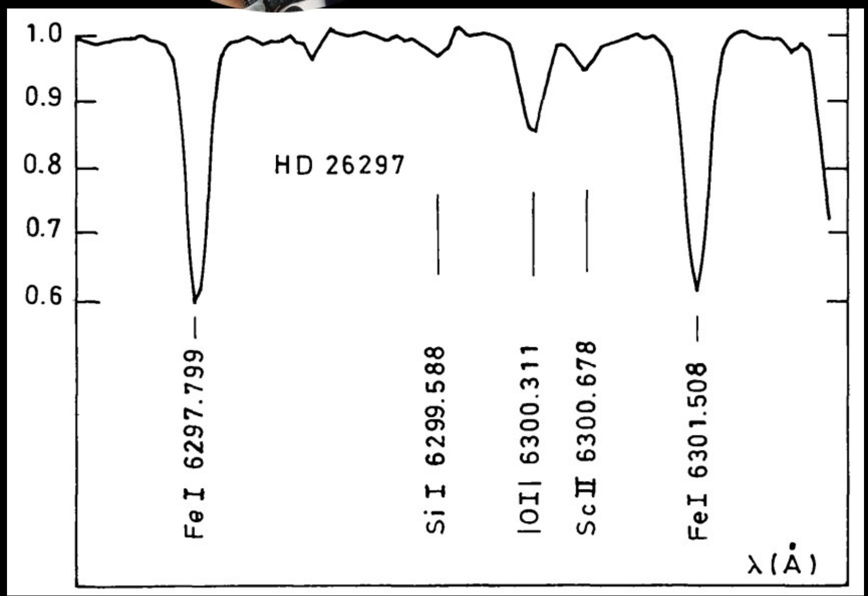
Scientific contributions of Beatriz Barbuy

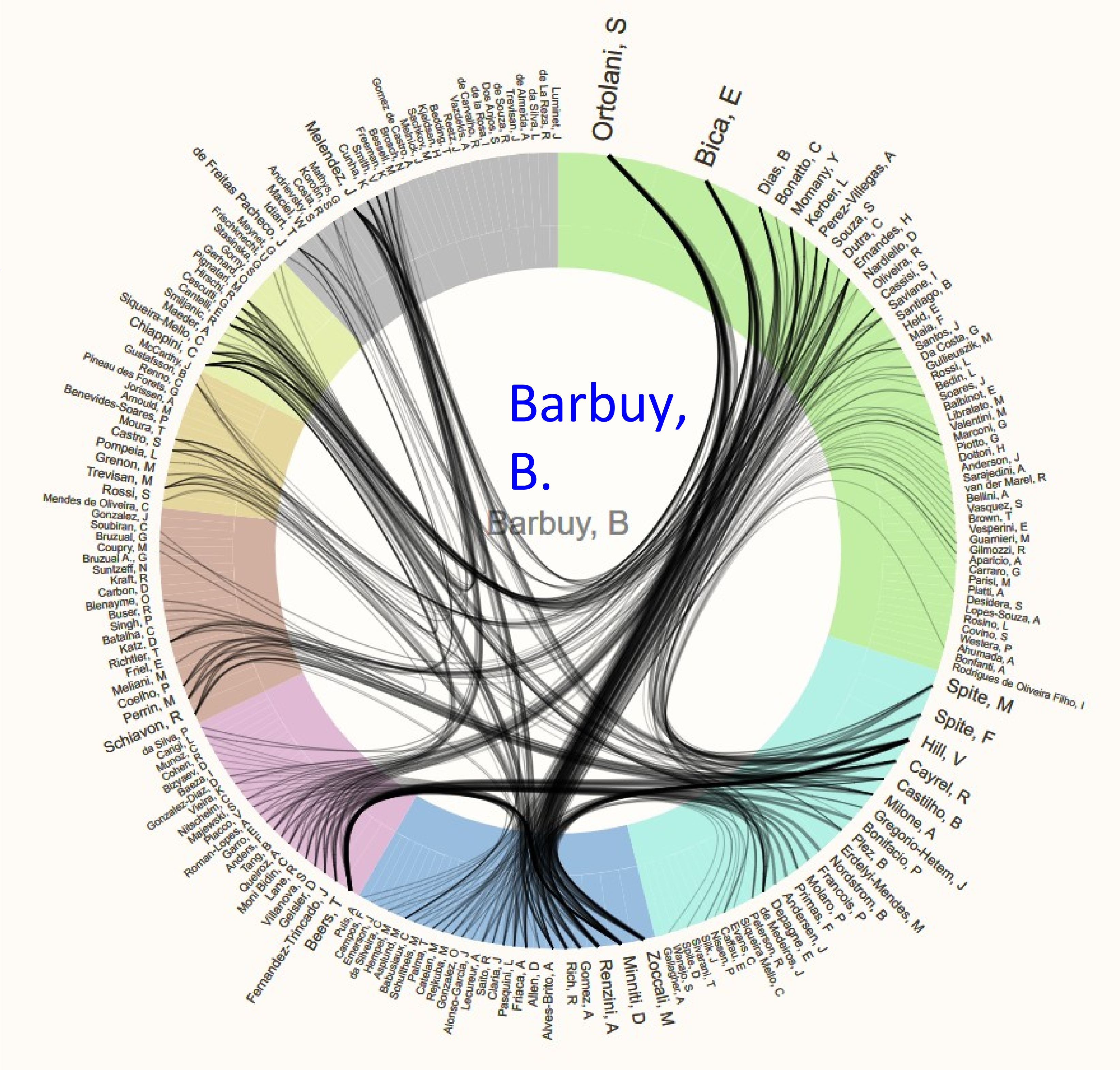


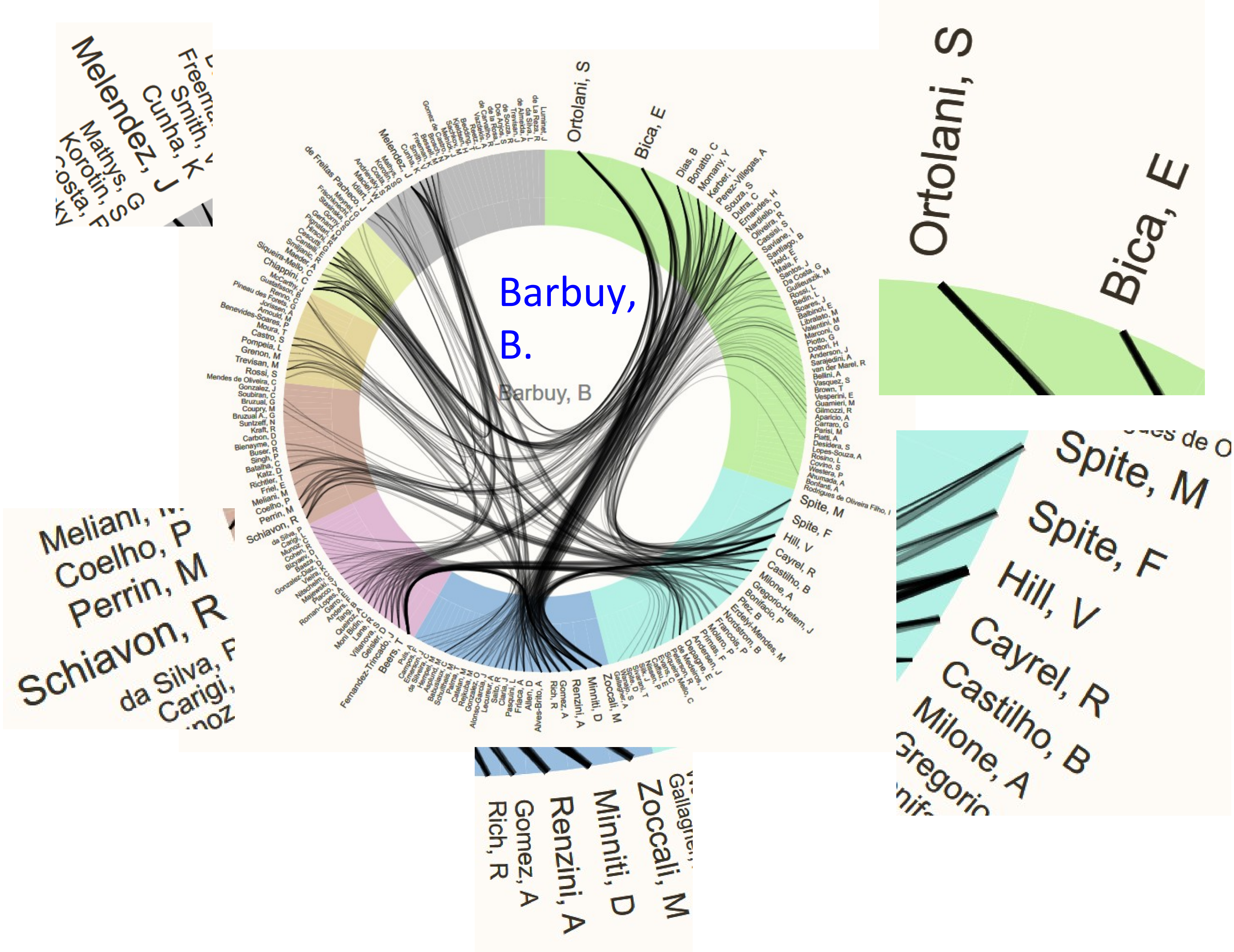
Jorge Meléndez, IAG - Univ. São Paulo, Brazil

Thanks to everybody for making possible IAU 395 in Paraty!

The IAU, Beatriz, co-chair Cristina, SOC, LOC (**LNA**: Bruno Castilho, Patricia Oliveira, Giuliana Capistrano; **ON**: Simone Daflon, Thiago Flaulhabe; **OV-UFRJ**: Helio Rocha-Pinto, Luan Ghezzi; **IAG-USP**: Paula Coelho, Anne Rathsam, Giulia Martos, Lais Borbolato, Luciana Silveira), Beatriz' former students, and others

Beatriz' author network





Barbuy, B.
Barbuy, B
Ortolani, S
Bica, E
Melendez, J
Cunha, K
Smith, V
Mathys, G
Korotin, S
Spite, M
Spite, F
Hill, V
Cayrel, R
Castilho, B
Milone, A
Meliani, M
Coelho, P
Perrin, M
Schiavon, R
da Silva, P
Carigi, L
Rich, R
Gomez, A
Renzini, A
Minniti, D
Zoccali, M

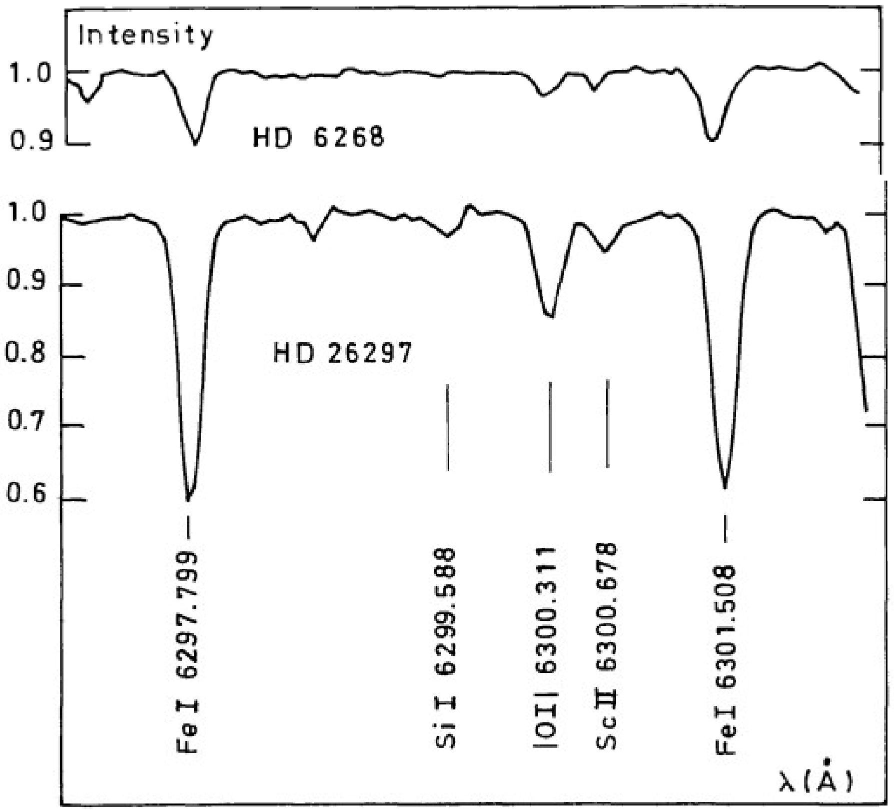
Astron. Astrophys. 191, 121–127 (1988)

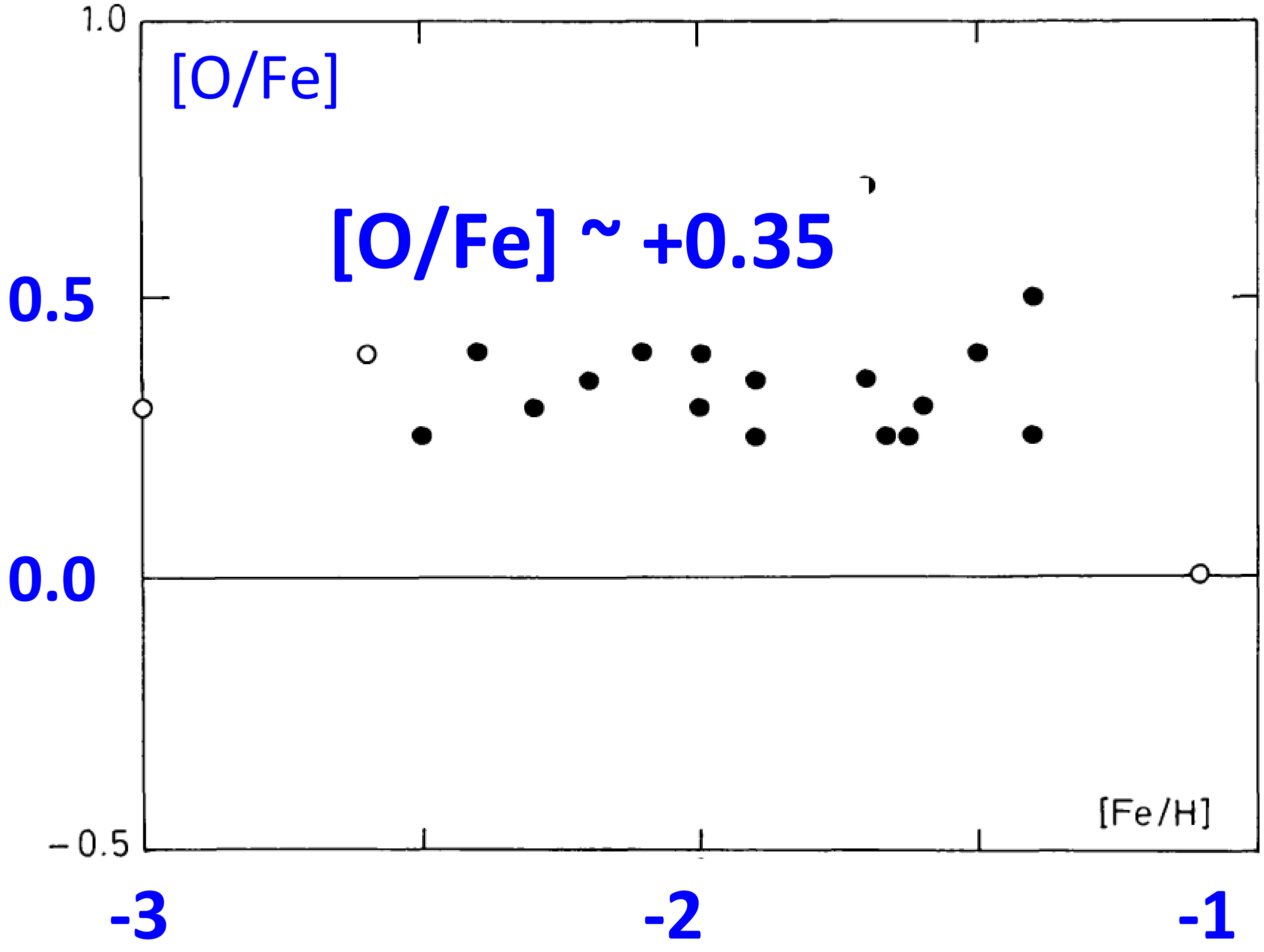
ASTRONOMY
AND
ASTROPHYSICS

Oxygen in 20 halo giants *

B. Barbuy [1,2]

[1] Universidade de Sao Paulo, Depto de Astronomia, C.P. 30627, Sao Paulo 01051, Brazil
[2] Observatoire de Paris-Meudon, F-92195 Meudon Pl Cedex, France





Astron. Astrophys. 236, 362–370 (1990)

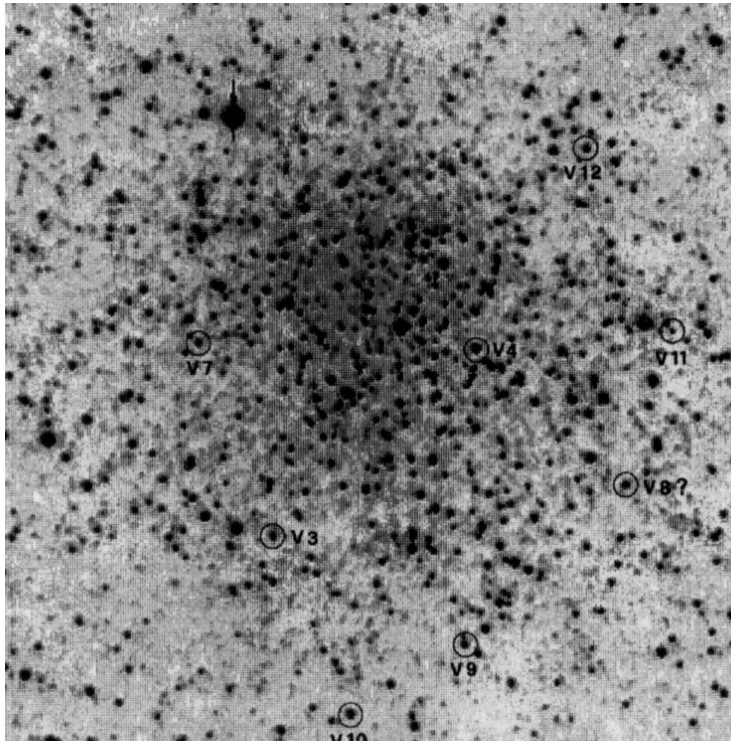
ASTRONOMY AND ASTROPHYSICS

+ 120 papers with Sergio Ortolani, including recent series: The Hubble Space Telescope UV Legacy Survey of Galactic Globular Clusters (Piotto et al.)

High-metallicity effects in *BVRI* colour-magnitude diagrams: the globular cluster NGC 6553*

S. Ortolani[1], **B. Barbuy**[2], **and E. Bica**[3]

[1] Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, I-35123 Padova, Italy
[2] Universidade de São Paulo, Departamento de Astronomia, C.P. 30627, São Paulo 01051, Brazil
[3] Universidade Federal do Rio Grande do Sul, Departamento de Astronomia, C.P. 15051, Porto Alegre 91500, Brazil



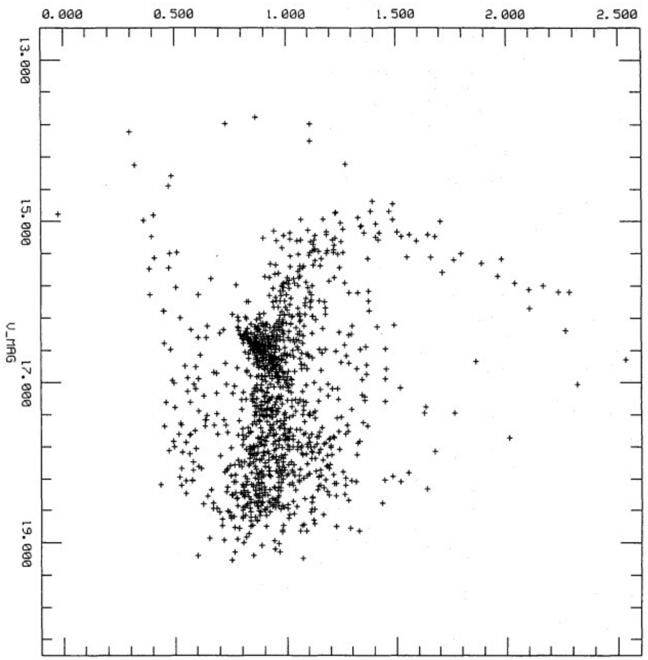


Fig. 5. CMD in V vs. $(V-R)$

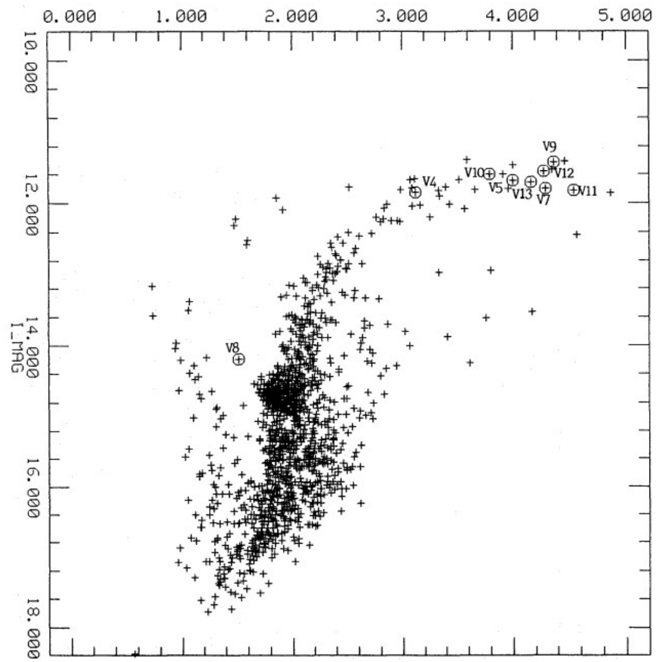


Fig. 6. CMD in I vs. $(V-I)$ for bright stars (non-saturated frame). The variable stars are identified

ASTRONOMY AND ASTROPHYSICS

A grid of synthetic spectra for the determination of effective temperature, gravity and metallicity of F, G, and K stars

Astron. Astrophys. 247, 108–121 (1991)

I. Description of the method *

R. Cayrel [1], M.-N. Perrin [1], B. Barbuy [2,3], and R. Buser [4]

Astron. Astrophys. 247, 122–129 (1991)

II. Application to 41 stellar spectra taken in the Basel field of SA 141*

R. Cayrel [1], M.-N. Perrin [1], R. Buser [2], B. Barbuy [3,4], and M.-F. Coupry [1]

$$\kappa_{at} = \frac{\pi e^2}{m c^2} \lambda_0^2 \alpha g f P_r H(a,v)/(\sqrt{\pi}\,\Delta \lambda_D)$$

Spite (1967)

Barbuy (1982)

$$\kappa_\lambda^{mol} = \frac{\pi e^2}{m_e c^2} \lambda_0^2 g_{J''} f_{v'J',v''J''} N^{AB}_{el,v'',J''} \frac{H(a,u)}{\sqrt{\pi}\Delta\lambda_D} \left(1 - e^{-hc/\lambda_0 kT}\right)$$

$$N^{AB}_{el,v'',J''} = \left(\frac{2\pi k T \mu}{h^2}\right)^{-3/2} \frac{N_A N_B}{Q_A Q_B} e^{D_0/kT} \frac{g_{el} g_{v''} g_{J''}}{g_{J''}} e^{-E_{el,v'',J''}/kT}$$

ASTRONOMY AND ASTROPHYSICS

A grid of synthetic spectra for the determination of effective temperature, gravity and metallicity of F, G, and K stars

Astron. Astrophys. 247, 108–121 (1991)

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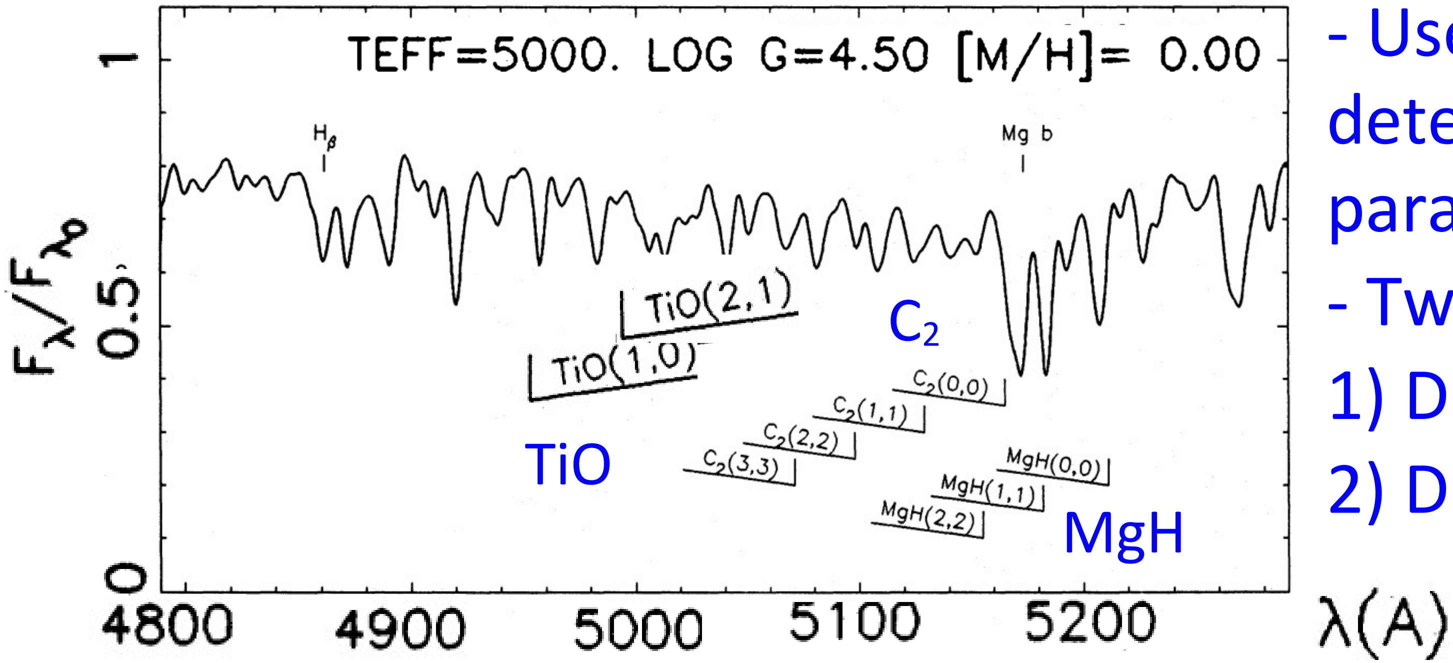
$$\kappa_{mol} = \frac{\pi e^2}{m_e c^2} \lambda_0^2\, f N''_{nvJ}\, H(a,v)/(\sqrt{\pi}\,\Delta\lambda_D)$$

Barbuy (1982)

Astron. Astrophys. 247, 122–129 (1991)

II. Application to 41 stellar spectra taken in the Basel field of SA 141*

R. Cayrel [1], M.-N. Perrin [1], R. Buser [2], B. Barbuy [3,4], and M.-F. Coupry [1]



- Use of stellar grids to detemine stellar parameters in F, G, K stars
- Two methods

1) Directly from the grid
2) Differentially (std stars)

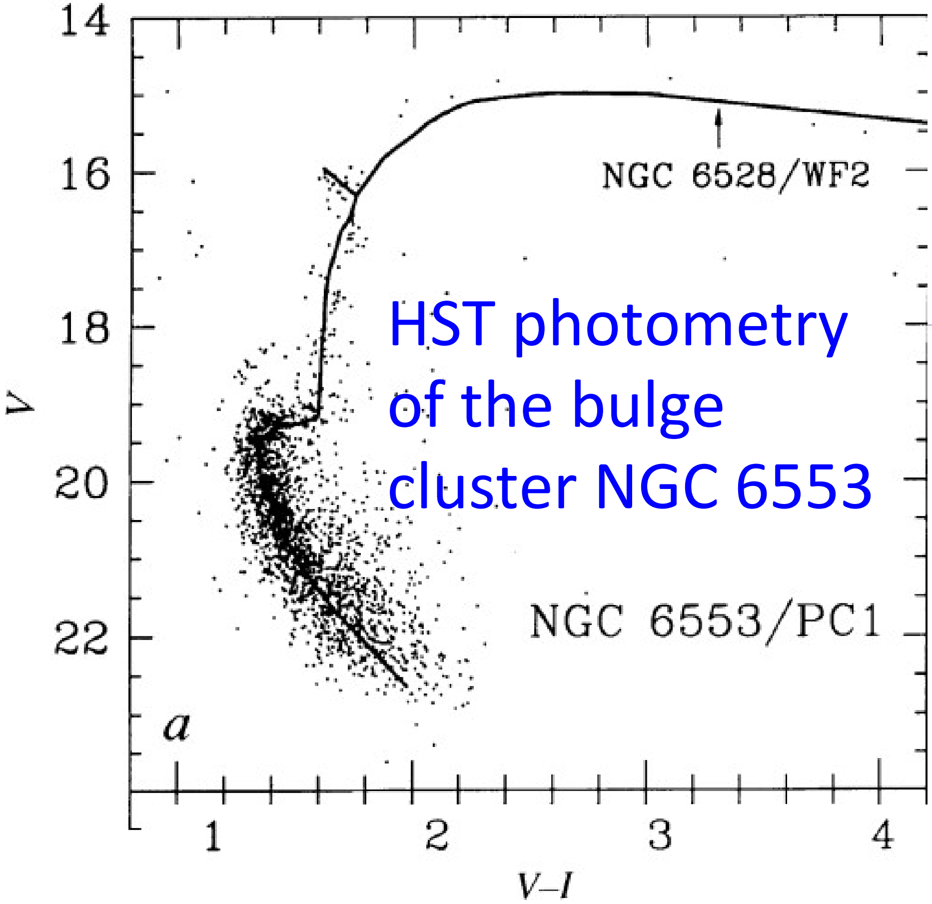
The Bulge is as old as the Halo

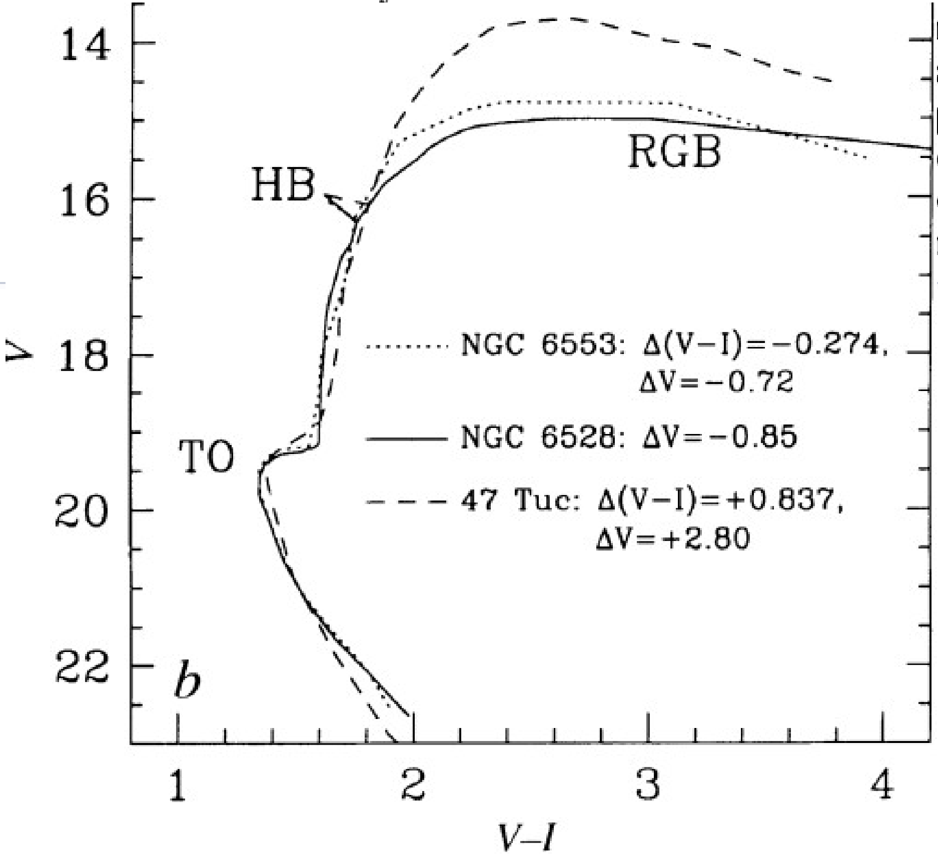
Near-coeval formation of the Galactic bulge and halo inferred from globular cluster ages

Sergio Ortolani*, Alvio Renzini†‡, Roberto Gilmozzi‡, Gianni Marconi§, Beatriz Barbuy||, Eduardo Bica¶ & R. Michael Rich*

* Univ
† Univ
‡ Euro
§ Osse
|| Univ
São P
¶ Univ
Depar

have experienced little chemical enrichment, by previous generations of stars.) It is not known, however, whether the bulge is the inner extension of the halo, having formed as part of the same process[1], or whether it formed much later, perhaps by a dynamical distortion of the inner regions of the disk[2,3]. Here we report observations obtained with the Hubble Space Telescope of two metal-rich globular clusters that form part of the bulge population. Within the uncertainties, these bulge globular clusters appear to be coeval with halo clusters, which suggests that the formation of the bulge was part of the dynamical process that formed the halo, and that the bulge gas underwent rapid chemical enrichment, in less than a few billion years.





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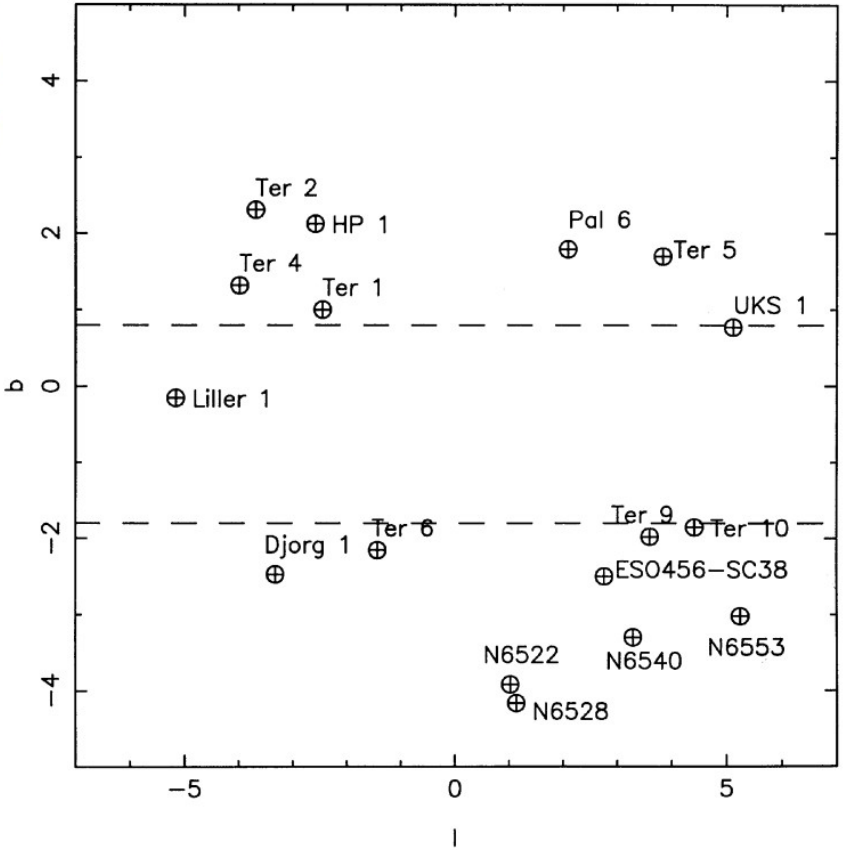
Astron. Astrophys. 333, 117–124 (1998)

ASTRONOMY AND ASTROPHYSICS

Globular clusters within 5° of the Galactic center*

B. Barbuy[1], E. Bica[2], and S. Ortolani[3]



hemisphere. The metallicity distribution of our sample clusters results similar to that of bulge field stars.

The present ground-based results coupled to main sequence data of two genuine bulge clusters using the Hubble Space Telescope, point to a scenario of an old flat bulge with common origin for the stellar populations in both globular clusters and field.

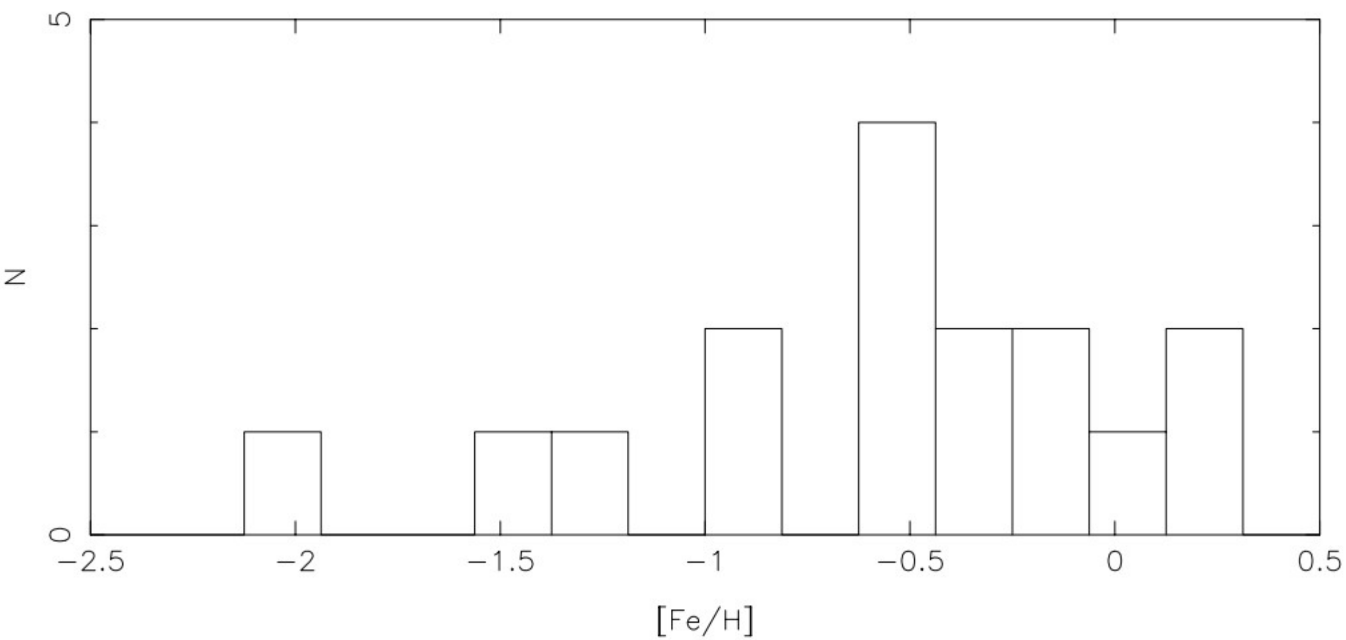


Fig. 10. Metallicity histogram for the present sample.

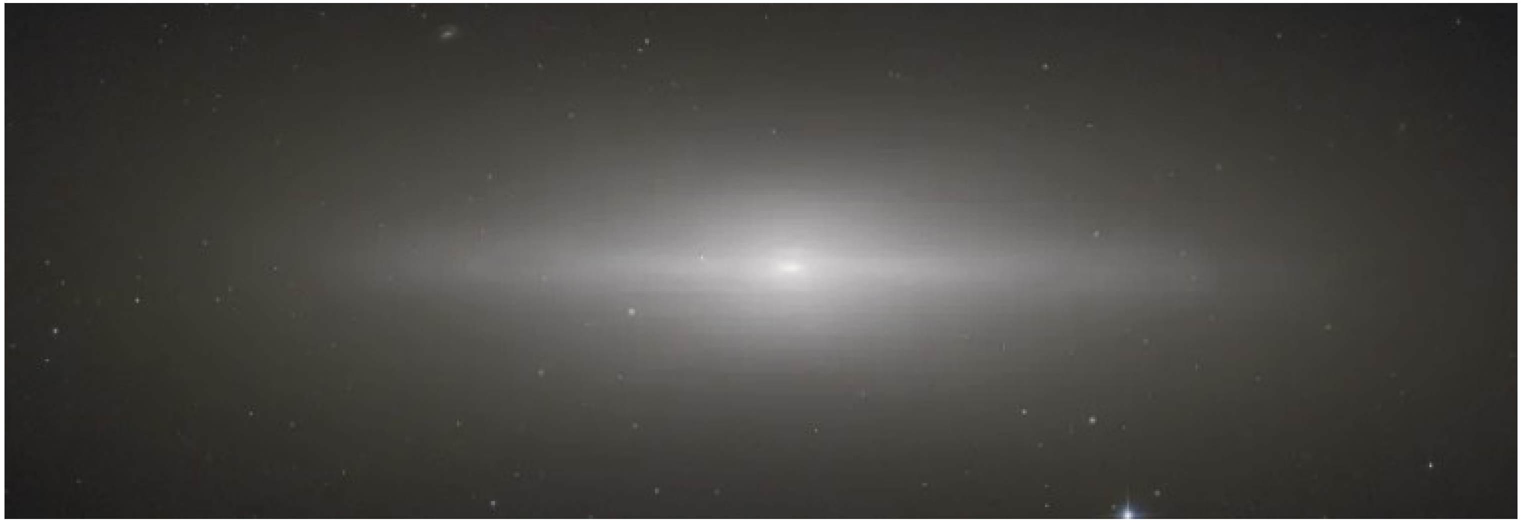
THE ASTRONOMICAL JOURNAL, 120:131–138, 2000 July

THE RATIO OF α-ELEMENTS TO IRON IN EARLY-TYPE GALAXIES FROM TiO AND Mg_2[1]

A. MILONE,[2] B. BARBUY,[3] AND R. P. SCHIAVON[4]

In order to derive the ratio of α-elements to iron in galaxies, we have observed the strongest TiO band heads of the γ and γ' systems at 7000–7500 Å in a sample of a dozen early-type galaxies. The equivalent widths of the TiO bands are compared with synthetic spectra for single-aged stellar populations and composite galaxy models, all computed with $[\alpha/Fe] = 0.0$ and $+0.3$. The same method is also applied to the $\langle Fe \rangle$ and Mg_2 Lick indices for the sample galaxies. The results obtained are $[Ti/Fe] \approx [Mg/Fe] \approx +0.3$, indicating a clear enhancement of the α-elements–to–iron ratio for our sample of early-type galaxies.

The observations of the TiO feature at 7000–7500 Å were carried out in 1993 June, 1993 July, and 1994 May, at the Cassegrain focus of the 1.60 m telescope of the Laboratório Nacional de Astrofísica (LNA) with a Boller & Chivens spectrograph. In 1997 June the Mg_2, Fe5270, and Fe5335 indices were observed for two sample galaxies.

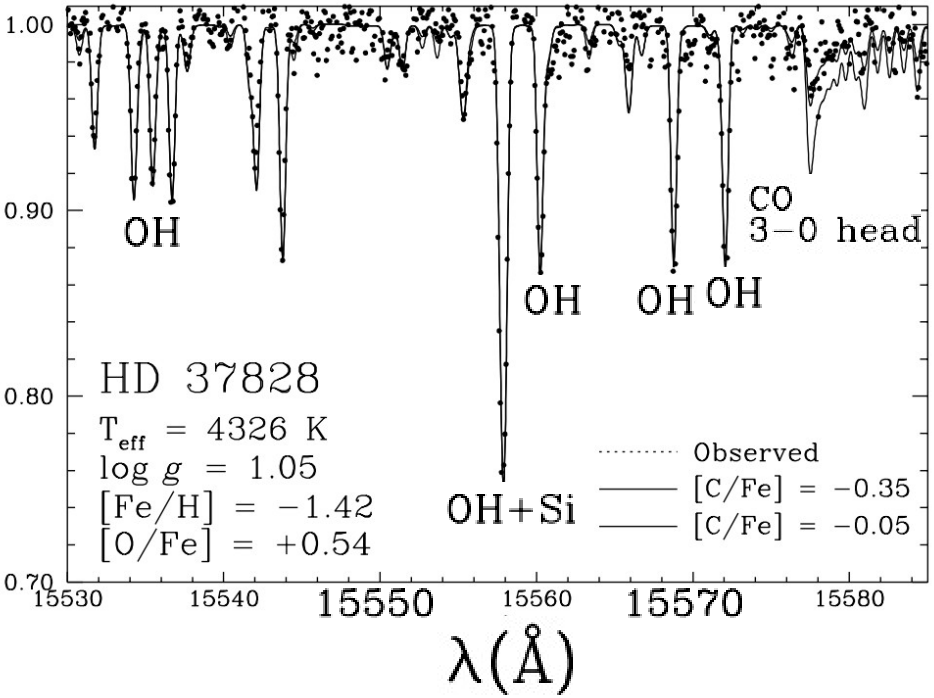


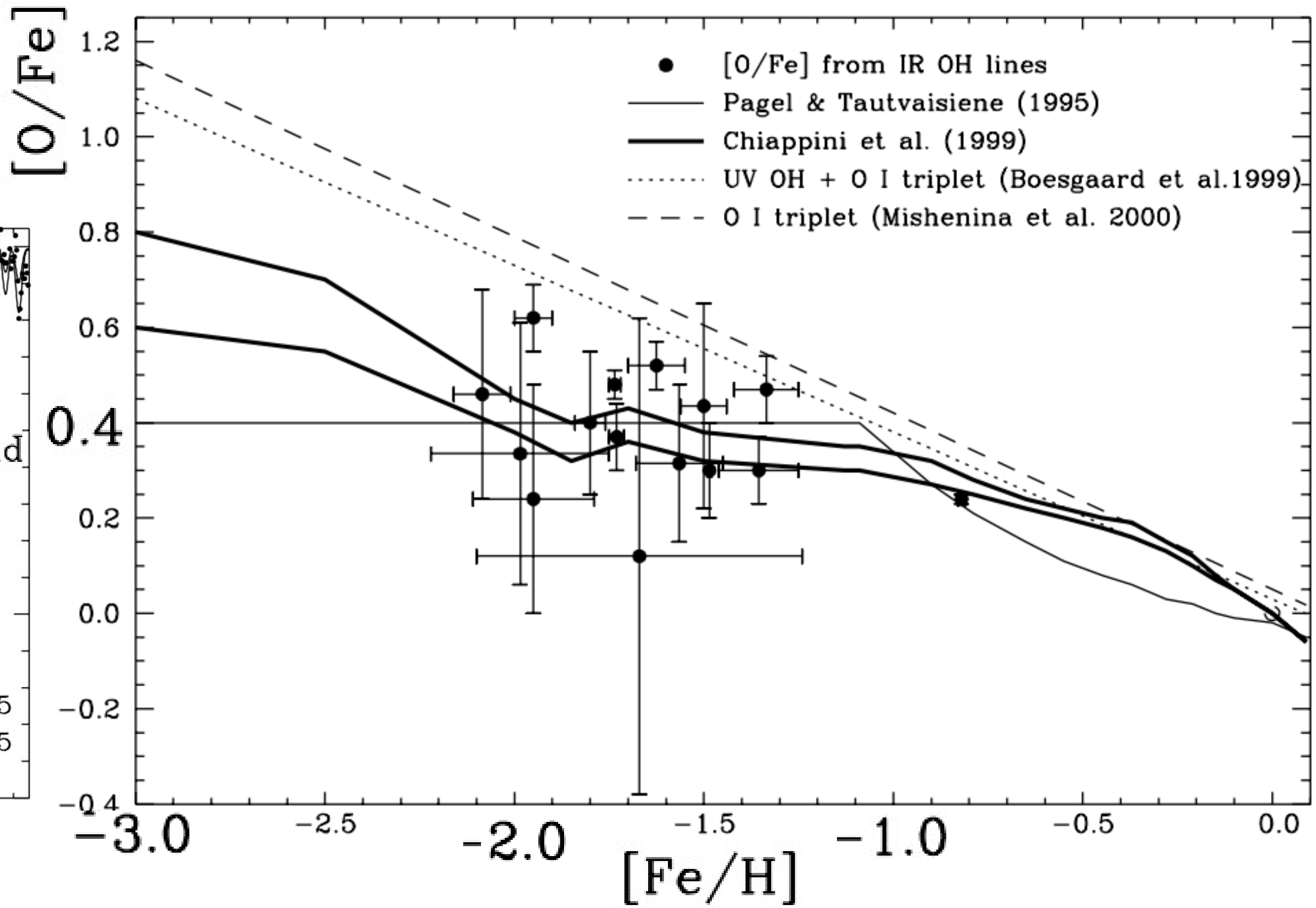
NGC 3115

THE ASTROPHYSICAL JOURNAL, 556:858–871, 2001 August 1

OXYGEN ABUNDANCES IN METAL-POOR STARS (−2.2 < [Fe/H] < −1.2) FROM INFRARED OH LINES

JORGE MELÉNDEZ[1] AND BEATRIZ BARBUY
Universidade de São Paulo, Instituto Astronomico e Geofísico, Department of Astronomy, Caixa Postal 3386, São Paulo, SP 01060-970, Brazil;
FRANÇOIS SPITE
Observatoire de Paris-Meudon, DASGAL, F-92195 Meudon Cedex, France; Francois.Spite@obspm.fr

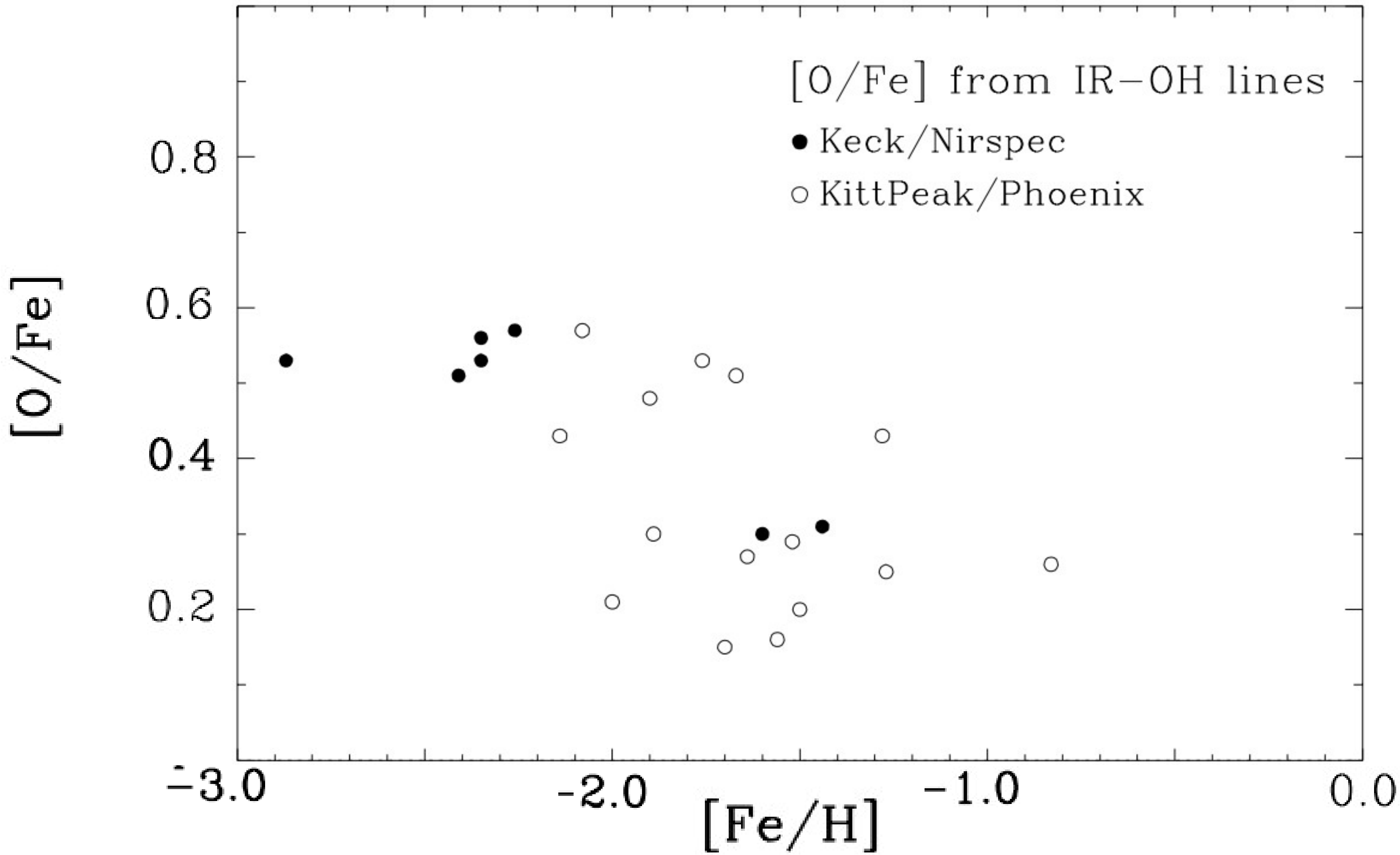




The Astrophysical Journal, 575:474–483, 2002 August 10

KECK NIRSPEC INFRARED OH LINES: OXYGEN ABUNDANCES IN METAL-POOR STARS DOWN TO [Fe/H] = −2.9[1]

Jorge Meléndez and Beatriz Barbuy
Universidade de São Paulo, IAG, Departamento de Astronomia, CP 3386, São Paulo 01060-970, Brazil;



THE ASTROPHYSICAL JOURNAL, 484:499–510, 1997 July 20

Paper 1

THE FeH WING-FORD BAND IN SPECTRA OF M STARS[1]

RICARDO P. SCHIAVON, B. BARBUY, AND PATAN D. SINGH

THE ASTROPHYSICAL JOURNAL, 510:934–943, 1999 January 10

Paper 2

THE TEMPERATURE SCALE OF METAL-RICH M GIANTS BASED ON TiO BANDS: POPULATION SYNTHESIS IN THE NEAR-INFRARED

R. P. SCHIAVON[2,3] AND B. BARBUY[2]

Astron. Astrophys. 345, 249–255 (1999)

Paper 3

Beryllium abundance in lithium-rich giants*

B.V. Castilho[1], F. Spite[2], B. Barbuy[1], M. Spite[2], J.R. De Medeiros[3], and J. Gregorio-Hetem[1]

The molecular lines of the following molecules were taken into account in the calculations: MgH ($A^2\Pi$-$X^2\Sigma$), C_2 ($A^3\Pi$-$X^3\Pi$), CN blue ($B^2\Sigma$-$X^2\Sigma$), CH ($A^2\Delta$-$X^2\Pi$), CH ($B^2\Delta$-$X^2\Pi$), CH ($C^2\Sigma$-$X^2\Pi$), OH ($A^2\Sigma$-$X^2\Pi$), NH ($A^3\Pi$-$X^3\Sigma$).

Paper 4

+ CN + CO in the infrared

THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 124:527–546, 1999 October

OSCILLATOR STRENGTHS AND DAMPING CONSTANTS FOR ATOMIC LINES IN THE *J* AND *H* BANDS

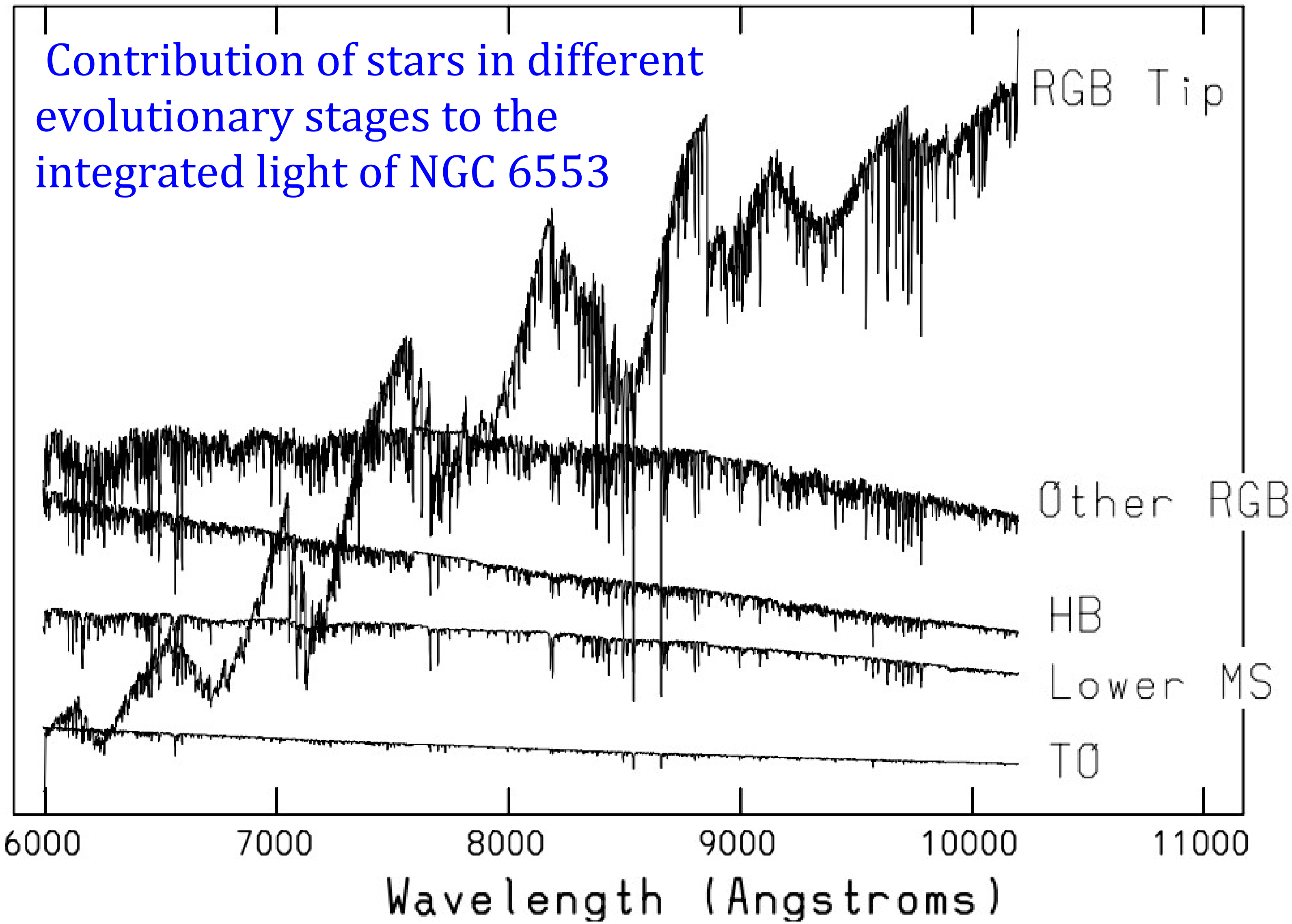
JORGE MELÉNDEZ AND BEATRIZ BARBUY

THE ASTROPHYSICAL JOURNAL, 510:934–943, 1999 January 10

THE TEMPERATURE SCALE OF METAL-RICH M GIANTS BASED ON TiO BANDS: SYNTHESIS IN THE NEAR-INFRARED

R. P. SCHIAVON[2,3] AND B. BARBUY[2]

Paper 2



A&A 443, 735–746 (2005)
DOI: 10.1051/0004-6361:20053511

Paper 5

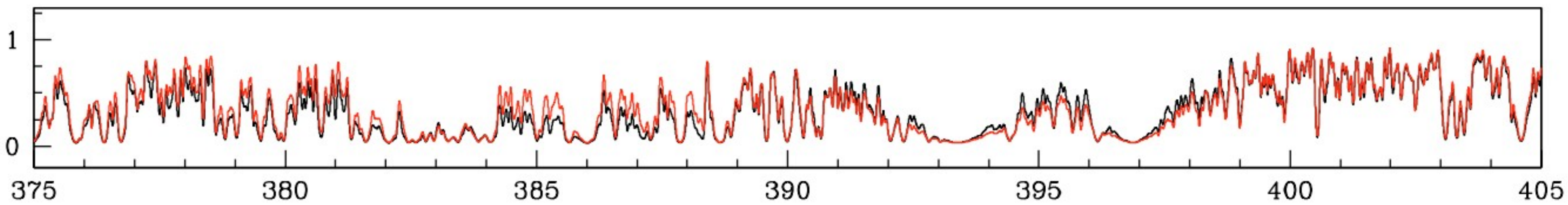
Astronomy & Astrophysics

A library of high resolution synthetic stellar spectra from 300 nm to 1.8 μm with solar and α-enhanced composition★,★★

P. Coelho[1,2], B. Barbuy[1], J. Meléndez[3], R. P. Schiavon[4], and B. V. Castilho[5]

Molecule	System	Number of lines
MgH	$A^2\Pi-X^2\Sigma$	1945
C_2 Swan	$A^3\Pi-X^3\Pi$	11 254
CN blue	$B^2\Sigma-X^2\Sigma$	92 851
CN red	$A^2\Pi-X^2\Sigma$	23 828
CH AX	$A^2\Delta-X^2\Pi$	10 137
CH BX	$B^2\Delta-X^2\Pi$	2016
CH CX	$C^2\Delta-X^2\Pi$	2829
CO nir	$X^1\Sigma^+$	7088
NH blue	$A^3\Pi-X^3\Sigma$	8599
OH blue	$A^2\Sigma-X^2\Pi$	6018
OH nir	$X^2\Pi$	2028
FeH	$A^4\Delta-X^4\Delta$	2705
TiO γ	$A^3\Phi$-$X^3\Delta$	26 007
TiO γ'	$B^3\Pi-X^3\Delta$	219 367
TiO α	$C^3\Delta-X^3\Delta$	360 725
TiO β	$c^1\Phi-a^1\Pi$	91 804
TiO δ	$b^1\Pi-a^1\Delta$	189 019
TiO ϵ	$E^3\Pi-X^3\Delta$	253 755
TiO ϕ	$b^1\Pi-d^1\Sigma$	105 082

360 citations related to many types of work, such as determination of precise radial velocities, determination of stellar parameters, stellar populations

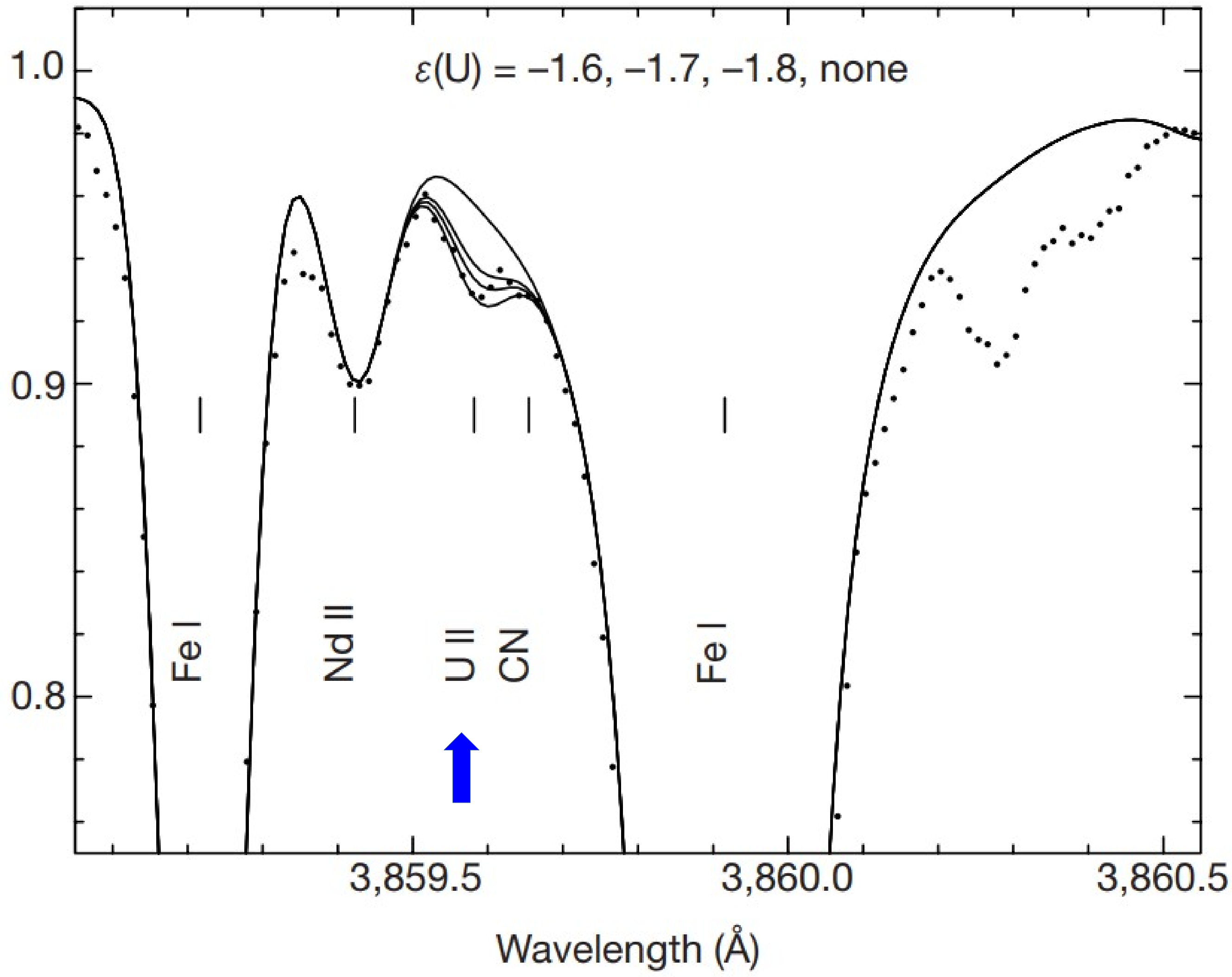


Measurement of stellar age from uranium decay

letters to nature

R. Cayrel*, V. Hill†, T. C. Beers‡, B. Barbuy§, M. Spite||, F. Spite||, B. Plez¶, J. Andersen*#, P. Bonifacio☆, P. François, P. Molaro☆, B. Nordström††# & F. Primas†**

First stars:
37 nights VLT,
16 papers



A&A 416, 1117–1138 (2004)
DOI: 10.1051/0004-6361:20034074

Astronomy & Astrophysics

First stars V - Abundance patterns from C to Zn and supernova yields in the early Galaxy★,★★

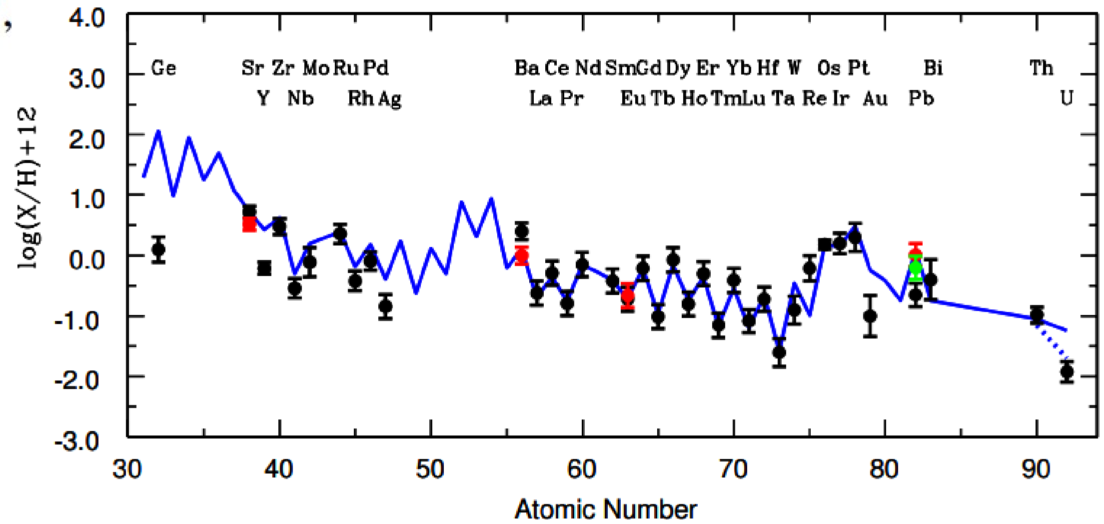
R. Cayrel[1], E. Depagne[1], M. Spite[1], V. Hill[1], F. Spite[1], P. François[1], B. Plez[2], T. Beers[3], F. Primas[4], J. Andersen[5,9], B. Barbuy[6], P. Bonifacio[7], P. Molaro[7], and B. Nordström[5,8]

A&A 550, A122 (2013)
DOI: 10.1051/0004-6361/201219949

First stars

XVI. HST/STIS abundances of heavy elements in the uranium-rich metal-poor star CS 31082-001★,★★

C. Siqueira Mello Jr.[1,2], M. Spite[2], B. Barbuy[1], F. Spite[2], E. Caffau[3,2], V. Hill[4], S. Wanajo[5], F. Primas[6], B. Plez[7], R. Cayrel[8], J. Andersen[9,10], [illegible][2], P. François[8], and P. Molaro[14]

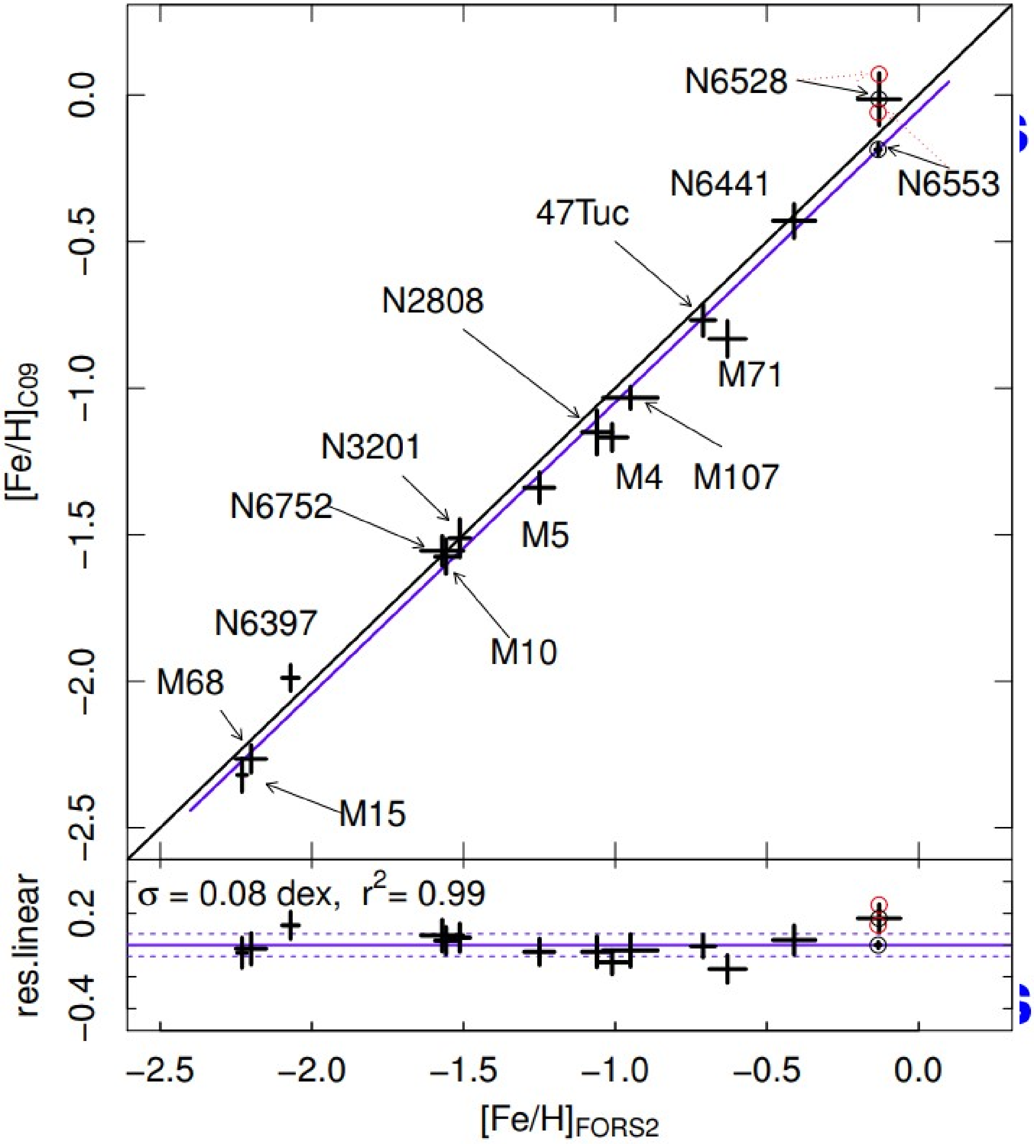


A&A 573, A13 (2015)
DOI: 10.1051/0004-6361/201423996

FORS2/VLT survey of Milky

I. Description of the method for derivation and application to NGC 6528, NGC 65 and Terzan

B. Dias[1,2], B. Barbuy[1], I. Saviane[2], E. V. Held[3], G.
M. Gullieuszik[3], an



A&A 590, A9 (2016)
DOI: 10.1051/0004-6361/201526765

FORS2/VLT survey of Milky Way globular clusters

II. Fe and Mg abundances of 51 Milky Way globular clusters on a homogeneous scale★,★★

B. Dias[1,2,3], B. Barbuy[2], I. Saviane[1], E. V. Held[4], G. S. Da Costa[5], S. Ortolani[4,6], M. Gullieuszik[4], and S. Vásquez[7,8,9

A&A 591, A53 (2016)
DOI: 10.1051/0004-6361/201628106

Astronomy & Astrophysics

High-resolution abundance analysis of red giants in the metal-poor bulge globular cluster HP 1★

B. Barbuy[1], E. Cantelli[1], A. Vemado[1], H. Ernandes[1], S. Ortolani[2,3], I. Saviane[4], E. Bica[5], D. Minniti[6,7], B. Dias[4], Y. Momany[3], V. Hill[8], M. Zoccali[6,9], and C. Siqueira-Mello[1]

Several papers on high resolution abundance analysis of bulge clusters using FLAMES-UVES, e.g. HP1, NGC 6522, NGC 6558, AL3, +others

Annual Review of Astronomy and Astrophysics

Annu. Rev. Astron. Astrophys. 2018. 56:223–76

Chemodynamical History of the Galactic Bulge

Beatriz Barbuy,[1] Cristina Chiappini,[2] and Ortwin Gerhard[3]

The Galactic Bulge can uniquely be studied from large samples of individual stars and is therefore of prime importance for understanding the stellar population structure of bulges in general. Here the observational evidence on the kinematics, chemical composition, and ages of Bulge stellar populations based on photometric and spectroscopic data is reviewed. The bulk of Bulge stars are old and span a metallicity range of $-1.5 \lesssim \mathrm{[Fe/H]} \lesssim +0.5$. Stellar populations and chemical properties suggest a star-formation timescale below ~2 Gyr. The overall Bulge is barred and follows cylindrical rotation, and the more metal-rich stars trace a box/peanut (B/P) structure. Dynamical models demonstrate the different spatial and orbital distributions of metal-rich and metal-poor stars. We discuss current Bulge-formation scenarios based on dynamical, chemical, chemodynamical, and cosmological models. Despite impressive progress, we do not yet have a successful fully self-consistent chemodynamical Bulge model in the cosmological framework, and we will also need a more extensive chrono-chemical-kinematic 3D map of stars to better constrain such models.

Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

Royal Astronomical Society

MNRAS **517,** 4590–4606 (2022) https://doi.org/10.1093/mnras/stac2136
Advance Access publication 2022 August 1

Abundance analysis of APOGEE spectra for 58 metal-poor stars from the bulge spheroid

R. Razera ,[1★] B. Barbuy ,[1★] T. C. Moura ,[1] H. Ernandes ,[1] A. Pérez-Villegas ,[2] S. O. Souza ,[1,3]

MNRAS **526,** 2365–2376 (2023) https://doi.org/10.1093/mnras/st
Advance Access publication 2023 September 22

Light elements Na and Al in 58 bulge spheroid stars from APOGEE

B. Barbuy ,[1,2★] A. C. S. Friaça,[1★] H. Ernandes ,[2★] T. Moura ,[†] T. Masseron,[3] K. Cunha ,[4,5,6] V.

Astronomy & Astrophysics manuscript no. aa52235-24corr
October 18, 2024

Abundances of iron-peak elements in 58 bulge spheroid stars from APOGEE

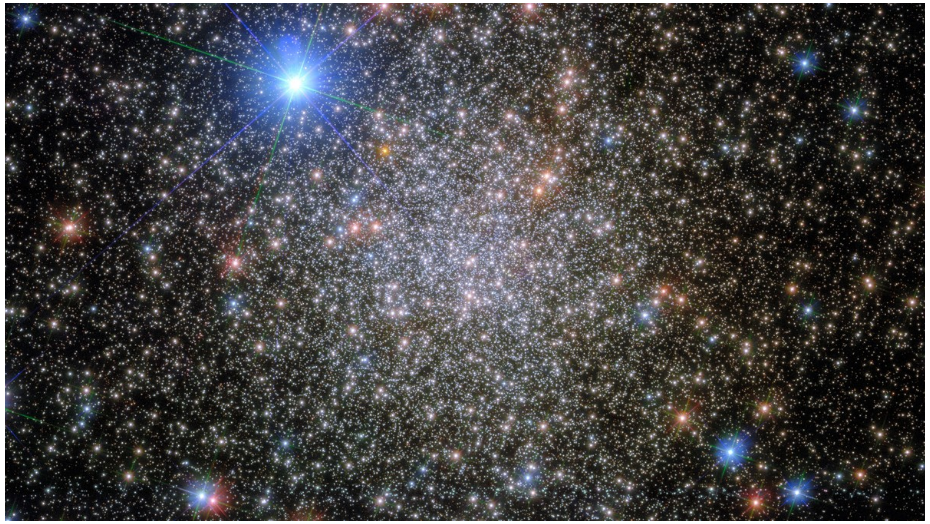
B. Barbuy[1], A.C.S. Friaça[1], H. Ernandes[2], P. da Silva[1], S. O. Souza[3], J. G. Fernández-Trincado[4], K. Cunha[5,6], V. V. Smith[7], T.

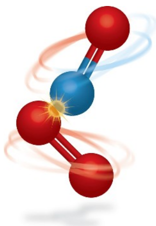
Beatriz: From micro to macro.

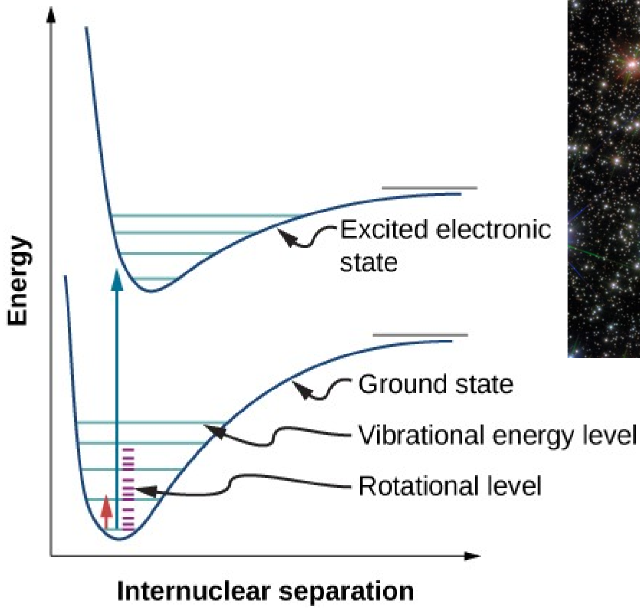
- Atomic data
- Molecular physics
- Radiative transfer in stellar atmospheres
- Stellar Astrophysics
- Different stellar populations:

disk, bulge, halo, field and cluster stars, and other galaxies

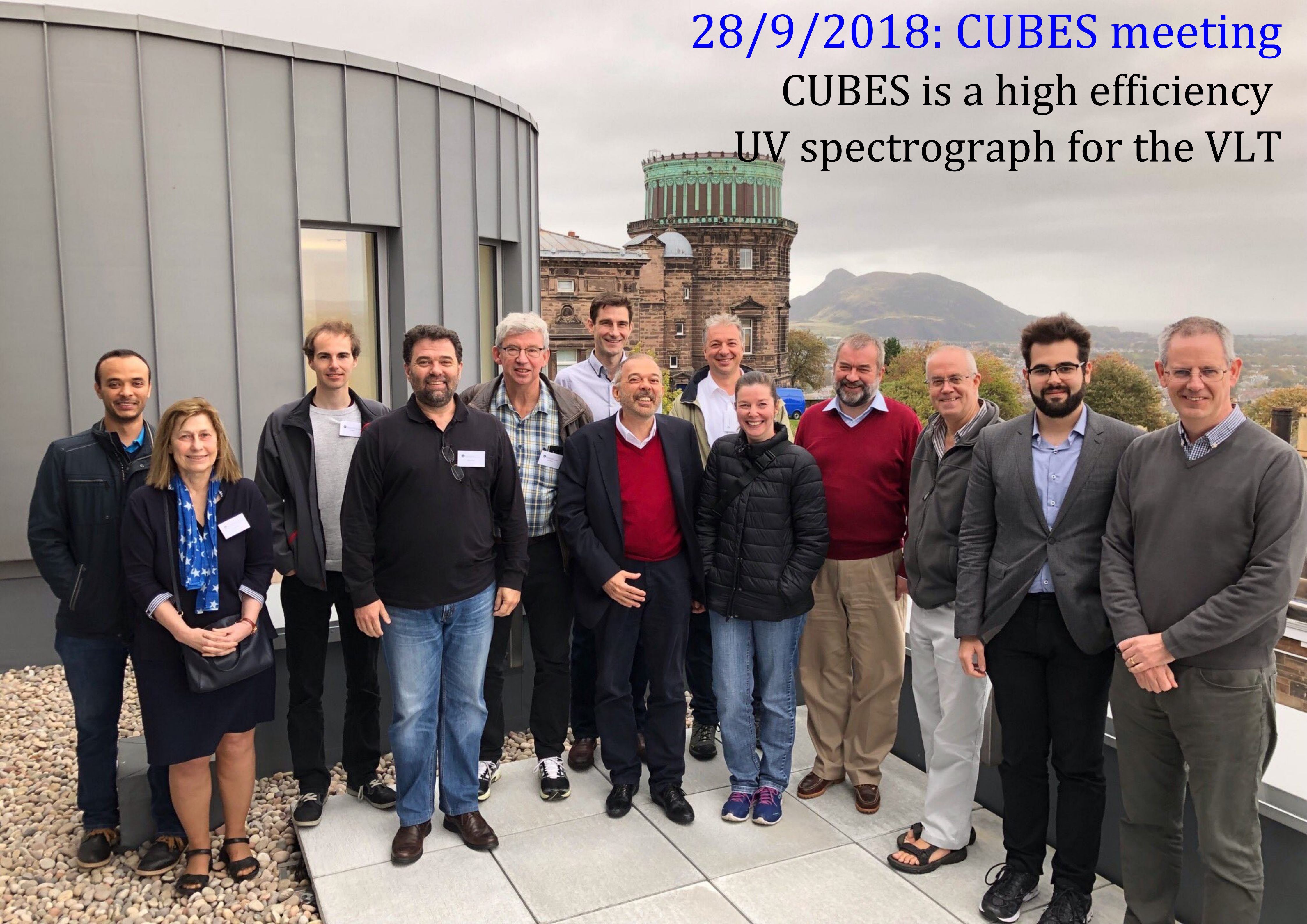
- Integrated spectra
- Instrumentation







Participants of ASOS meeting on Atomic Data for Astrophysics, organized by Prof. Beatriz Barbuy at the Univ. São Paulo, 7/2016.


28/9/2018: CUBES meeting
CUBES is a high efficiency
UV spectrograph for the VLT

Beatriz Barbuy is in the list of most influential scientists in the world and she is the most influential Brazilian astronomer and **among the top physicists in Brazil**

- Over 300 papers
- Over 20k citations
- h-index: 70

Updated science-wide author databases of standardized citation indicators

John P. A. Ioannidis, Kevin W. Boyack, Jeroen Baas

https://journals.plos.org/plosbiology/article?id=10.1371%2Fjournal.pbio.3000918&fbclid=IwAR1LBmD2R_YUSfpLxQ3VcGtIed4QC5To9WA0ZO_LFAX4dAxkK3_21hhF7bU

"Children" and "grandchildren" of Beatriz all around the world for student exchanges, postdocs and permanent positions.

The "extended family" of Beatriz, have expanded interests:

- Instrumentation
- Galaxies
- Galactic archaeology
- Stellar astrophysics
- Exoplanets
- Outreach