

# Curriculum Vitae et Studiorum

## *Marcella Di Criscienzo*

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**Name:** Marcella  
**Surname:** Di Criscienzo  
**Place of birthday:** Napoli, Italy  
**Date of birthday:** 30 Dicembre 1976  
**Address:** via Ettore Giovenale 80, I-00177, Rome, Italia  
**Work address:** INAF-Osservatorio Astronomico di Roma,  
via Frascati 33, I-00040, Monte Porzio Catone, Rome, Italy  
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**Corrent position:** Post-Doctoral fellowship at INAF-OAR

**Languages & Computers**

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**Italian:** mother tongue  
**Polish:** mother tongue  
**English:** good

**Operative systems:** UNIX, Linux, Windows  
**Programming** SMongo, Unix shell scripts, Fortran, IDL  
**Analysis Software** IRAF, Gnuplot, Midas, ISIS, DaoPhot, Allstar, Allframe,  
DaoPhot, SkyCalc, SAOimage, GRATIS, Period04

**Education**

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- June 1995** – Diploma di Maturità Scientifica at  
Liceo Scientifico "E. Vittorini" of Naples
- December 2002** – Degree in Physics at University of Naples "Federico II"  
Title: "*Studio pulsazionale ed evolutivo di RR lyrae*"  
Supervisor: Prof. M. Capaccioli, Prof.ssa F. Caputo, Dr. M. Marconi  
evaluation: 110/110 cum laude
- March 2007** – PhD degree in Astronomy at University of Rome "Tor Vergata"  
Title: "*Self-consistence distance scales for Population II variables*" .  
Supervisor: Prof. R. Buonanno, Prof. F. Caputo & Dr. M. Marconi

**Contracts at public and private institutions, fellowships or appointments:**

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- April 2003** – "Contratto di collaborazione ad attività di ricerca" (2 years)  
Title: **"Modelli di pulsazione stellare per variabili di pop II"**  
Where: INAF-OAC
- April 2005** – "Borsa di studio" (7 month)  
Title: **"Variabili pulsanti e formazione della Via Lattea"**  
Where: INAF-OAC
- February 2006** – "Contratto di collaborazione ad attività di ricerca" (1 year)  
Title: **"Variabili pulsanti come traccianti delle popolazioni stellari della Via Lattea e della piccola nube di Magellano: preparazione delle survey STREGA@VST e STEP@VST"**  
Where: INAF-OAC
- June 2007** – "Contratto di collaborazione ad attività di ricerca" (2 years)  
Title: **"Modelli stellari ed asterosismologia"**  
Where: INAF-OAR  
Supervisors: Prof.ssa F. D'Antona & Dott. P.Ventura
- June 2009** – "Contratto di collaborazione ad attività di ricerca" (21 months)  
Title: **"Multi popolazioni stellari in Ammassi Globulari"**  
Where: INAF-OAR  
Supervisors: Prof.ssa F. D'Antona & Dott. P.Ventura

## National and international cooperations

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1. KASC (Kepler Asteroseismic Science Consortium) member at the NASA mission **Kepler**. The candidate belong at two Working Groups: WG#4 on the study of  $\delta$  Scuti stars and WG#10 on RR Lyrae stars.
2. Co-PI in the survey STREGA@VST (STRUcture and Evolution of the GALaxy) (PI Dott.ssa M.Marconi) and in the survey STEP@VST (PI:Dott. V. Ripepi) of 4 year with the Capodimonte VST GTO.
3. Participants as INAF member in Europeans Network on Elio- an Astrosismology (HELAS). HELAS is born in the 2006 with the scope to coordinate activity between European Institute which are operative in the topics of pulsations of stars.
4. Same of the accepted proposals in the last years:
  - **2002** –Near-Infrared PL and PLC relations of anomalous Cepheids in the dwarf spheroidal galaxy Ursa Minor , NICS@TNG, PI: M. Marconi
  - **2003** –NIR Photometry or RR Lyrae stars in Baade window to estimate the distance to the Galaxy Center , SOFI@NTT/ESO, PI: R. Buonanno
  - **2003** –The RR Lyrae star population of the remote Galactic globular cluster NGC 2419 , Dolores@TNG, PI: V. Ripepi
  - **2003** – The RR Lyrae  $\log P-(M_K)$  and  $\log P-(J-K)$  relations in Galactic globular clusters , NICS@TNG, PI: F. Caputo
  - **2004** –NIR observations of Cepheids in IC1613 and NGC 5253: implications for the Cepheid and SNIa distance scale , SOFI@NTT/ESO, PI: I. Musella
  - **2005** –The RR Lyrae  $\log P-(K)$  and  $\log P-(J-K)$  relations in Galactic globular clusters, NICS@TNG, PI: M. Dall’Ora
  - **2006** –The star formation history of Ursa Minor dwarf galaxy from its variable star populations, Dolores@TNG, NICS@TNG, PI: V. Ripepi
  - **2006** –Optical photometry of RR Lyrae in Ursa Minor (3 night in visitor mode)Goal: Relative and Absolute distances; Determination of the chemical composition Instrument:BFOSC/Cassini
  - **2007** – Stellar Archeology in the Milky Way Halo, WFI@VLT/ESO, PI:G. Clementini

## School & Conference

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- November 2001** – Scuola nazionale di Astroparticelle, Bologna, Italia
- June 2002** – International meeting "*New Horizons in the Globular Cluster Astronomy*", Padova, Italia
- March 2003** – International meeting "*Stars in Galaxies*", La Palma, Canarie
- May 2003** – Scuola Nazionale di Astrofisica "*Local Group Galaxies and new generation telescopes*", Isola d'Elba, Italia
- May 2005** – Scuola Nazionale di Astrofisica "*Observational Cosmology and Cosmic Distance Scale*" Sant'Agata(NA), Italia
- June 2005** – International meeting "*Stellar Pulsation and Evolution*", Monte Porzio Catone(RM), Italia
- September 2005** – PhD workshop on "*ASTrophysics of Variable Stars*", Pecs, Hungary
- March 2006** – ESO conference "*Globular Cluster-Guides to Galaxies*", Conception, Cile
- December 2006** – IAU Symposium 241 "*Stellar Populations as Building Blocks of galaxies*", La Palma, Canarie, Spagna
- August 2007** – International meeting "*XXI Century challenges for stellar evolution*", Cefalú, Italia
- June 2008** – HELAS tutorial: "*Spectroscopic mode identification with the HELAS software package FAMIAS*", Leiden, Belgio
- June 2009** – Conferenza internazionale "*HELAS-Synergies between solar, and stellar modelling*", Roma, Italia
- November 2009** – Conferenza internazionale "*Light Elements in Universe*", Ginevra, Svizzera

## Talks & Seminars

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- March 03** – Talk at the international conference, La Palma, Canary Island, on  
*"Pulsation models of RR Lyrae stars: dependence on the mixing-length parameter alpha"*
- April 03** – Seminare at the Observatory of Naples, on:  
*"RR Lyrae Stars in Galactic Globular Clusters. A Theoretical approach to variables in M3"*
- November 03** – Seminare at the Observatory of Rome, on:  
*"Evolution-pulsation connection for RR Lyrae stars"*
- March 04** – Seminare at the University "TorVergata", on:  
*"RR Lyrae Stars in Galactic Globular Clusters. Pulsational Predictions"*
- March 05** – Seminare at the University "TorVergata", on:  
*"RR Lyrae-based calibration of the globular cluster luminosity function"*
- September 05** – Talk at the International PhD school in Asterosystemology, Pecs, Hungary, on  
*"Non linear and convective models of RR Lyrae stars"*
- February 06** – Seminare at the Observatory of Naples, on:  
*"RR Lyrae-based calibration of the globular cluster luminosity function "*
- March 06** – Seminare at the University "TorVergata", on:  
*"RR Lyrae Stars distance scale: theory and observations"*
- December 06** – Seminare at the University "TorVergata", on:  
*"Self-consistent distance scales for Population II variables"*
- March 07** – Talk at the University "TorVergata", on:  
*"The defence of my PhD thesis"*
- February 08** – Seminare at the Observatory of Naples, on:  
*"Variabili in NGC2419 "*
- October 09** – Talk at the Mid term meeting (PRIN-07) at INAF-OAR:  
*"Sintesi di popolazione di alcuni ammassi globulari"*

**And...**

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- **2008-2009** Seminars of astronomy (invited) and courses in Physics and Mathematics (*corsi di recupero*) in public schools.
- **2002-2010** Public outreach in astronomy for many initiatives organized by INAF (ASTROLAB, European researcher night, etc..)

1. Benko, J., Kepler team, **Di Criscienzo, M.**  
*Flavours of variability: 29 RR Lyrae stars observed with Kepler*  
 2010, MNRAS, accepted for publication after minor revisions
  
2. Szabo, R., Kepler team **Di Criscienzo, M.**  
*Does Kepler unveil the mystery of the Blazhko effect? First detection of period doubling in Kepler Blazhko RR Lyrae stars*  
 2010, MNRAS, accepted for publication after minor revisions
  
3. **Di Criscienzo, M.**, Ventura, P. D'Antona, F., Piotto, G. & Milone, A.  
*The Helium spread in 47 Tuc*  
 MNRAS, 2010, (arXiv1006.2024D)
  
4. F. D'Antona, P. Ventura, V. Caloi, A. D'Ercole, E. Vesperini, R. Carini, **M. Di Criscienzo.**  
*Terzan 5: an alternative interpretation for the split horizontal branch*  
 2010, ApJ, 715, 63
  
5. **Di Criscienzo, M.**, D'Antona, F. & Ventura, P.  
*A detailed study of the main sequence of the Globular Cluster NGC 6397: can we derive constraints on the existence of multiple populations?*  
 2010, A&A, 511, 70
  
6. Grigahcene, A.; Antoci, V.; Balona, L.; Catanzaro, G.; Daszynska-Daszkiewicz, J.; Guzik, J. A.; Handler, G.; Houdek, G.; Kurtz, D. W.; Marconi, M.; Monteiro, M. J. P. F. G.; Moya, A.; Ripepi, V.; Suarez, J. -C.; Uytterhoeven, K.; Borucki, W. J.; Brown, T. M.; Christensen-Dalsgaard, J.; Gilliland, R. L.; Jenkins, J. M.; Kjeldsen, H.; Koch, D.; Bernabei, S.; Bradley, P.; Breger, M.; **Di Criscienzo, M.**; Dupret, M. -A.; Garcia, R. A.; Garcia Hernandez, A.; Jackiewicz, J.; Kaiser, A.; Lehmann, H.; Marin-Ruiz, S.; Mathias, P.; Molenda-Zakowicz, J.; Nemeč, J. M.; Nuspl, J.; Paparo, M.; Roth, M.; Szabo, R.; Suran, M. D.; Ventura, R.  
*Hybrid  $\gamma$  Doradus  $\delta$  Scuti pulsators: new insight into the physics of the oscillations from Kepler observations*  
 ApJ, 2010, 713, 192
  
7. K. Kolenberg, R. Szabo, D. W. Kurtz, R. L. Gilliland, J. Christensen-Dalsgaard, H. Kjeldsen, T. M. Brown, J. M. Benko, M. Chadi, A. Derezas, **M. Di Criscienzo**, E. Guggenberger, K. Kinemuchi, A. Kunder, Z. Kollath, G. Kopacki, P. Moskalik, J. M. Nemeč, J. Nuspl, R. Silvotti, M.D. Suran, W. J. Borucki, D. Koch, J. M. Jenkins  
*First Kepler results on RR Lyrae stars*  
 2010, ApJ, 713, 198

8. **Di Criscienzo, M.**, Ventura, P., D'Antona, F.,  
*The role of the equation of state in models of very low-mass stars*  
 2009, Astrophysics and Space Science (ASTR184), contributo con referaggio a congresso  
 HELAS  
 URL:<http://www.springerlink.com/content/xj720m858t11g210/>
  
9. **Di Criscienzo, M.**, Ventura, P., D'Antona, F.,  
*Updated pre-main sequence tracks at low metallicities for  $0.1 \leq M/M_{\odot} \leq 1.5$*   
 2009, A&A, 496, 223D
  
10. **Di Criscienzo, M.**, Ventura, P., D'Antona, F., Marconi, M., Ruoppo, A., Ripepi, V.  
*Matching the frequency spectrum of pre-main sequence stars by means of standard and  
 rotating models*  
 2008, MNRAS, 389, 325D
  
11. Ripepi, V., Clementini, G., **Di Criscienzo, M.**, Greco, C., Dall'Ora, M., Federici, L.,  
 Di Fabrizio, L., Musella, I., Marcella, M., Baldacci, L., Maio, M.  
*On the remote Galactic Globular Cluster NGC2419*  
 2007, ApJLetter, 667, 61
  
12. Bono, G., Caputo, F., **Di Criscienzo, M.**  
*RR Lyrae stars in Galactic globular clusters. VI. The Period-Amplitude relation*  
 2007, A&A, 476, 779B
  
13. **Di Criscienzo, M.**; Caputo, F.; Marconi, M., Cassisi, S.  
*Synthetic properties of bright metal-poor variables. II BL Her stars*  
 2007, A&A, 471, 893
  
14. Marconi, M., **Di Criscienzo, M.**  
*Updated pulsational models of BL Herculis stars*  
 2007, A&A, 467, 223
  
15. Marconi, M., Cignoni, M., **Di Criscienzo, M.**; Castelli, F., Ripepi, V., Musella, I.,  
 Ruoppo, A.,  
*Predicted properties of RR Lyrae stars in the SDSS photometric system*  
 2006, MNRAS, 371, 1503
  
16. **Di Criscienzo, M.**; Marconi, M.; Musella, I.; Caputo, F.  
*RR Lyrae based calibration of Globular Cluster Luminosity Function*  
 2006, MNRAS, 365, 1357

17. **Di Criscienzo, M.**; Marconi, M.; Caputo, F.  
*RR Lyrae Stars in Galactic Globular Clusters. III. Pulsational Predictions for Metal Content  $Z=0.0001$  to  $Z=0.006$*   
2004, ApJ,612.
18. Ripepi, V.; Monelli, M.; dall’Ora, M.; Bono, G.; Corsi, C.; Caputo, F.; Pulone, L.; Testa, V.; Andreuzzi, G.; Buonanno, R., Marconi, G., Marconi, M., **Di Criscienzo, M.**, Storm, J., degl’Innocenti, S.  
*UBVI Time-series Photometry of the Old LMC Globular Cluster Reticulum*  
2004, CoAst, 145, 24
19. Marconi, M.; Caputo, F.; **Di Criscienzo, M.**; Castellani, M.  
*RR Lyrae Stars in Galactic Globular Clusters. II. A Theoretical Approach to Variables in M3*  
2003, ApJ, 596.

...waiting for the comment of the referee

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1. **Di Criscienzo, M.**, Greco, C., Dall’Ora, Ripepi, V., Clementini, G.,M., Federici, L., Di Fabrizio, L., Musella, I., Marcella, M., Baldacci, L., Maio, M.  
*Newly Discovered Variable stars in Globular Cluster NGC 2419*  
AJ, submitted



1. Di Criscienzo, M.  
The helium spread among the stars of 47Tuc  
2010,IAUS, 278,175
2. **Di Criscienzo, M.**; Caputo, F.; Marconi, M., Musella, I.  
RR Lyrae besed calibration of Globular Cluster Luminosity Function  
2009, gcgg.book, 213D (<http://adsabs.harvard.edu/abs/2009gcgg.book..213D>)
3. **Di Criscienzo, M.**; Caputo, F.; Marconi, M., Cassisi, S.  
*Theoretical models of BL Her stars*  
2008, MmSAI, 79, 713D (<http://adsabs.harvard.edu/abs/2008MmSAI..79..713D>)
4. **Di Criscienzo, M.**, Greco, C., Dall’Ora, Ripepi, V., Clementini, G.,M., Federici, L.,  
Di Fabrizio, L., Musella, I., Marcella, M., Baldacci, L., Maio, M.  
*NGC 2419:an “intergalactic wanderer” or a simple Galactic Globular Cluster?*  
2008MmSAI,79,710D (<http://adsabs.harvard.edu/abs/2008MmSAI..79..710D>)
5. Dall’Ora, M., Clementini, G., Kinemuchi, K., Ripepi, V., Marconi, M., **Di Criscienzo, M.**,  
di Fabrizio, L., Greco, C., Rodgers, C. T., Kuehn, C., Smith, H. A.  
RR Lyrae stars in the Bootes structure  
2007, IAUS, 241, 331 (<http://adsabs.harvard.edu/abs/2007IAUS..241..331D>)
6. **Di Criscienzo, M.**, Greco, C., Dall’Ora, M., Ripepi, V., Marconi, M., Musella, M.,  
Stetson, P.  
The NGC 2419 project: preliminary results on stellar variability  
2007, IAUS, 241, 243 (<http://adsabs.harvard.edu/abs/2007IAUS..241..243D>)
7. Ripepi, V., Greco, C, Clementini, G., **Di Criscienzo, M.** Dall’Ora, M. Federici, L.  
Musella, I.  
Variable population of Globular Cluster NGC 2419  
2007, ASPC, 374, 77R (<http://adsabs.harvard.edu/abs/2007ASPC..374...77R>)
8. **Di Criscienzo, M.**,Marconi, M. & Caputo, F.  
Pulsational Analysis of RR Lyrae Stars  
2006, ASPC, 349, 225 (<http://adsabs.harvard.edu/abs/2006ASPC..349..225D>)
9. **Di Criscienzo, M.**; Caputo, F.; Marconi, M., Musella, I.  
RR Lyrae besed calibration of Globular Cluster Luminosity Function  
2006, MmSAIT, 9, 238. (<http://adsabs.harvard.edu/abs/2006MSAIS...9..238D>)
10. Alcalá,J., Marconi, M., Ripepi, V., De Martino, D., Musella, I. e altri 10 coautori,  
The stellar VST-GTO surveys at INAF-OAC  
2006, MSAIS, 9,204 (<http://adsabs.harvard.edu/abs/2006MSAIS...9..204A>)
11. Ripepi, V., Marconi, M., Musella, I., Alcalá, J., Capaccioli, M., Cappellaro, E., Covino,  
E., Dall’ora, M., **Di Criscienzo, M.**, e altri 14 coautori,  
STEP-the SMC in TIME  
2006, MSAIS, 9,267(<http://adsabs.harvard.edu/abs/2006MSAIS...9..267R>)

12. Marconi, M., Musella, I., Ripepi, V., De Martino, D., Cappellaro, E., Cignoni, M., **Di Criscienzo, M.**, e altri 15 coautori,  
STREGA@VST: Structure and Evolution of the Galaxy  
2006, MSAIS,9, 253 (<http://adsabs.harvard.edu/abs/2006MSAIS...9..253M>)
13. **Di Criscienzo, M.**; Marconi, M.; Caputo, F.  
Pulsation models of RR Lyrae stars: dependence on the mixing-length parameter alpha  
2004, MmSAI, 75 (<http://adsabs.harvard.edu/abs/2004MmSAI..75..190D>)
14. **Di Criscenno, M.**; Marconi, M.; Caputo, F.  
Pulsational Constraints to the Distance to Globular Clusters  
2003, ASPC, 296 (<http://adsabs.harvard.edu/abs/2003ASPC..296..374D>)

My research interests cover a wide range of topic related to the structure and evolution of stars and stellar systems.

### 1) Evolutionary models and synthetic populations

Actually I have a post-doctoral fellowship at Rome Observatory in the framework of the interpretation of Multiple Populations in Globular Cluster. I'm analyzing in detail, through the computation of evolutionary models and synthetic populations, different Galactic Globular Clusters. The most recent results in this contest are summarized here:

*a) A detailed study of the main sequence of the Globular Cluster NGC 6397: can we derive constraints on the existence of multiple populations?* **Di Criscienzo , Ventura, D'Antona, 2009, accepted for publication in A&A** I have studied in detail the globular cluster NGC 6397 which contains a large fraction of "second generation" stars (>70% according to recent analysis), the helium abundance of its stars might also be affected, show some star-to-star variation, and be larger than the standard Big Bang abundance  $Y \sim 0.24$ . The main question is: can we derive constraints on this issue from the analysis of the main sequence width and from its luminosity function? I have build up new models for the turnoff masses and the main sequence down to the hydrogen burning minimum mass, adopting two versions of an updated equation of state (EOS) including the OPAL EOS. Models consider different initial helium and CNO abundances to cover the range of possible variations between the first and second generation stars. I have compared the models with the observational main sequence making also simulations of the theoretical luminosity functions, for different choices of the mass function and of the mixture of first and second generation stars, and compare them with the observed luminosity function, by means of the Kolmogorov Smirnov –KS– test. We have found that the study of the width of the main sequence at different interval of magnitude is consistent with the hypothesis that both generations are present in the cluster. If the CNO increase suggested by spectroscopic observation is taken into account the small helium spread of the main sequence in NGC 6397 implies a substantial helium uniformity ( $\Delta Y \sim 0.02$ ) between first and second generation stars. The possible spread in helium doubles if an even larger increase of CNO is considered. The luminosity function is in any case well consistent with the observed data.

*b) Helium Spread in the Globular Cluster 47 Tuc.* **Di Criscienzo, Ventura, D'Antona, Milone, Piotto, MNRAS, submitted** Several spectroscopic studies of 47 Tuc have shown chemical anomalies consisting mainly in strong CN band and Na-O anticorrelations for 50-70% of the investigated samples. Because these anomalies are found in stars also belonging to the Main Sequence, they suggest that a consistent second generation is present in 47 Tuc. Photometric data confirm the existence of multiple populations in this cluster. In particular the analysis of a large number of archival HST data of the cluster core shows a splitted Sub Giant Branch with at least two distinct components: a brighter one with a spread in magnitude and a second one, made of about 10% of stars, a little fainter (0.05 mag). We have explored the possibility that the CN strong stars all belong to a second generation, but that only a small part has an increase in total C+N+O, while the rest have helium abundance higher than primordial, being the different CN strength mainly due to the different Nitrogen abundance in the forming gas, CNO processed in stars of a first generation. I have base our analysis on the comparison of evolutionary and synthetic population models both with the Horizontal Branch and the Sub Giant Branch data of 47 Tuc. We find that the particular morphology of the Horizontal Branch of 47 Tuc can be explained only if a spread in helium abundance of 0.02 dex is taken into account. The same variation in helium is able to explain the spread in

luminosity of the Sub Giant Branch while a small part of the second generation is characterized by a small C+N+O increase and provides an explanation for the faint Sub Giant Branch.

*c) An interpretation of the recent data for the Sub Giant Branch and Main Sequence of NGC 6388* Di Criscienzo et al. 2010, in preparation This work is in progress. I'm actually computing models and synthetic population to give a plausible interpretation of the spread of the SGB of NGC6388 emerged by the most recent data.

## **2) Asteroseismology**

I'm involved in the construction of a theoretical framework for the interpretation of the present and future data on young intermediate mass pulsating stars. I have learned in last years the use of some linear adiabatic non-radial pulsation codes (Aarhus package and OSC37 in particular) to calculate frequencies of multiperiodic non radial pulsating stars in order to interpretate observed ones. In **Di Criscienzo et al. 2008 (MNRAS, 389)** I have applied the ATON evolutionary code to the computation of detailed grids of standard (non-rotating) and rotating pre-main sequence (PMS) models and computed their adiabatic oscillation spectra, with the aim of exploring the seismic properties of young stars. As, until now, only a few frequencies have been determined for ~40 PMS stars, the way of approaching the interpretation of the oscillations is not unique. A new method was build making use, when necessary, also of our rotating evolutionary code to compute the models for PMS stars. This method can be used to interpretate the observed spectra of delta scuti-type stars both from already available ground based observations and from the more accurate and extensive COROT and KEPLER ones. On this topic I'm a member of the KASC (Kepler Asteroseismic Science Consortium) team, and in particular involved in two WG (Working Group) one of which on Delta Scuti stars. This collaboration will permit in the next future to use (and eventually test) the proposed method on stars observed by Kepler.

## **3) Pulsation models of Population II stars**

The study of Population II variables in globular clusters and similar metal-poor field have a central role in my research. Radially pulsating stars, whether they are Population I or Population II stars, are of great relevance in several fields of modern astrophysics. In particular, RR Lyrae variables are widely used, via the calibration of their absolute visual magnitude  $M_V(RR)$  in terms of the iron-to-hydrogen content  $[Fe/H]$ , as standard candles for distance determination in the Local Group. On the other hand, since the absolute magnitude of the globular cluster main-sequence turnoff is a classical "clock" to estimate the age of these ancient stellar systems, one easily understands the relevance of an accurate RR Lyrae distance scale for cosmological studies. In particular, on the basis of updated nonlinear pulsation models including a nonlocal time-dependent treatment of convection, I have produced a new theoretical scenario for RR Lyrae stars with different chemical composition, typical of Galactic globular clusters ( $0.0001 < Z < 0.006$ ). All the computed models have been transformed both in the Johnson-Cousins and in the SDSS photometric bands, and relevant relations connecting pulsation observables, such as the period and the amplitude of the oscillation, to the intrinsic stellar parameters have been derived and applied to the Galactic Globular cluster samples. The dependence of theoretical predictions on the adopted efficiency of convection has also been investigated in detail. The same nonlinear convective code used for RR Lyrae stars has been extended to Population II Cepheids (BL Her and W Virg) and combined with an updated evolutionary scenario to obtain synthetic models of this class of stars, and in particular

pulsational relations providing distance estimates for those Galactic Globular Clusters which have a blu HB and a very small number of RR Lyrae. A comparison between the distances obtained for RR Lyrae and the ones for Population II stars has shown a good agreement and demonstrated the self consistency of the adopted theoretical scenario. All these results are contained in highly quoted papers as **Di Criscienzo et al. 2004 (ApJ, 612)**, **Marconi & Di Criscienzo, 2007 (A&A, 467)**, **Di Criscienzo et al. 2007 (A&A, 471)**, **Bono, Caputo, Di Criscienzo, 2007, (A&A, 476)**

#### **4) Calibration of the Globular Cluster Luminosity Function**

RR Lyrae also provide an independent test of the Cepheid distance scale for nearby galaxies (Magellanic Clouds, M31), as well as a calibration of secondary distance indicators (e.g., the globular cluster luminosity function, GCLF) in external galaxies, thus yielding relevant clues about the value of the Hubble constant. In **Di Criscienzo et al. 2006, (MNRAS, 365)** I have used various calibrations of the  $M_V(\text{RR})-[\text{Fe}/\text{H}]$  relations (including the theoretical one based on the above discussed pulsation models) and several globular cluster catalogues to calculate the turnover magnitude of the Galactic GCLF, the first step to use the GCLF distance indicator. The application to external galaxies has shown that the turnover magnitude of metal poor clusters in external galaxies is in excellent agreement with the value of both Galactic and M31 ones, as inferred by an RR Lyrae distance scale referenced to the same LMC fiducial distance.

#### **5) Data analysis and interpretation of the RR Lyrae in NGC2419**

I have studied the stellar variability of the GC NGC2419 from the observational point of view. NGC2419 is one of the most interesting and still poorly studied Galactic globular cluster. It is probably the stripped core of a dwarf satellite of the Milky Way. I have studied the cluster stellar content in the context of a large project that involves different researchers around the world. I have performed the photometric reduction of VI time-series data of NGC2419 obtained with the SuprimeCam@SUBARU and have worked on the variability search by combining my dataset with TNG and HST data, in order to have a better sampling of the light curves. Up to now about 40 new RR Lyrae stars have been discovered, thus almost doubling the number of RR Lyrae stars known so far in the cluster. The present dataset and the comparison with the theoretical scenario will allow us to test the possible existence of a tidal stream around the cluster. All these results are listed and described in **Ripepi et al. 2007 (ApJ Letter, 667)** and **Di Criscienzo et al. 2010, (AJ, in preparation)**.