

## Linda Lombardo



### Title

A close look at young intermediate mass giant stars: clues of rotation and mixing

### Abstract

In the search of a sample of metal-poor bright giant stars using Strömgren photometry, we serendipitously found a sample of 26 young (ages younger than 1 Gyr) metal-rich giants, with masses between 2.5 and 6 solar masses. Ten of these stars also rotate rapidly ( $v_{\text{ini}} > 10$  km/s). The high stellar masses imply that these stars were of spectral type A to B when on the main sequence. This evolutionary stage is not very well characterised by observations so far, because of the short time spent by stars in this phase. This sample of giant stars allows us a close look at this rapid evolution. It is an opportunity for testing the predictions of theoretical stellar tracks on the evolution of chemical abundances and rotational velocities. We determined chemical abundances of 16 elements (C, N, O, Mg, Al, Ca, Fe, Sr, Y, Ba, La, Ce, Pr, Nd, Sm, and Eu) and rotational velocities of the stars. The chemical analysis shows that all but one of the sample stars have low  $[\text{C}/\text{Fe}]$  and high  $[\text{N}/\text{Fe}]$  ratios together with constant  $[(\text{C}+\text{N}+\text{O})/\text{Fe}]$ , suggesting that they have undergone CNO processing and mixing. The stars do not show any chemical peculiarities, except for the Ba abundance; the majority of the stars in the sample show a Ba abundance higher than solar, but solar s-process elemental abundances. The observed rotational velocities are in line with theoretical predictions of the evolution of rotating stars.

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## Education

- 2019–current **PhD student (Astrophysics)**, *Observatoire de Paris - PSL University*, Paris, France.  
2016–2019 **MSc (Astrophysics and Cosmology)**, *University of Bologna*, Bologna, Italy.  
Thesis: Metallicity of the globular cluster NGC5286  
2011–2016 **BSc (Physics)**, *University of Pisa*, Pisa, Italy.

## Publications

- Paper **"Young giants of intermediate mass. Evidence of rotation and mixing"**, *Lombardo, L., François, P., Bonifacio, P., Caffau, E., Matas Pinto, A.d.M., Charbonnel, C., Meynet, G., Monaco, L., Cescutti, G., Mucciarelli, A.*, *A&A* 656, A155 (2021).
- Paper **"Detailed investigation of two high-speed evolved Galactic stars"**, *Matas Pinto, A.d.M., Caffau, E., François, P., Spite, M., Bonifacio, P., Wanajo, S., Aoki, W., Monaco, L., Suda, T., Spite, F., Sbordone, L., Lombardo, L., Mucciarelli, A.*, *Astronomische Nachrichten* (2021).
- Paper **"Purveyors of fine halos. III. Chemical abundance analysis of a potential  $\omega$ Cen associate"**, *Koch-Hansen, A.J., Hansen, C.J., Lombardo, L., Bonifacio, P., Hanke, M., Caffau, E.*, *A&A* 645, A64 (2021).

## Talks

- November 10, 2021 **ChETEC-INFRA Schools on Nuclear Astrophysics Questions (SNAQs)**, online.  
Contributed talk: "Evidence for rotation and mixing in a sample of young massive giant stars"
- September 8-10, 2021 **ChETEC COST Action Meeting**, Lisbon & online.  
Contributed talk: "CERES survey: atmospheric parameters and abundances of elements O to Zn"

## Observing proposals

- "A young metal poor population in the Galactic halo?"**, *PI: Lombardo L.*, ESO period 108.  
Time awarded: 9 hours with VLT/UVES in service mode

## Observational experience

- September 20-23, 2021 **Observatoire de Haute-Provence (OHP)**, 193 cm telescope.  
Four nights of observation with SOPHIE spectrograph.

## Languages

- Italian Native  
English Proficient  
French Intermediate

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