Elemental Abundances Change Based on Galactic Position:

An APOGEE View of [α/Fe] vs [Fe/H] Across the Galactic Disk

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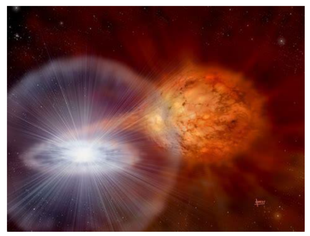
SOURCES OF ELEMENTS

- Type Ia supernovae come from binary systems of a white dwarf. When they explode, they produce a lot of iron and iron peak elements. Type Ia supernovae take a long time to explode with a range of 100 million years to billions of years.

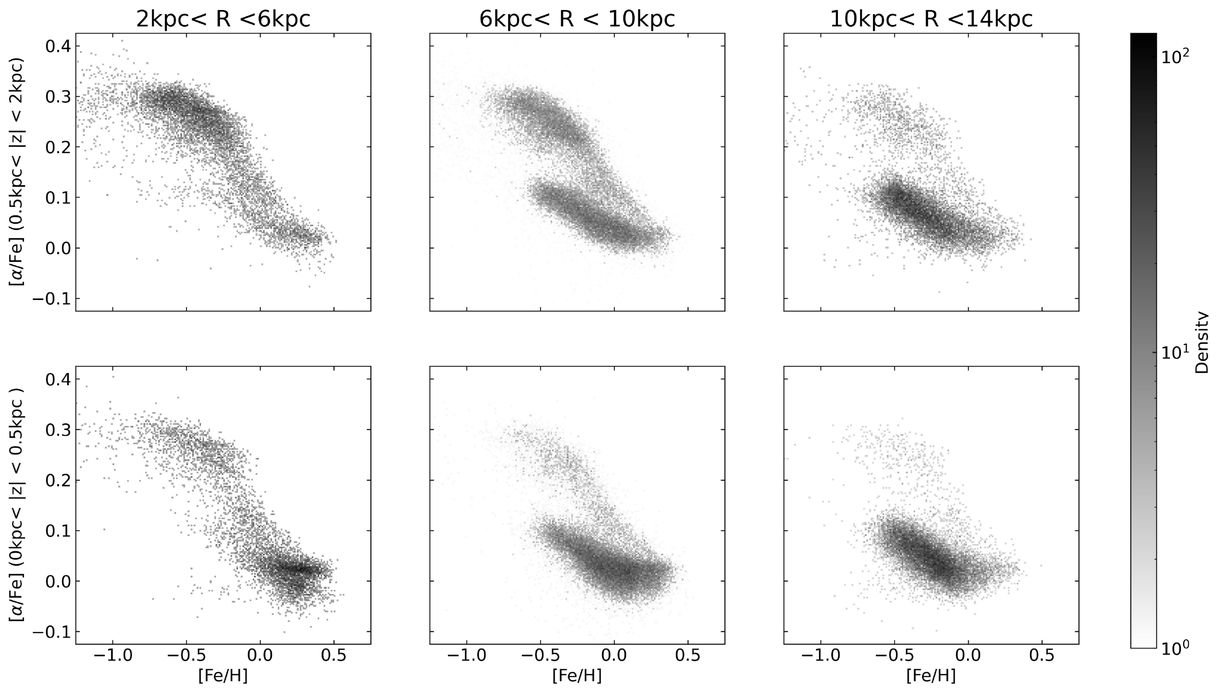


[3]

- Type II supernovae come from core collapse massive stars. When they explode, they produce many alpha elements (like oxygen and magnesium) in addition to iron. Type II Supernovae explode soon after star formation.

[4]

- Newly formed stars then record elemental abundances of the interstellar medium from which they were formed.



RESULTS

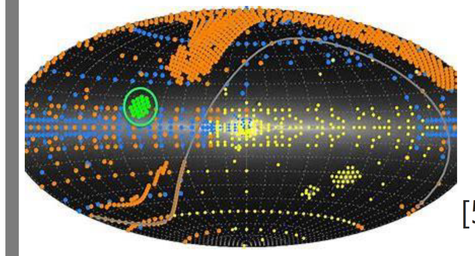
- There is a clear correlation between position in the galaxy and [α/Fe] abundance [1]
- High [α/Fe] abundance is most populated furthest from the midplane but closest to the center in terms of radius
- Low [α/Fe] abundance is most populated closer to the midplane and furthest from the center in terms of radius
- Near the solar neighborhood there is a bimodality of high and low [α /Fe].

CONCLUSIONS

- Due to the transition between high to low [α/Fe] and the bimodality, we know that the formation of the Galaxy was a complex process
- Further modeling and theories are needed to better explain this bimodal region.

APOGEE-2 :
(Apache Point Observatory Galactic Evolution Experiment 2) [2]

- APOGEE-2 was a survey of hundreds of thousands of stars in the Milky Way Galaxy.
- Used spectroscopy of near infrared light to observe any chemical patterns of stars in the Galaxy



[5]

ABUNDANCE NOTATION:

- Represents the ratio between different elemental abundances
- The ratios are in a logarithmic scale with 0.0 being the solar values.
- [Fe/H] is a comparison of iron abundance based on hydrogen abundance called Metallicity
- [α/Fe] is a comparison of Alpha Element abundance and iron abundance

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References:
[1] Hayden et al. 2015, ApJ, 808, 132, doi: 10.1088/0004-637X/808/2/132
[2] Abdurro'uf et al. 2022, ApJS, 259, 35, doi:10.3847/1538-4365/ac4414
[3] David A. Hardy (astroart.org)
[4] X-ray: NASA/CXC/Penn State/S.Park et al.; Optical: Pal.Obs. DSS
[5] Sloan Digital Sky Survey