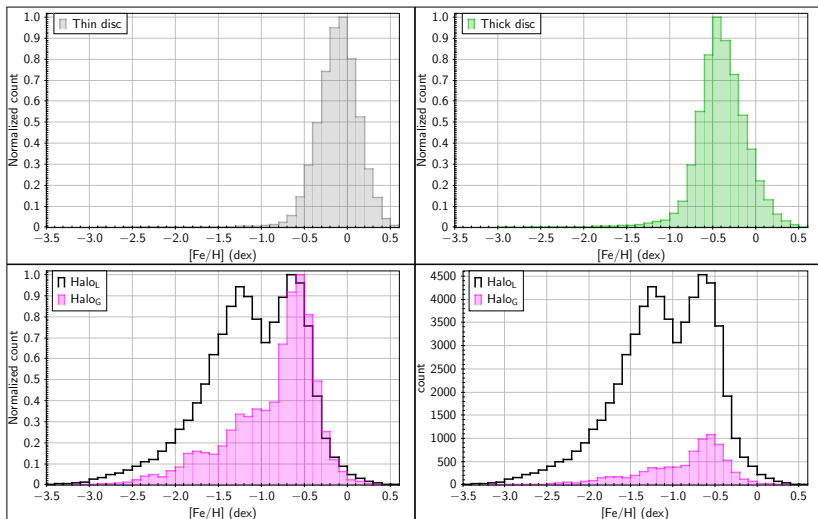
Galactic Archaeology : HOW ?

Data samples and methodology !!



Source : Deepak (2023), *Chemodynamic studies of the Galaxy*, PhD thesis, Pondicherry University, Puducherry

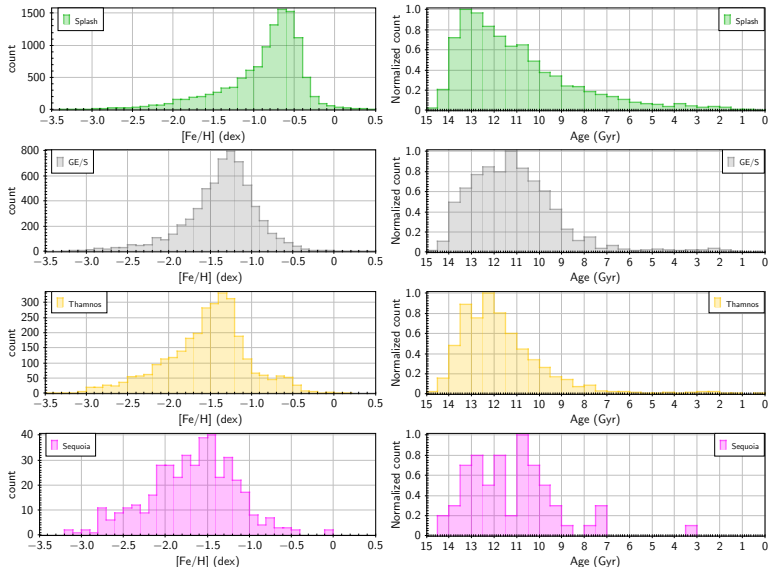
Galactic thin disc, thick disc and halo : Metallicity distributions



(Deepak, 2023, *Chemodynamic studies of the Galaxy*, PhD thesis, Pondicherry University, Puducherry)

Here, Halo_L = Sample with low spectral-resolution and Halo_G = Sample with high spectral-resolution

Metallicity and age function of halo's four major components



(Deepak, 2024, Journal of Astrophysics and Astronomy, Volume 45, Issue 2, id.25)

But there are many more small ones !!

Limitations/problem :

- Not many metal-poor stars
- Many of the provided abundance estimates are not reliable
 - Inhomogeneous methodology : Small differences among studies can result in large differences in the derived atmospheric parameters/abundances
 - Conventional spectroscopic methods are not very reliable for metal-poor stars' atmospheric parameters/abundance estimates

Solutions/plans :

- Collect all the metal-poor stars' spectra available in the literature
- Design spectro-photometric methods to derive atmospheric parameters and abundances more accurately
- And then study the formation and evolution history of the Galaxy
- BIGGER PLAN : Developed methodology will be used to analyze the data from 4MOST and CUBES.

Thank you for your attention !!

THE END!