

Innocenza Busà

C U R R I C U L U M

2007

Curriculum Vitae

Name: Innocenza Busà

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Academic Titles: Diploma di Maturità scientifica
Diploma di Laurea in Fisica (Astrophysics Section)
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1 Curriculum

1995: I get the degree in Physics 'summa cum laude' after defending a thesis entitled "Study of the Chromospheric Activity in the Binary System HR 1099 by UV Spectroscopy";

February 2000: I get the PhD Diploma defending a thesis entitled "Semi-empirical NLTE models of the chromosphere of the binary system V 711 Tau".

March 2000 - May 2001: I work as a fellow at the Astronomical Observatory of Napoli.

June 2001: Post-doc Fellow at the University of Hamburg (Hamburger Sternwarte).

Present position (Sep 2001): Researcher at the Astrophysical Observatory of Catania Italy.

2 Educational Background in Astrophysics:

I attended the following Astrophysics courses at Institute of Astronomy of the University of Catania:

- 1) Astronomy
- 2) Solar Physics
- 3) Radio Astronomy
- 4) Space Physics

All courses required a final exam, which I passed with full marks.

3 Research fields

I have worked on the study of the 3-D structure and dynamics of magnetic signatures in the atmospheres of cool stars. I have used Doppler Imaging Technique on IUE IUESIPS and NEWSIPS high resolution spectra; the analysis implies IDL and FORTRAN software development. From these studies I have found that the controversial physical conditions that generate the broad wings of chromospheric and TR lines of many active stars, can be ascribed to localized regions rather than to the whole star (see, e.g., Busà et al. 1999).

In order to correlate stellar activity and global stellar parameters, depending on the inner structure of the stars, during my PhD studies I began to work on semi-empirical NLTE modeling of active stars. The main steps have been:

- 1) Semiempirical-models: the method and the effect of the assumptions.
- 2) ADAS (Atomic Data and Analysis Structure) to calculate the EM from the emitted flux.
- 3) Emission Measure: developing IDL-FORTRAN77 (UNIX) software to introduce the turbulent pressure in the total pressure gradient calculating.
- 4) Construction of constrained atmospheric models of active binary systems (constraints: photospheric and transition region CM-T) (UNIX-IDL).
- 5) Use of the MULTI code (Carlsson, 1986) to solve level populations of the H, Mg, C, Si, Ca, Na atomic models and comparison with observations.

In my PhD thesis I used the diagnostic power of $H\alpha$ and Mg II h resonance lines to explore the nature of the broad and narrow components detected in the chromospheric emission of the RSCVn-type binary system V 711 Tau. $H\alpha$ and Mg II lines, such as many strong spectral lines in the visible and near UV spectrum play, infact, an unique role in the study of the chromospheric structure being very efficient diagnostics of the chromospheric physical conditions in cool stars as shown by several authors. In particular I performed an extensive semi-empirical modeling of $H\alpha$ and Mg II h lines by means of NLTE radiative transfer calculations. Use is made of the transition region emission measure to constrain the upper chromosphere structure of the models.

During my PhD studies I have worked independently.

Since 1995 I have occasionally been teaching general Astronomy and general Physics to undergraduate students.

I have had also the opportunity to participate in collaborative projects inside the stellar-activity research group at the Catania's Astrophysical Observatory. I am currently involved in the "World Space Observatory" WSO/UV project.

During my fellowship at the Astronomical Observatory of Naples I have extensively worked on the study of the chromosphere-diagnostic power of infrared lines such as the triplet lines of ionized calcium, the Na I and the KI resonance

lines and on the NLTE treatment of UV line-blanketing in cool stars. This work implies the development of atomic models, modification of the NLTE radiative transfer code MULTI and the development of IDL and FORTRAN procedures.

I also have data reduction and manipulation experience in these areas:

- Reduction of CCD EFOSC spectra using MIDAS reduction facility.
- Use of the interactive data handling language IDL for data visualization, including 3D plotting and images and spectra analysis, including the IUERDAF extension for IUE data reduction. I have also developed an extensive library of my own IDL routines.

4 Schools and Meetings:

- JENAM 95, Joint European & National Astronomy Meetings "Progress in European Astrophysics", Catania (Italy), September 1995.
- Scuola Nazionale di Astrofisica, Acireale (CT - Italy), May 1997.
- Summer School "MHD waves and turbulence in Solar and laboratory plasmas", Königs-Wusterhausen (Berlin), September 1997.
- Summer School "Dynamical MHD Phenomena in Solar and Astrophysical Plasmas", Heraklion, Crete (Greece), July 1998.
- EUROCONFERENCE "Stellar Cluster and Associations: Convection, Rotation and Dynamos", Palermo (Italy), May 1999.
- Summer School "Radiative Transfer and Radiation Hydrodynamics", Oslo (Norway), June 1999.
- Scuola Nazionale di Tecnologie Astronomiche, Napoli (Italy), September 2000.
- IAU Symposium No. 210: "Modeling of stellar atmospheres", 17-21 June 2002, Uppsala, Sweden
- XLIX Congresso della Societa Astronomica Italiana, 2-7 May 2005, Catania, Italy
- IAU Symposium 227 "Massive Star Birth: A Crossroads of Astrophysics", May 16-20 2005, Acireale, Italy
- 10th RVS workshop - September 15-16 2005, Cambridge, UK
- XCI Congresso Nazionale Società Italiana di Fisica, Catania, 26 Sep - 1 Oct 2005

- International Conference on “Ettore Majorana’s legacy and the physics of the XXI century, 5-6 Oct 2006, Catania, Italy Workshop
- La figura di Marcello Rodonó nella ricerca Astrofisica, 23-24 Ottobre 2006, Catania, Italy
- CATANIA WORKSHOP ON NUCLEAR AND NEUTRINO ASTROPHYSICS, 16-17 Febbraio 2007, Catania, Italy
- 51 Congresso Nazionale Società Astronomica Italiana, 17-20 Apr 2007, Firenze, Italy Workshop ”Acquisizione ed elaborazione di immagini scientifiche in IDL ed ENVI”, 9 May 2007, Catania

5 Publications

5.1 Refereed Publications

References

- [Catanzaro et al.(2008)] Catanzaro, G., Leone, F., Busà, I., Romano, P. 2008. Spectroscopy of the hot pulsating star β Cephei. Velocities and EWs from C, N, O and Si lines. *New Astronomy* 13, 113-117.
- [Busà et al.(2007)] Busà, I., Aznar Cuadrado, R., Terranegra, L., Andretta, V., Gomez, M. T. 2007. The Ca II infrared triplet as a stellar activity diagnostic. II. Test and calibration with high resolution observations. *Astronomy and Astrophysics* 466, 1089-1098.
- [Andretta et al.(2005)] Andretta, V., Busà, I., Gomez, M. T., Terranegra, L. 2005. The Ca II Infrared Triplet as a stellar activity diagnostic . I. Non-LTE photospheric profiles and definition of the R_{IRT} indicator. *Astronomy and Astrophysics* 430, 669-677.
- [Busà et al.(2001)] Busà, I., Andretta, V., Gomez, M. T., Terranegra, L. 2001. A method to estimate the effect of line blanketing in NLTE radiative transfer calculations. *Astronomy and Astrophysics* 373, 993-997.
- [Lanzafame et al.(2000)] Lanzafame, A. C., Busà, I., Rodonò, M. 2000. Chromospheric two-component NLTE modelling of the binary system V 711 Tau = HR 1099. *Astronomy and Astrophysics* 362, 683-690.
- [Busà et al.(1999)] Busà, I., Pagano, I., Rodonò, M., Neff, J. E., Lanzafame, A. C. 1999. Chromospheric imaging of the active binary system V 711 Tauri = HR 1099 in December 1992. *Astronomy and Astrophysics* 350, 571-581.

5.2 Contributed Papers

References

- [Lanza et al.(2007)] Lanza, A. F., Bonomo, A. S., Cutispoto, G., Busà, I., Lanzafame, A. C., Messina, S., Pagano, I., Strassmeier, K. G. 2007. Solar-Like Activity and Planetary Transits. EAS Publications Series 25, 161-164.
- [Distefano et al.(2007)] Distefano, E., Messina, S., Cutispoto, G., Parihar, P. S., Comparato, M., Busà, I., Lanza, A. F., Lanzafame, A. C., Pagano, I., Strassmeier, K. G. 2007. ARCO: a program for Automatic Reduction of CCD Observations. EAS Publications Series 25, 165-169.
- [Busà et al.(2006)] Busà, I., Andretta, V., Gomez, M. T., Terranegra, L., Aznar Cuadrado, R. 2006. SARG observations of 40 stars with different activity level: test for the R- $\{IRT\}$ chromospheric activity indicator .. Memorie della Societa Astronomica Italiana Supplement 9, 229.
- [Busà et al.(2003)] Busà, I., Andretta, V., Gomez, M. T., Terranegra, L. 2003. A Non-LTE Analysis of the Ca II Infrared Triplet as a Diagnostic Tool in Solar-type Stars. The Future of Cool-Star Astrophysics: 12th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (2001 July 30 - August 3), eds. A. Brown, G.M. Harper, and T.R. Ayres, (University of Colorado), 2003, p. 1134-1139. 12, 1134-1139.
- [Pagano et al.(2003)] Pagano, I., and 26 colleagues 2003. The World Space Observatory Project WSO/UV. Memorie della Societa Astronomica Italiana Supplement 3, 327.
- [Lanzafame et al.(2003)] Lanzafame, A. C., Busà, I., Rodonò, M. 2003. Chromospheric Two-Component NLTE Modelling of RS CVn Systems. Modelling of Stellar Atmospheres 210, 8P.
- [Ragaini et al.(2003)] Ragaini, S., Andretta, V., Gomez, M. T., Terranegra, L., Busà, I., Pagano, I. GAIA spectroscopy of active solar-type stars. ASP Conf. Ser. Vol 298, p.461, 2003
- [Busà et al.(2003)] Busà, I., Pagano, I., Rodonò, M., Gomez, M. T., Andretta, V., Terranegra, L. NLTE line-blanketed CaII calculations for evaluation of GAIA spectroscopic performances. ASP Conf. Ser., Vol 298, p. 403, 2003
- [[Pagano et al.(2003)] I. Pagano, I. Busà, G. Cutispoto, A. F. Lanza, A. C. Lanzafame, G. Leto, S. Messina, I. Ribas, M. Rodonò, R. Ventura Dicembre 2003, Looking for nano-flares and stellar micro-variability as mechanisms for coronal heating in COROT Week N.5, Berlin, http://berlinadmin.dlr.de/Missions/corot/cw5/contributions/pagano_et_al_1.pdf
- [Pagano et al.(2002)] I. Pagano, I. Busà, S. Catalano, G. Cutispoto, A. Frasca, A. F. Lanza, E. Marilli, S. Messina, M. Rodonò, Dicembre 2002, Flare, microflares and rotational modulation in late dwarfs and RS CVn system in

COROT Week N.3, Liege,

http://www.astro.ulg.ac.be/orientation/asterosis/week3/texte/apwg_pagano.PDF.gz

- [Andretta et al.(2002)] V. Andretta, I. Busà, M. T. Gomez, S. Ragaini, L.Terranegra Semi-empirical chromospheric models of late-type stars in "Modelling of Stellar Atmospheres: IAU 210th Symposium, Uppsala, Sweden, 17-21 June, 2002.
- [Rodonò et al.(2002)] M. Rodonò, I. Busà, G. Marino, I. Pagano, R. U. Claudi, R. Gratton, S. Desisera, G. Bonanno, R. Cosentino, S. Scuderi, High Resolution Observations of HR 1099 with SARG at TNG in "JENAM 2001 International Scientific Conference, Monaco, Germania, 10-15 Settembre, 2001.
- [Busà et al.(2001)] Busà, I., Lanzafame, A. C., Rodonò, M. 2001. Chromospheric NLTE Modelling of the Active Binary System V 711 Tau Using Doppler Imaging Constraints (CD-ROM Directory: contribs/busa). 11th Cambridge Workshop on Cool Stars, Stellar Systems and the Sun 223, 1213.
- [Busà et al.(2000)] Busà, I., Rodonò, M., Pagano, I., Neff, J. E. 2000. Chromospheric imaging of the active binary system V711 Tau = HR 1099. Stellar Clusters and Associations: Convection, Rotation, and Dynamos 198, 435.
- [Busa et al.(1996)] Busa, I., Pagano, I., Rodono, M., Neff, J. E. 1996. Spectral imaging of the HR 1099 chromosphere in December 1992. Cool Stars, Stellar Systems, and the Sun 109, 641.

5.3 Other Publications

-) Busà I., Palumbo M.E., Scuderi S. (Eds.), INAF-OAC, Annual Report 2004, <http://woac.ct.astro.it/report/rep2004/oacrep04/index.html>
-) Busà, I., Andretta, V., Gomez, M. T., Terranegra, L., 2001, Coolnews, n.54 June 2001
-) Lanzafame A.C., Busà, I., Rodonò, M., 2000, Coolnews, n.54 July 2000
-) Busà, I., Semi-empirical NLTE chromospheric models of the binary system V 711 Tau = HR 1099, Coolnews, n.51 April 2000
-) Busà, I., Pagano, I., Rodonò, M., Neff, J.E., Lanzafame A.C., 1999, Coolnews, n.47 November 1999

5.4 Oral Contributions

-) *Semi-empirical NLTE modelling of stellar atmospheres using Doppler Imaging constraints* at the Hamburger Sternwarte (GERMANY) January 2001
-) *Semiempirical NLTE chromospheric modelling of the binary system V711 Tau* at the Astrophysical Observatory of Catania (ITALY) January 2000
-) *Chromospheric Imaging of the binary RSCVn system V711 Tau* at the Summer School "Dynamical MHD Phenomena in Solar and Astrophysical Plasmas", Heraklion, Crete (Greece), July 1998

-) *Sviluppi recenti sulle diagnostiche cromosferiche* at the Workshop La figura di Marcello Rodon nella ricerca Astrofisica Catania, 23-24 Ottobre 2006,
<http://www.oact.inaf.it/gass/meeting/ppt/innocenza.busa.ppt>

6 Observing Experiences

1. SARG, *Study of a new index of chromospheric activity in late-type stars, R_{IRT} , from the CaII infrared triplet*
Principal Investigator (AOT5 6 04 081) Febbraio 2002
 2. SARG, *Using starspots as tracers of stellar differential rotation*
Co-Investigator (AOT8 TAC 88) Agosto 2003
 3. SARG, *Investigating magnetic activity induced by star-planet interaction*
Co-Investigator (AOT13 TAC 59) 2006
-) MSSO 2.3 m telescope (Australia)
Five nights 7-11 Sep 2001
DBS Spectroscopy
 -) Asiago 1.8 m telescope Padova (Italy)
Five nights 7-11 Nov 2000
Echelle Spectroscopy
 -) Loiano 1.5 m telescope Bologna (Italy)
Six nights 20-25 Oct 2000
Echelle Spectroscopy