Sulfur abundances in the Galactic bulge and disk

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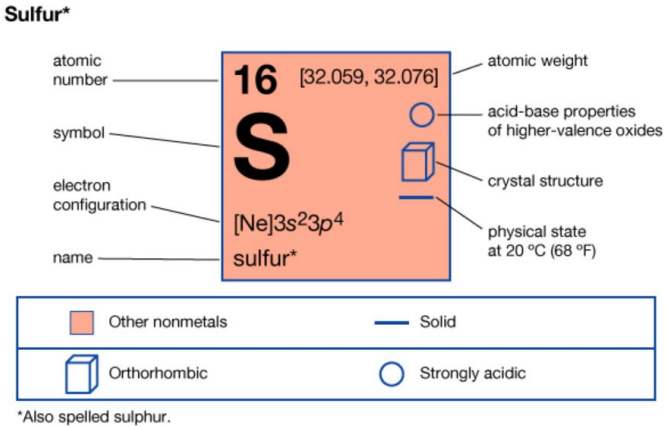
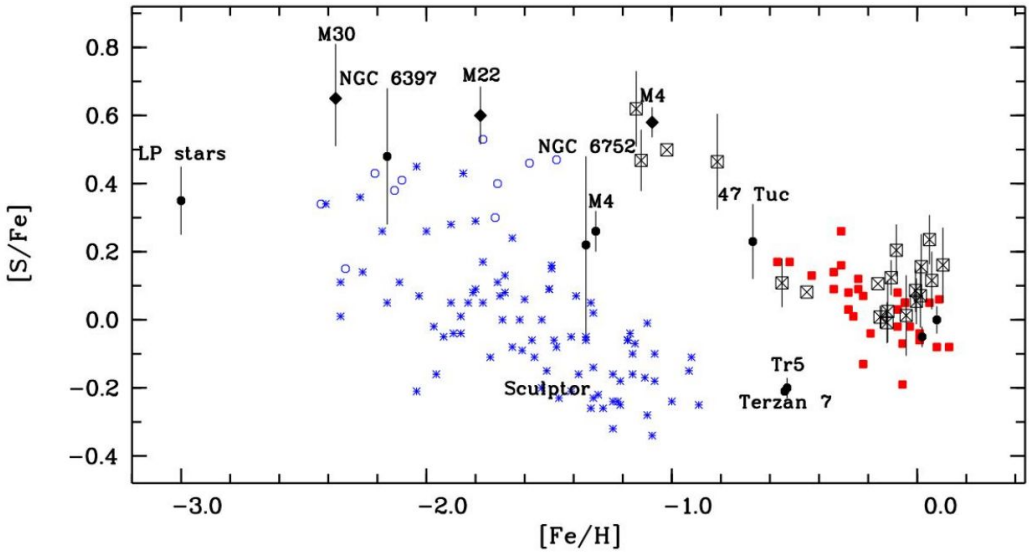
Sulfur

- α-element
- It is produced in massive stars by
  - O-convective shell burning
  - explosive O-burning
- It is moderately volatile
- Sulfur (S) multiplets:
  - Mult. 8 (675 nm), Mult. 6 (870 nm) → solar metallicity
  - Mult. 1 (920 nm), Mult. 3 (1045 nm) → metal-poor regime
  - Forbidden line [SI] (1082 nm) → solar metallicity dwarf stars and metal-poor giants



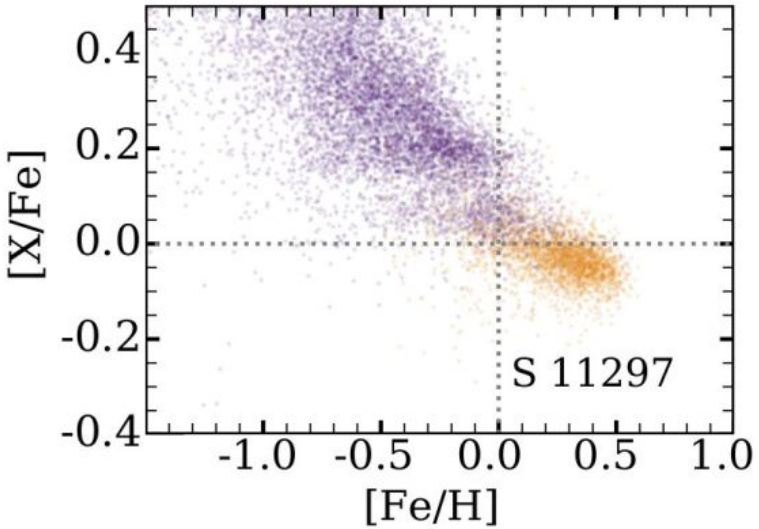
State of the art of S behavior

Duffau+2017



Perdigon+2021. LTE S abundances for ~1855 FGK-type stars in the solar neighbourhood

First study concerning S in the Galactic bulge:
Griffith+2020



Observational data & analysis

- FLAMES/UVES spectra of bulge stars
  - R~42310
  - S/N~20-180 at 900 nm
  - wavelength coverage: 376 - 946 nm
  - Number of targets: 74
- FLAMES/UVES spectra of thick disk stars
  - R~42000-110000
  - S/N~122-400 at 900 nm
  - wavelength coverage: 665 - 1042 nm or 565 - 946 nm
  - Number of targets: 23
- UVES POP spectra of thin disk stars
  - R~80000
  - S/N~300-500 in V band
  - wavelength coverage: 300 - 1000 nm
  - Number of targets: 30

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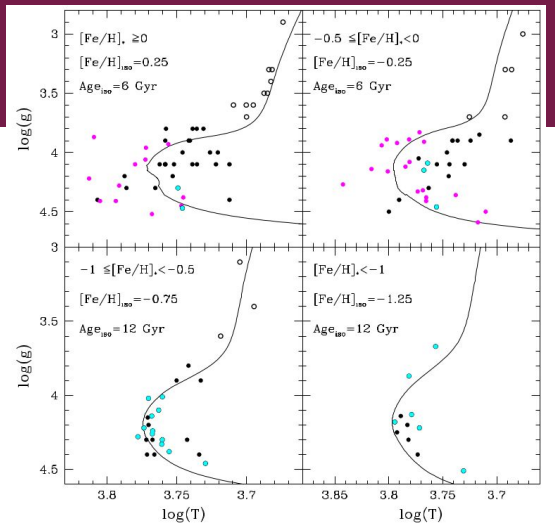
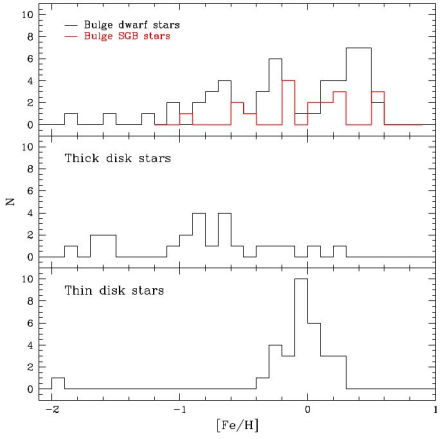


Bensby et al. 2009 - 2020

estimated atmospheric parameters, chemical abundances of 13 species (**except S**), kinematic, ages and radial velocities of the targets



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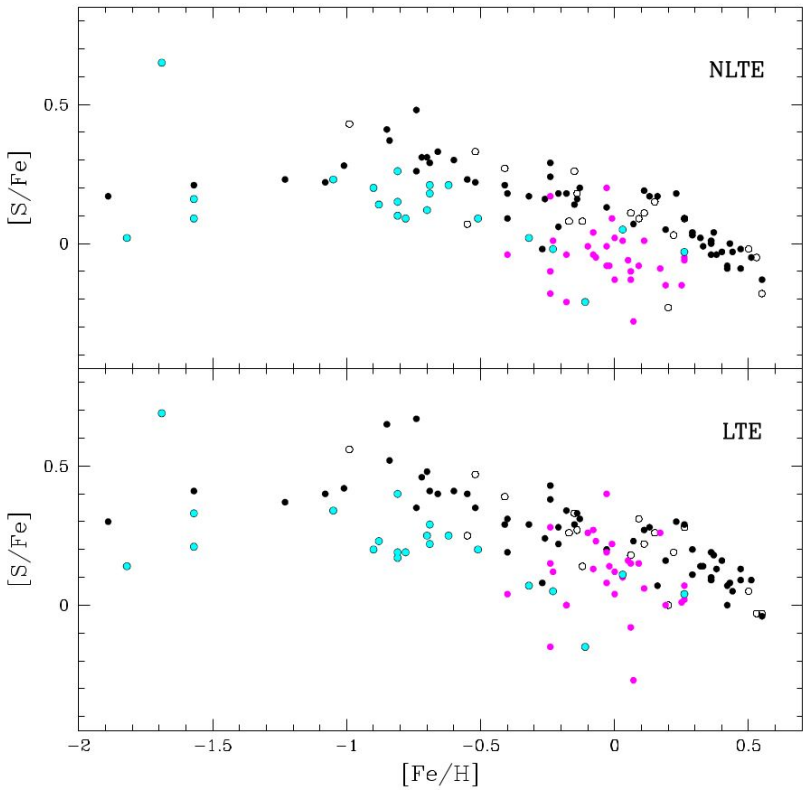
- The spectral range covered by the data allowed us to measure sulfur abundances from lines of Mults. 1, 6 and 8.
- Lines of Mult. 6 and 8 too weak were rejected
- We evaluated telluric lines contamination
- We selected only stars with at least two S lines in their spectra
- Sulfur abundances were measured by spectrosynthesis or line equivalent widths
- We measured NLTE corrections according to Takeda+2015

Results

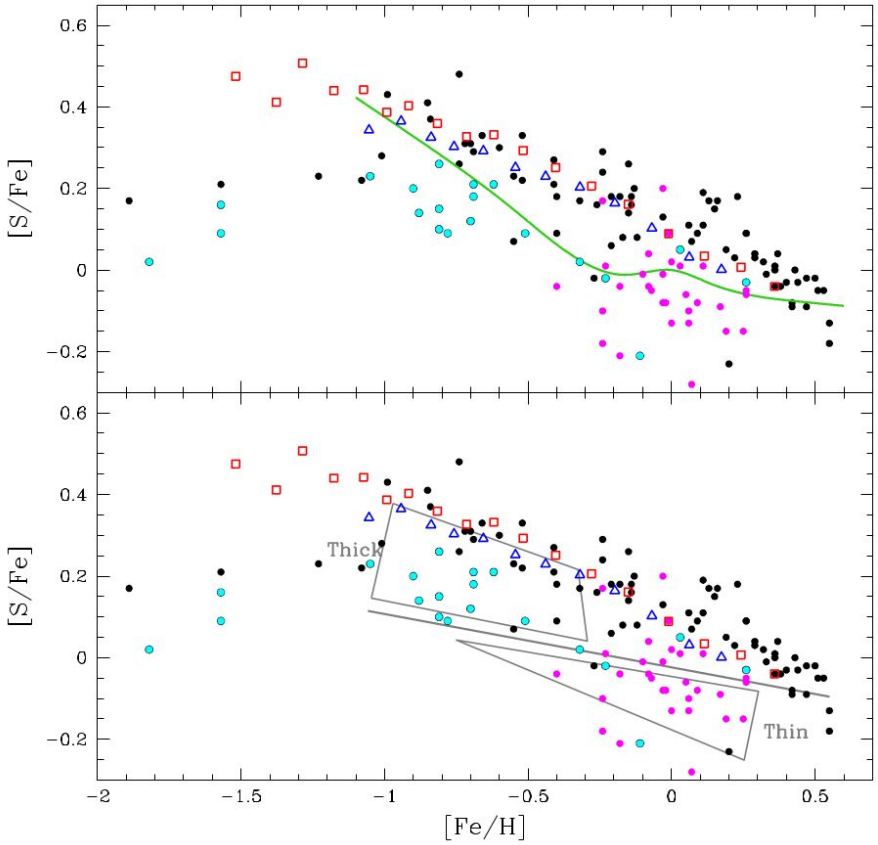


- Galactic bulge
- thick-disk stars
- thin-disk stars

- S behaves like an α-element in the Galactic bulge
- The Galactic bulge is S-rich with respect to both the thick and thin disk

$A(S)_{\odot}$ = 7.16 (Caffau+2011)

Discussion



This work:
- Galactic bulge
- thick disk stars
- thin disk stars

Literature:
- median trend for bulge stars from Griffith+2020
- median trend for thick disk stars from Griffith+2020
- Duffau+2017 mean trend
- Perdigon+2021

- In the metallicity range -1 < [Fe/H] < -0.1, our results for bulge stars and those of Griffith et al. (2020) are similar
- In the metallicity range −1 <[Fe/H]< −0.5, our measurements in thick disk stars lie in the thick disk area defined by Perdigon+2021.
- Our thick disk sample is less S-enriched with respect to the thick disk sample of Duffau+2017 and Griffith+2020
- Griffith+2020 found similar S trends for bulge and thick disk stars, in contradiction with our results
- The [S/Fe] values obtained for thin disk stars are comparable with those by Duffau+2017 and Perdigon+2021

Conclusions

- Sulfur behaves like an α-element in the Galactic bulge.
- Our results for thick and thin disk stars are in agreement within errors with those in the literature
- Unlike Griffith+2020, we found that the Galactic bulge is S-rich with respect to both the thick- and thin- disks, supporting a more rapid formation and chemical evolution of the Galactic bulge than the disk.

Thank you for your attention