Mass Loss and Luminosities of S and C AGB stars with and without Li

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COLLABORATION

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Guandalini et al. 2009 PASA, 26, 168

OUTLINE

Steps of this exercise:

- Formation of a subsample of AGB (C and S) stars, with observations of Li abundances available in literature
- Evolutionary properties of AGB stars compared with the Li abundances
- Behaviour of Li along the Giant Branches according to our data.
- Link with our models for extra-mixing.

FORMATION OF THE SUBSAMPLE

The scope of our research is of performing an analysis of **Galactic AGB stars** of different chemical composition looking for correlations between their basic parameters

(**Bolometric Luminosity, Mass Loss, IR Photometric Colors, Period of Variability**……).

See**:**

Guandalini et al. 2006 *C-rich AGBs*

Guandalini & Busso 2008 *S type AGBs*

We are trying to apply the tools developed and used in these works to stars of moderate luminosity.

FORMATION OF THE SUBSAMPLE

* Formation of the Sub-Sample starts from the previous work of **Uttenthaler et al. 2007** on *AGB stars in the bulge* and Li.

* We extend it to the *Galactic AGB stars of the disk*, already examined in their photometrical properties. We search for estimates of Li-abundance in the literature.
Our aim is of a creating a subsample more homogeneous in terms of mass.

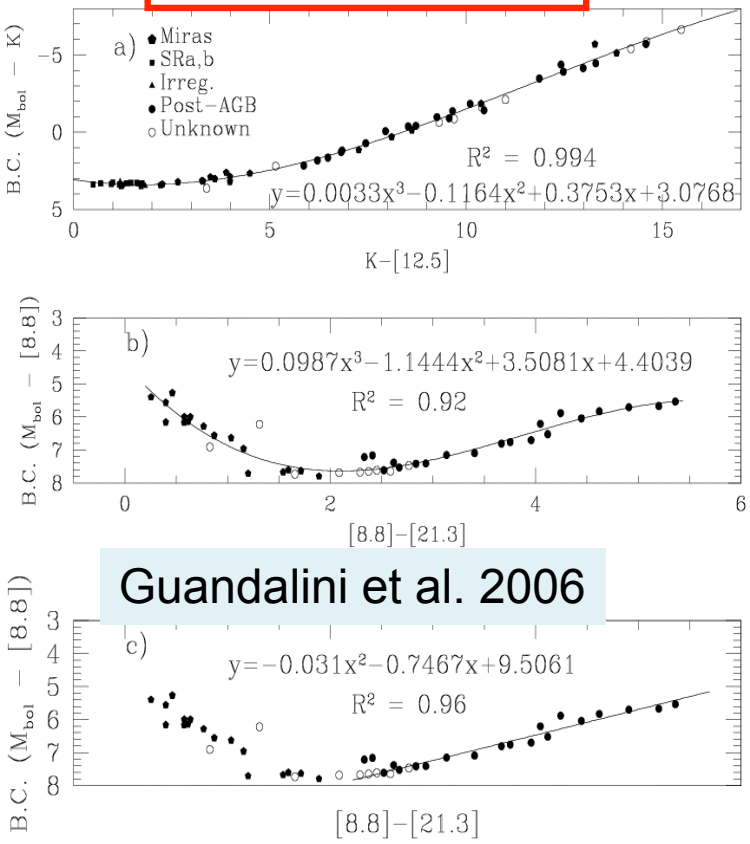
We use only sources with:

1) A “good” estimate of the distance
2) Reliable near-to-mid IR photometry

TOOLS: BOLOMETRIC CORRECTIONS

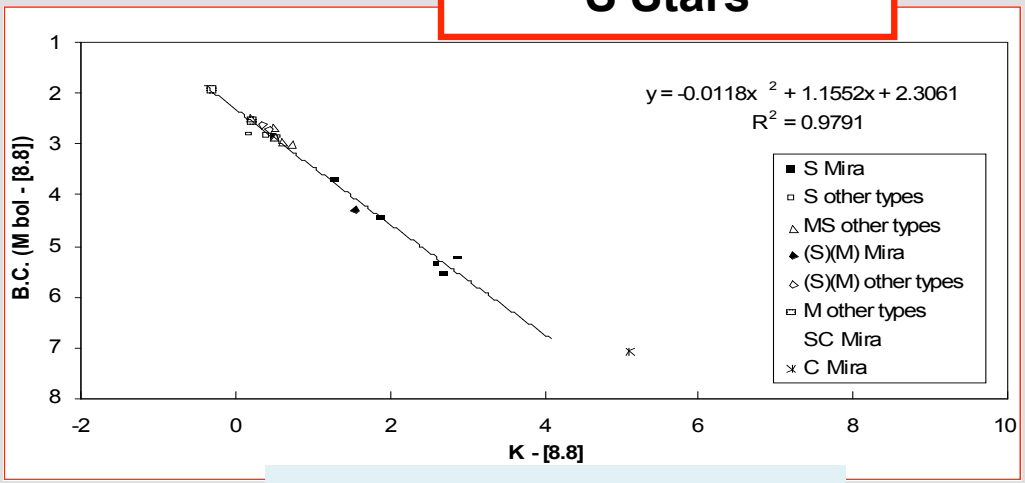
Developed in *Guandalini et al. 2006* and *Guandalini & Busso 2008* to estimate Luminosities and mass loss of AGBs:
Bolometric Corrections obtained using near-to-mid infrared colors.

C-rich Stars

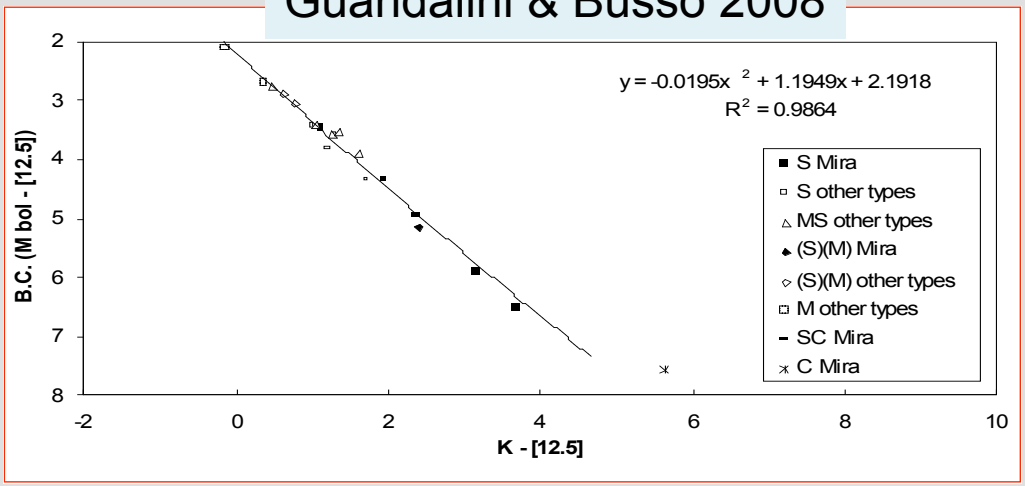


Guandalini et al. 2006

S Stars



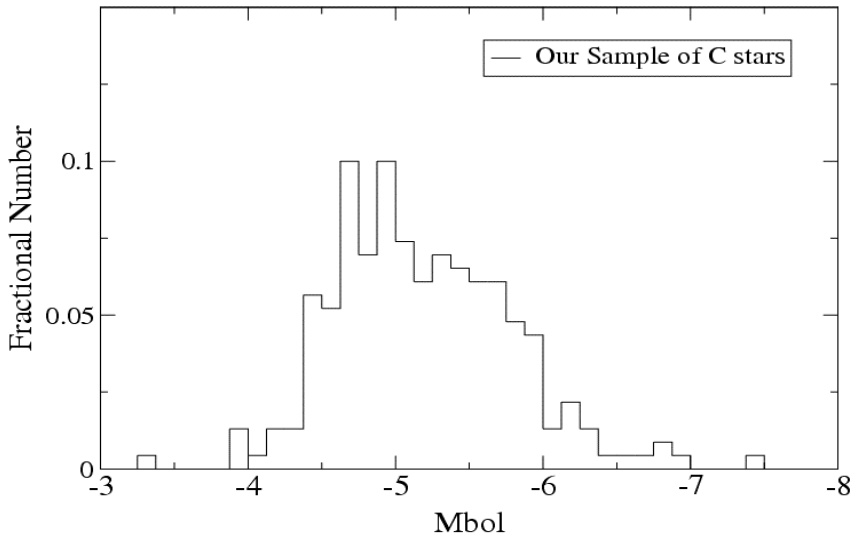
Guandalini & Busso 2008



TOOLS: LUMINOSITY FUNCTIONS

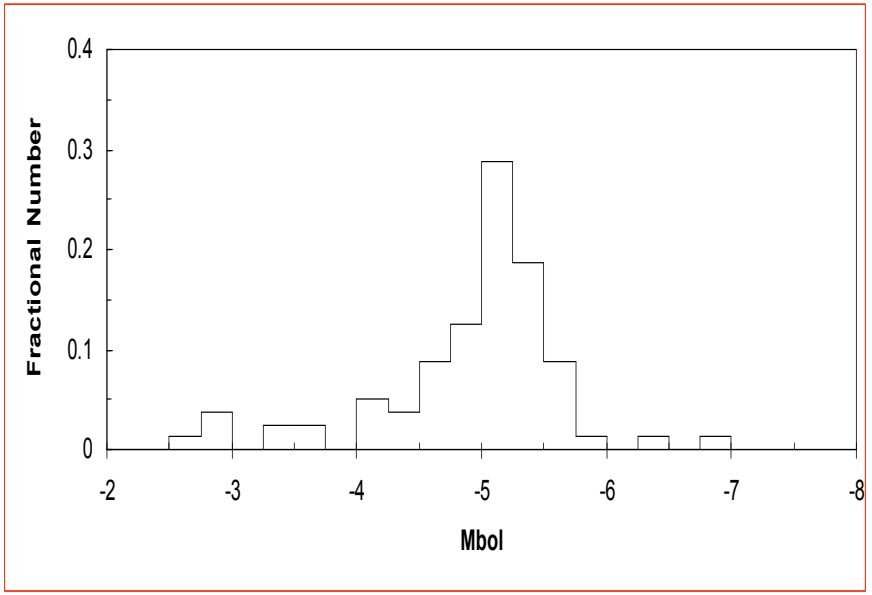
From sample of AGB stars with reliable ways to estimate their distance, we were able to estimate good **Luminosity Functions**.

C-rich Stars



Guandalini et al. 2006

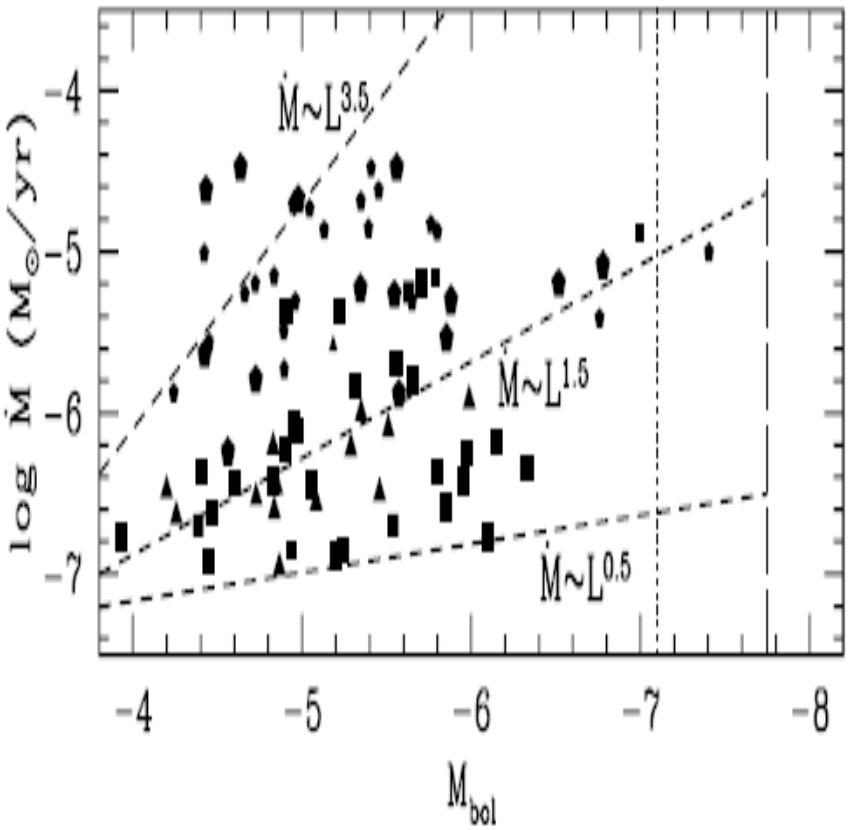
S Stars



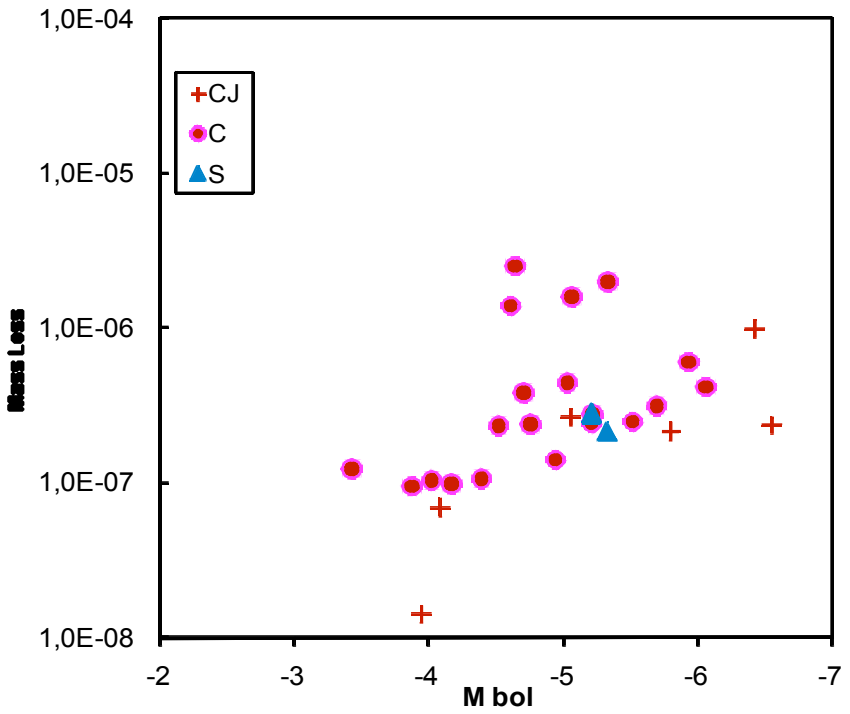
Guandalini & Busso 2008

MASS LOSS RATES AND BOLOMETRIC MAGNITUDES

Guandalini et al. 2006

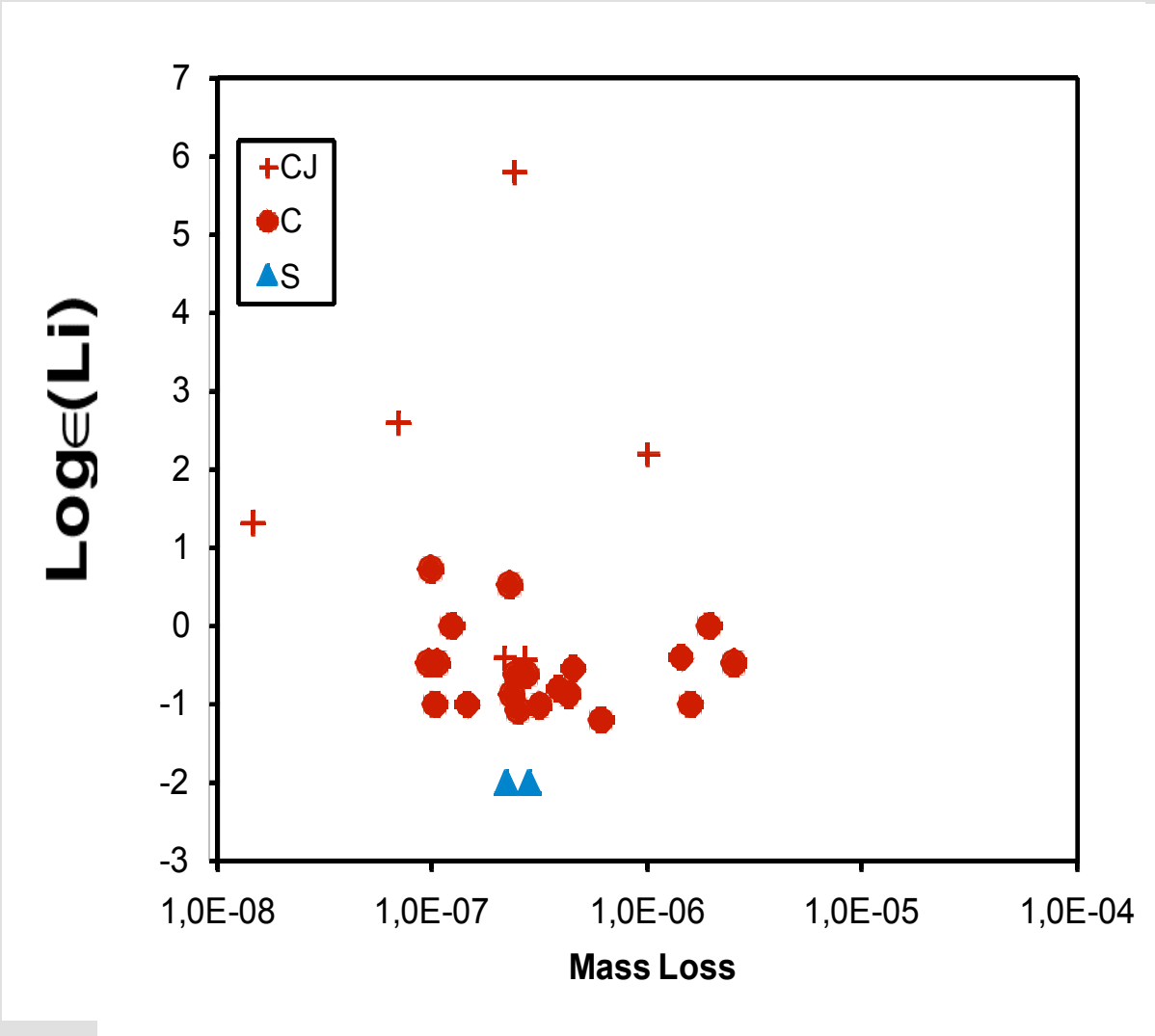


Stars of the sample examined here



LI ABUNDANCES AND MASS LOSS RATES

No particular relation between variations of the mass loss rates and Li-abundances.



LI ABUNDANCES AND BOLOMETRIC MAGNITUDES

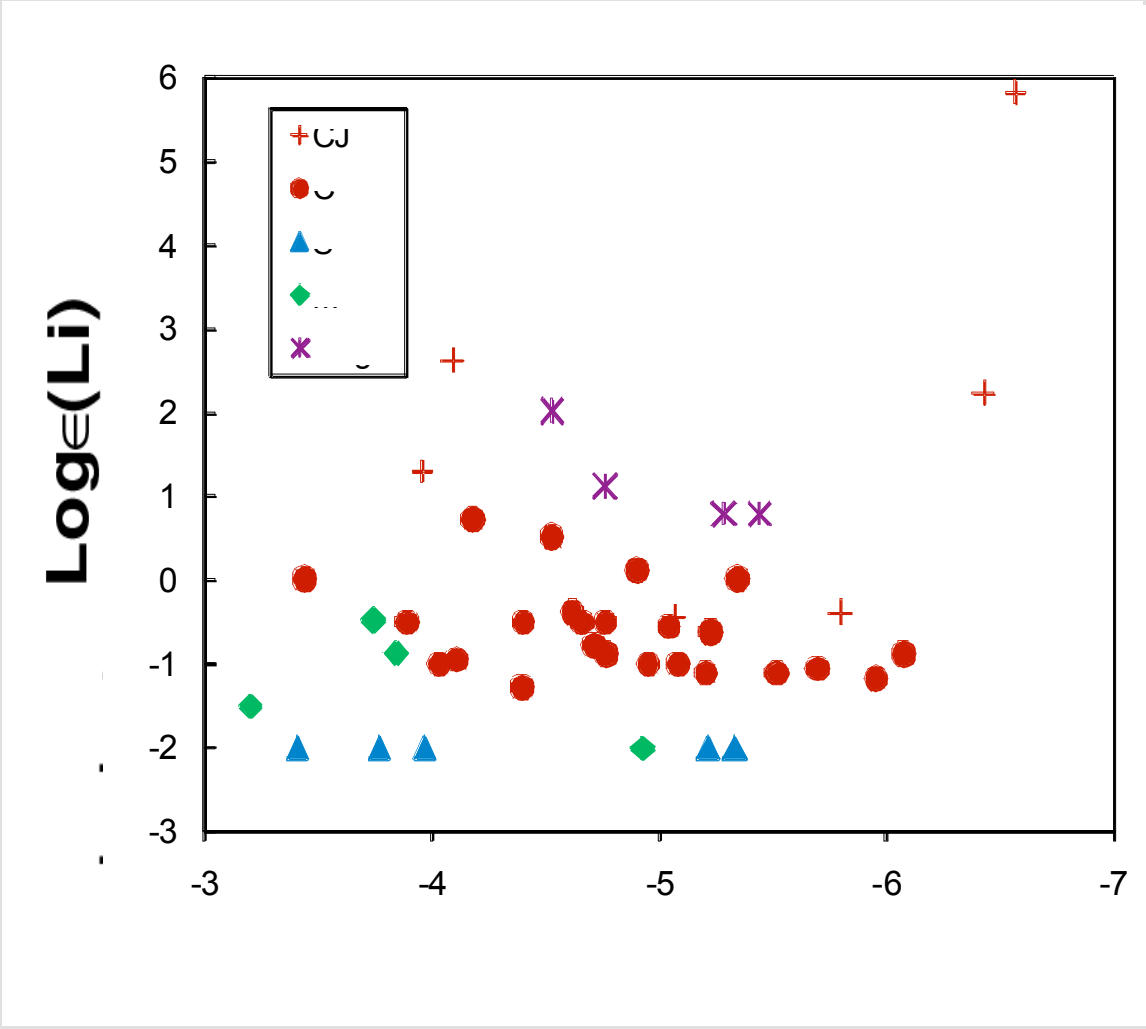
1) **CJ**: Li-rich, but sources with peculiar evolutionary properties

2) **Bulge stars** (Uttenthaler et al. 2007)

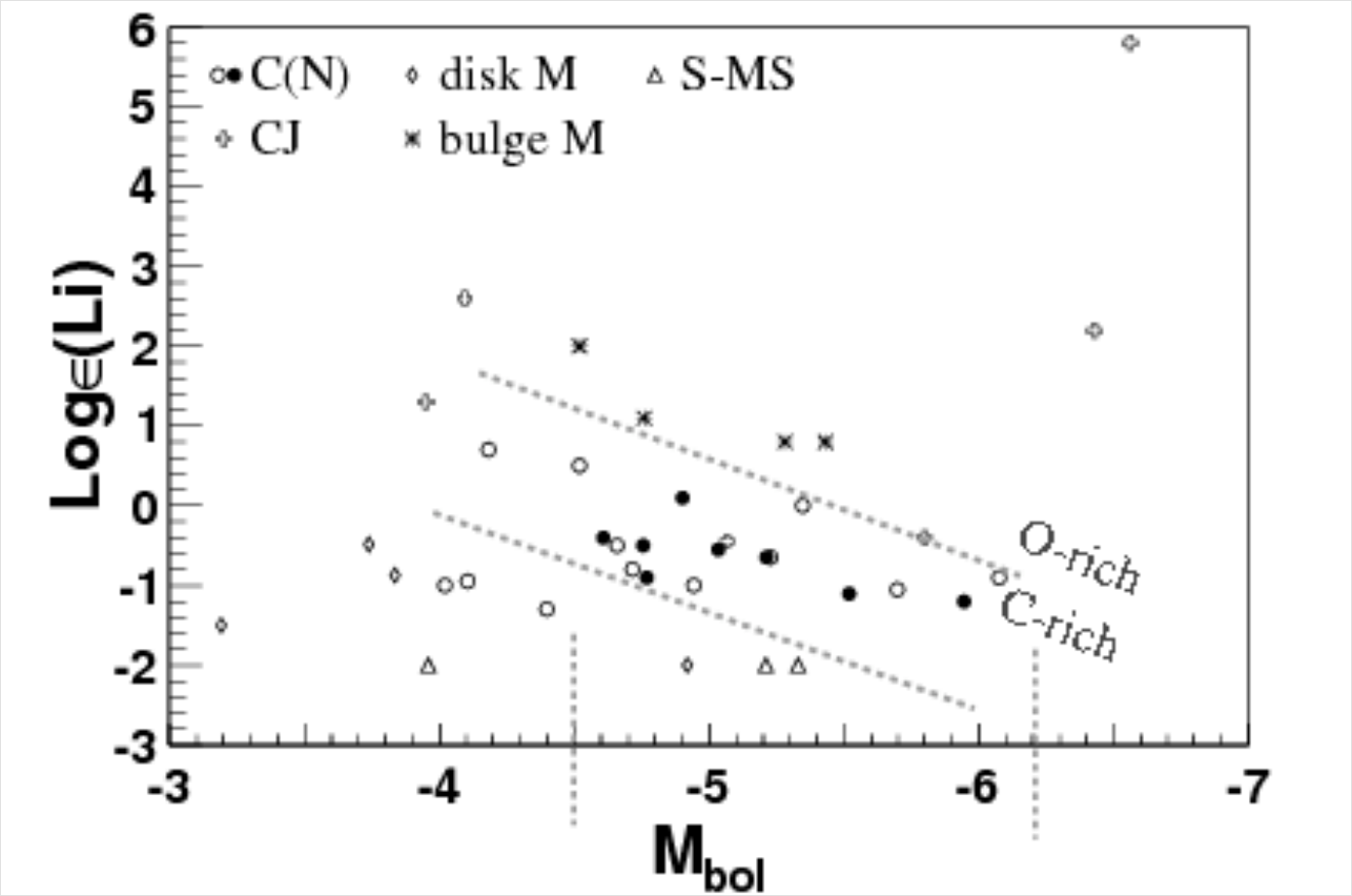
3) **Carbon stars**

4) **M** and **S** **stars** (low Li)

For the Carbon stars if we further refine the estimates of their distances…



LI ABUNDANCES AND BOLOMETRIC MAGNITUDES

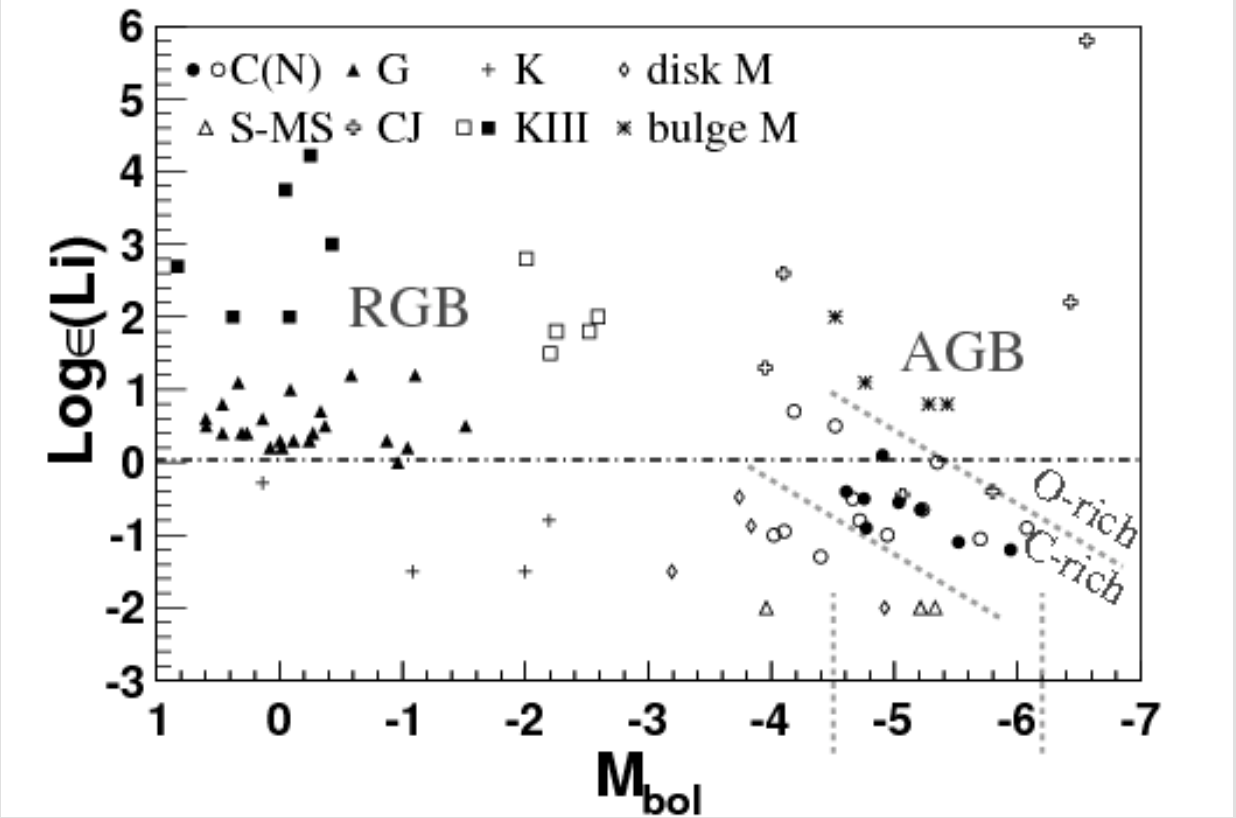


LI ABUNDANCES AND BOLOMETRIC MAGNITUDES

We add **Galactic RGB G and K sources** with well-known distances and estimates of Li abundances.

Different groups:

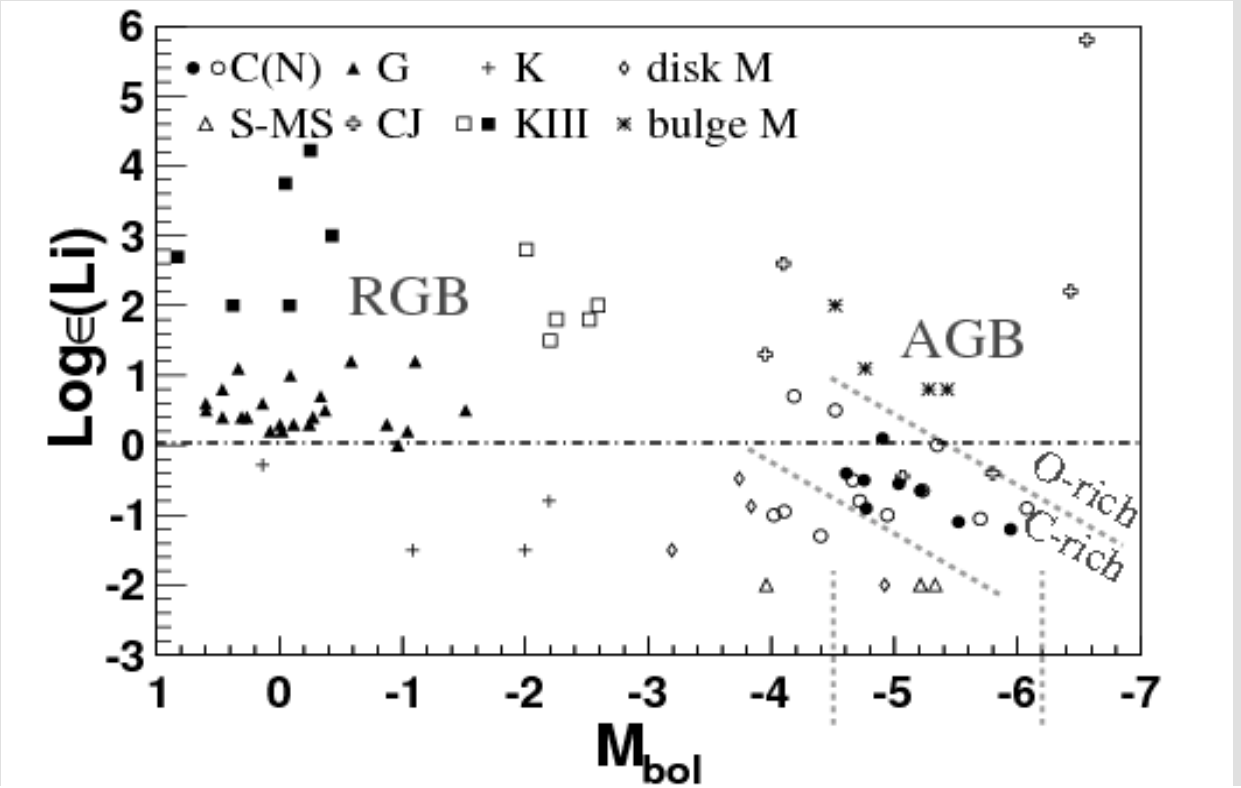
•K-type (crosses, Li-poor)
•K –type (squares, Li-rich)
•G-type (triangles)



LI ABUNDANCES AND BOLOMETRIC MAGNITUDES

We can examine how the different classes of stars are placed in this plot and extrapolate the possible evolutionary tracks depending on their Li abundance and luminosity.

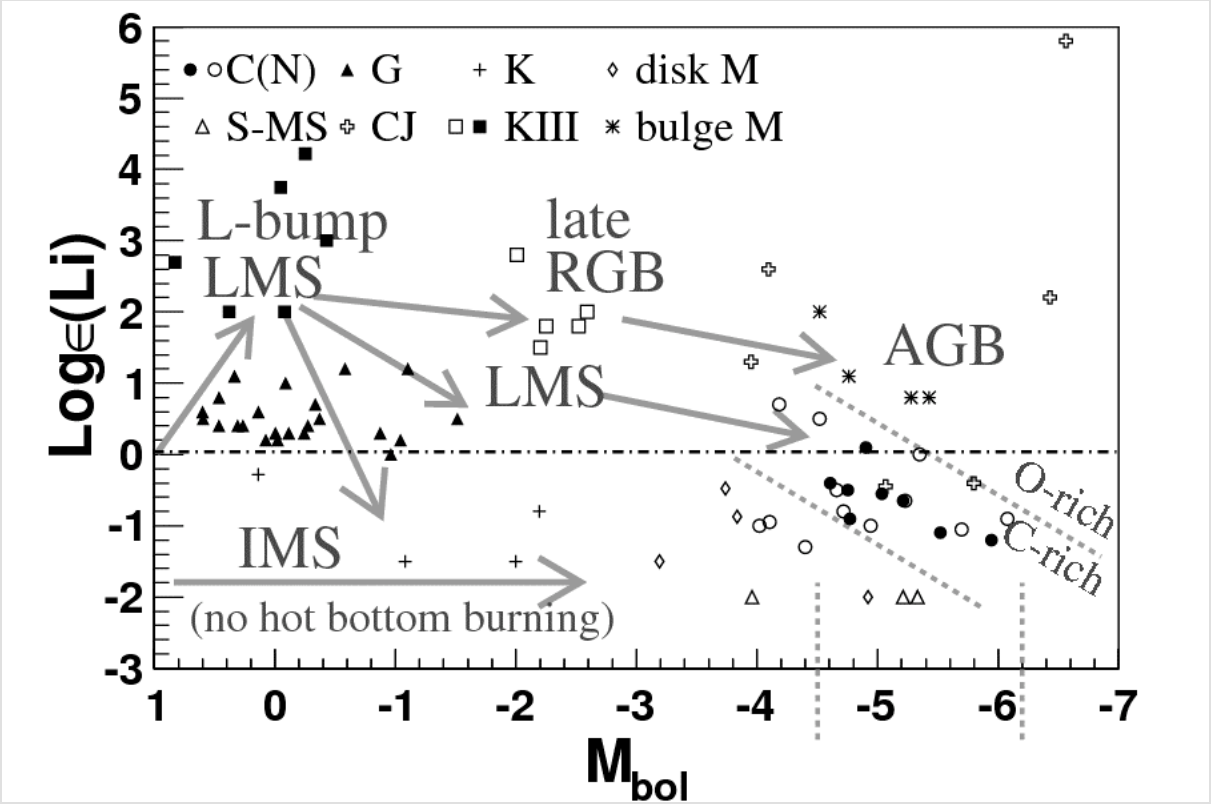
•**Li-rich K-type stars:** placed mainly at two different bolometric magnitudes.
•Li-rich K-stars with Bolometric Magnitude around -2. Uncertain classification between early-AGB and late RGB (Charbonnel & Balachandran 2000): in our view they should be late RGB.



LI ABUNDANCES AND BOLOMETRIC MAGNITUDES

•Production of Li at the Bump of the L-function at the beginning of the Giant Branches

•K stars without Li might be IMS with no hot bottom burning or LMS with strong depletion of Li.



APPLICATION TO THE MODELS

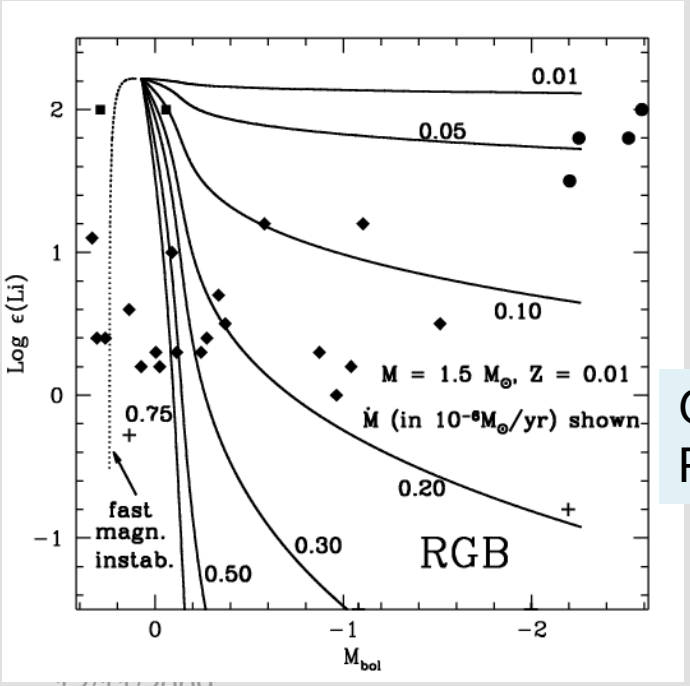
Our model, just few words:

see Palmerini's poster for a detailed description.

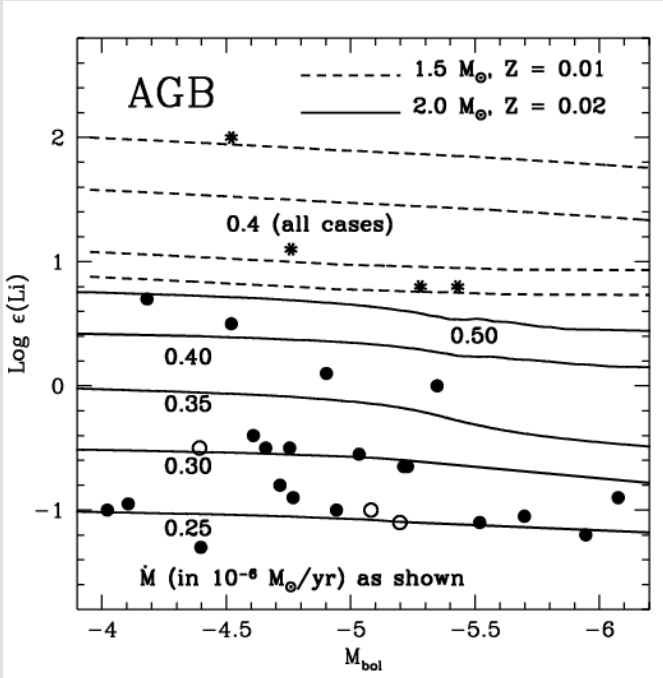
Two types of extra-mixing:

1)Fast Mixing (left panel) at the Bump of the L-function causes production of Li (buoyancy of magnetic instability)

2)Slow Mixing (right panel): during the remaining part of the RGB and the AGB, that causes depletion of Li (buoyancy of larger magnetized structures)



Guandalini et al. 2009 PASA



CONCLUSIONS

•We have examined a subsample of Galactic AGB stars of moderate luminosity (MBol fainter than -6) having phenomena of extra-mixing for Li. Their masses are between 1.2 – 2.2 Solar Masses

•The study of this subsample gives us the chance to refine the study of the relation between bolometric Magnitude and mass loss rates starting from previous analyses made on larger and more general samples.

•The relation between the Li abundance and the luminosity, examined for different classes of stars along the RGB and the AGB branches, shows us that, for stars of moderate luminosity, Li is produced at the Bump of the L-function and then is depleted with different rates during the successive evolution of the sources along the RGB and AGB.

•The behaviour of Li in evolved stars seems to be explained by the model presented in **Palmerini's poster** thanks to two different phenomena of extra-mixing:
Fast Mixing → due to buoyancy of magnetic instability → Production of Li
Slow Mixing → due to buoyancy of larger magnetized structures → Depletion of Li