

# *Curriculum Vitae*

## Michele Cantiello

### *Personal data*

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Position: Post-doctoral Research Associate at the INAF- Osservatorio Astronomico di Teramo  
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### *Education*

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- ✓ PhD in Physics, Università degli Studi di Salerno, Italy November 2001- October 2004.  
Thesis entitled: “*The Surface Brightness Fluctuations method: Models and Observations*”. Advisors: Prof. Enzo Brocato, Prof. Salvatore Capozziello. In collaboration with the INAF-Osservatorio Astronomico di Teramo, and The Johns Hopkins University (Baltimore, US)
- ✓ *Laurea* degree in Physics Università degli Studi “Federico II” di Napoli, Italy: October 1994 - July 2001. Graduated with top score 110/110 *summa cum laude*.  
Thesis title: “*The Surface Brightness Fluctuations method: a distance indicator and a tracer of stellar populations properties*” (in Italian). Advisors: Prof. Massimo Capaccioli, Dr. Enzo Brocato

### *Employment History*

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Since July 2007: Post-doc Research Associate at the INAF-Osservatorio Astronomico di Teramo (OATe)  
July 2006 - June 2007: Post-doc Research Associate at the Washington State University (Pullman, WA, US)  
March 2005 - June 2006: Post-doc Research Associate at the INAF OATe  
2001 - 2004: PhD student  
2001 - 2002: Post-*lauream* grant at the OATe  
2000 - 2001: Pre-*lauream* grant at the INAF-Osservatorio Astronomico di Capodimonte-Napoli

### *Professional Activities*

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- ✓ *Teaching experiences*  
2001-2004 Member of the commission for Physics examinations at the Engineering department (University of Salerno); 2001-2004 Seminars and classes with general Astrophysical interest at the Engineering department (University of Salerno); 2001-2003 Member of the examining commission of the “*Astrophysics and Space Science Laboratory*” class at the Department of Physics (Università dell'Aquila); 2003-2004 Member of the examining commission for the Master in Astronomy held at the OATe and Università di Teramo; Since 2000 Member of the staff at the OATe for public outreach activities (school visits, nightly visits to the Observatory, etc.); Co-supervising various *Laurea* degree thesis.
- ✓ *HST programs*  
During cycle-14 of HST I was the P.I. an HST Archival Research program with title: *Measurements of Surface Brightness Fluctuations in Normal and Peculiar Early-type*. The project was awarded ~100.000 US\$ by NASA (Program ID #AR-10642; administrative P.I. J. Blakeslee);
- ✓ *Observational/telescope experiences*  
2006: CTIO proposal with title: Calibration of the Surface Brightness Fluctuation Method for Young and Intermediate Age Stellar Populations (P.I: Walker Alistair); 2002: Roque de Los Muchachos, Santa Cruz de La Palma, Spain. Optical and near-IR observations of the galaxies NGC6869 e NGC6951, at the 4m-class telescope Telescopio Nazionale Galileo (P.I. Brocato Enzo); Since 2001: Member of the staff at the 70cm Teramo-Normale-Telescope at the OATe, with various optical observations of Supernovae, and search of GRBs optical counterparts.

### *Current research interests*

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My research interest is the study of the properties of stars in distant star clusters and galaxies.

In past few years I have been working on the *Surface Brightness Fluctuations* (SBF) method, and how SBF can help to study unresolved stellar populations. The SBF method was introduced to measure distances of ellipticals up to ~20 Mpc. Today SBF applications cover a wider range of astronomical objects, and reach distances up to ~150 Mpc. Moreover, SBF magnitudes are used to carry on detailed analysis of the evolutionary properties of stars in unresolved stellar systems. I've been interested to both the observational and theoretical aspects of SBF, either as a distance indicator, or as a stellar population tracer.

On the observational side, I have developed a data analysis technique to measure the radial SBF-gradients in normal ellipticals. This pipeline has been successfully applied to detect SBF-gradients in several galaxies observed with ACS@HST. In particular, I showed that SBF-gradients can be used to refine the accuracy of SBF-based distances (via a *sliding* technique), and provide a new piece of

information on the radial variations of stellar population properties in the galaxy. Furthermore, I have derived SBF magnitudes in different optical bands for ~20 galaxies, analysing the distance and the stellar population contents of the host stellar system. More recently, analyzing imaging data of 4 distant ellipticals (average  $cz \sim 6000$  Km/s), the farthest *optical* SBF measurement for a galaxy has been obtained. Coupling these data with theoretical calibration (SPoT models), the distance of the galaxies has been derived and, with them, an estimation of the Hubble parameter, obtaining  $H_0 \sim 76$  Km/s/Mpc.

On the theoretical side, together with the Teramo-Spot group, I have worked to define a technique to model SBF magnitudes with detail, based on the method of the stellar population synthesis. With these simulations we obtained detailed predictions for SBF and integrated colours of unresolved stellar systems. One of the main properties of the SPoT synthesis code is that it allows scrutinizing SBF and colours under various assumptions of the characteristics of the stellar system: IMF, mass-loss, properties of stars in bright/fast evolutionary stages (hot-HBs, TP-AGBs, Post-AGBs...), etc. Taking advantage of this property we have carried on an extensive study on the sensitivity of SBF magnitudes and SBF-colours to changes of the stellar population system.

More recently, I've been working on extragalactic star cluster systems, both Globular Clusters Systems (GCS), and Young Massive Clusters. Since star clusters are, in first approximation, simple stellar populations (i.e., single age single metallicity stellar systems) they provide the ideal target for stellar population studies, being unaffected by the additional problem arising from the coexistence of stellar populations with different ages and metallicities. As a consequence the analysis of the star cluster system in galaxies is a very powerful tool to study the history of star formation and evolution of the host galaxy. I have studied the properties of the GCS in the lenticular NGC5866 using B, V and R band data, analysing the photometric and structural properties of the GCS. A similar study has been carried out for the star clusters system in the late-type spiral NGC3370, based on ACS B, V and I-band images. Both these studies have been carried out taking advantage of the SPoT code to simulate Simple Stellar Populations (SSP) with different age, mass and metallicity, so to constrain the properties of the star cluster system from data/models comparisons.

I've used SPoT SSP models also to carry on numerical experiments on GCS, in order to study the link between colour bimodality and metallicity bimodality in GCS. These experiments - together with existing observational evidences - have proved that the presence of a bimodal colour distribution, typically observed in spheroidal galaxies, does not necessarily imply the presence in the galaxy of two distinct GC subpopulations with different epochs or mechanisms of formation. In fact, detailed analysis of colour-metallicity relations have shown that unimodal metallicity distributions can be *projected* into bimodal colour distributions due to the non-linearity of these relations.

### ***Keywords and ongoing research***

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*Keywords:* Galactic and extra-galactic distance scale - Surface Brightness Fluctuations - elliptical galaxies - stellar population synthesis - globular clusters systems - star clusters - stellar evolution - galactic evolution

### ***Ongoing Projects & Collaborations***

Analysis of Photometric and spatial properties of the Star Clusters in NGC3370, based on ACS B-, V- and I-band images - with J. Blakeslee (HIA, Victoria, Canada), E. Brocato (INAF-OATe, Italy); Stellar population study using multi-wavelength SBF measurements, and near-IR SBF gradients - J. Blakeslee, E. Brocato, G. Raimondo (INAF-OATe, Italy), I. Biscardi (INAF-OATe, Italy), M. Hempel (Univ. of Florida, US); Modelling stellar population properties including late stars at bright and fast evolutionary stages (Hot-HBs, TP-AGBs, etc.): effects and predictions using SBF magnitudes from UV to near-IR bands - G. Raimondo, E. Brocato; A synoptic study of Globular Clusters, galaxy colours, and SBF gradients in Virgo galaxies - S. Mei (Obs. Paris Meudon, Paris, France); Optical and near-IR CMD and SBF analysis of Magellanic Cloud star clusters - G. Raimondo, A. Walker (CTIO), E. Brocato; Calibrating SNeIa with near-IR SBF - I. Biscardi, E. Brocato, G. Raimondo.

### ***Other professional activities***

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Peer review referee for "The Astronomical Journal", "Monthly Notices of the RAS"

2009: Co-editor of the proceedings of the LII Meeting of the Italian Astronomical Society, published by the "Memorie della Società Astronomica Italiana" (Vol. 80);

2008: Member of the Local Organizing Committee for the LII Meeting SAIT held in Teramo;

Since 2005: Development and maintenance of the web site of the Teramo Stellar-Populations-Tools group (Teramo-SPOT [www.oa-teramo.inaf.it/spot](http://www.oa-teramo.inaf.it/spot))

### ***List of Refereed Publications***

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1. Blakeslee, J.P., Cantiello, M., Peng, E. 2010, ApJ, 710, 51 – “*The Mass-Metallicity Relation of Globular Clusters in the Context of Nonlinear Color-metallicity Relations*”
2. Cantiello, M., Brocato, E., Blakeslee, J.P. 2009, A&A, 503, 87 – “*The star cluster population of the spiral galaxy NGC 3370*”
3. Biscardi, I., Raimondo, G. Cantiello, M., Brocato, E. 2008, AJ, 678, 168 – “*Optical Surface Brightness Fluctuations of Shell Galaxies toward 100 Mpc*”
4. Cantiello, M., Blakeslee, J.P. 2007, ApJ, 669, 982 – “*On the Metallicity-Colour Relations and Bimodal Colour Distributions in Extragalactic Globular Cluster Systems*”
5. Cantiello, M., Blakeslee, J.P., Raimondo G., Brocato, E., Capaccioli, M. 2007, ApJ, 668, 209 - “*The Globular Cluster System in NGC5866: Optical Observations from the HST Advanced Camera for Surveys*”
6. Cantiello, M., Blakeslee, J.P., Raimondo G., Brocato, E., Capaccioli, M. 2007, ApJ, 668, 130 - “*Surface Brightness Fluctuations from Archival ACS Images: A Stellar Population and Distance Study*”

7. Cantiello, M., Blakeslee, J.P., Raimondo G., Brocato, E., Capaccioli, M. 2007, ApJ, 662, 940 - “*Detection of SBF in Elliptical Galaxies imaged with the Advanced Camera for Surveys. B- and I-band measurements*”
8. Cantiello, M., Blakeslee, J.P., Raimondo G., Mei, S., Brocato, E., Capaccioli, M. 2005, ApJ, 634, 239 - “*Detection of Radial SBF gradients with the Advanced Camera for Surveys*”
9. Raimondo, G., Brocato, E., Cantiello, M., Capaccioli, M., 2005, AJ, 130, 2625 - “*Optical and Near-Infrared Surface Brightness Fluctuations. II. Models of young and intermediate age stellar populations*”
10. Cantiello, M. 2004, PhD thesis Univ. degli studi di Salerno, “*The SBF method: Models and Observations*”
11. Cardone, V., Cantiello, M. 2003, A&A, 405, 125 - “*Pixel lensing observations towards globular clusters*”
12. Cantiello, M., Raimondo, G., Brocato, E., Capaccioli, M. 2003, AJ, 125, 2783 - “*New Optical and Near-Infrared SBF. A primary distance indicator ranging from globular clusters to distant galaxies?*”

### ***Non-refereed publications***

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1. Biscardi, I.; Raimondo, G.; Cantiello, M.; Brocato, E. - “*Optical SBFs of distant shell galaxies*”. Proceedings of the International Conference. AIP Conference Proceedings, Volume 1111, pp. 233-234 (2009)
2. Cantiello, M.; Brocato, E. ; Raimondo, G. - “*Disentangling  $t$  &  $Z$  in distant unresolved stellar systems*”. Proceedings of the International Conference. AIP Conference Proceedings, Volume 1111, pp. 35-38 (2009).
3. Cantiello, M.; Raimondo, G.; Brocato, E.; Biscardi, I. - “*Distances and Stellar Population properties using the SBF method*”. Proceedings of the 52° Conference of the Italian Astronomical Society, held 05-09 May 2008 in Teramo. Edited by M. Cantiello, S. Cristallo, G. Di Rico, A. Pietrinferni, G. Ramondo
4. Biscardi, I.; Raimondo, G.; Cantiello, M.; Brocato, E. - “*Optical SBFs of shell galaxies*”. Proceedings of the 52° Conference of the Italian Astronomical Society, held 05-09 May 2008 in Teramo. Edited by M. Cantiello, S. Cristallo, G. Di Rico, A. Pietrinferni, G. Raimondo
5. Cantiello, M.; Raimondo, G.; Brocato, E.; Blakeslee, J. P.; Capaccioli, M. - “*Simulating CCD Images of Elliptical Galaxies*”. Proceedings of the conference “From Stars to Galaxies: Building the Pieces to Build Up the Universe”. ASP Conference Series, Vol. 374, held 16-20 October 2006 at Venice, Italy. Edited by Antonella Vallenari, Rosaria Tantalò, Laura Portinari, and Alessia Moretti., p.403
6. Cantiello, M.; Raimondo, G.; Blakeslee, J. P.; Brocato, E.; Capaccioli, M. - “*SBF: Multi-Wavelength Data and Models*”. Proceedings of the conference “From Stars to Galaxies: Building the Pieces to Build Up the Universe”. ASP Conference Series, Vol. 374, held 16-20 October 2006 at Venice, Italy. Edited by Antonella Vallenari, Rosaria Tantalò, Laura Portinari, and Alessia Moretti., p.401
7. Raimondo, G.; Cantiello, M.; Brocato, E.; Blakeslee, J.; Capaccioli, M. - “*Tracing stellar populations of galaxies with the SBF method*”. Stellar Populations as Building Blocks of Galaxies, Proc. of IAU Symp. #241. Edited by A. Vazdekis & R. Peletier. Cambridge: Cambridge University Press, 2007, pp.199-200
8. Cantiello, Michele; Blakeslee, J. P.; Raimondo, G.; Brocato, E.; Capaccioli, M. - “*Surface Brightness Fluctuations From Archival ACS Images: A Stellar Population And Distance Study*”. American Astronomical Society Meeting 210, #81.07; Bulletin of the American Astronomical Society, Vol. 38, p.326
9. Cantiello, M.; Blakeslee, J.; Raimondo, G.; Mei, S.; Brocato, E.; Capaccioli, M. - “*SBF Gradients of E-galaxies detected with ACS*”. Memorie della Societa Astronomica Italiana Supplement, v.9, p.305 (2006)
10. Ripepi, V., et al. - “*STEP - the SMC in Time: Evolution of a Prototype interacting dwarf galaxy*”. Memorie della Societa Astronomica Italiana Supplement, v.9, p.267 (2006)
11. Raimondo, G.; Brocato, E.; Cantiello, M.; Capaccioli, M. - “*Investigating Resolved Stellar Populations with SBF*”. Memorie della Societa Astronomica Italiana Supplement, v.9, p.265 (2006)
12. Raimondo, G.; Cantiello, M.; Brocato, E.; Capaccioli, M. - “*Surface Brightness Fluctuations: a powerful tool for investigating unresolved stellar populations*”. Memorie della Soc. Astr. Italiana, v.75, p.198 (2004)
13. Cantiello, M.; Dolci, M.; Maiorano, E.; Masetti, N.; Palazzi, E.; Brocato, E. - “*GRB030329: optical observations at Teramo*”. GRB Coordinates Network, 2074, 1 (2003)
14. Cantiello, M.; Raimondo, G.; Brocato, E.; Capaccioli, M. - “*Surface Brightness Fluctuations: a Theoretical Point of View*”. New Horizons in Globular Cluster Astronomy, ASP Conference Proceedings, Vol. 296, held 24-28 June 2002 at Dipartimento di Astronomia, Universita' di Padova, Padova, Italy. Edited by Giampaolo Piotto, Georges Meylan, S. George Djorgovski and Marco Riello. ISBN: 1-58381-143-5, 2003, p.369

### ***Seminars and talks***

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1. “Analyzing the properties of unresolved stellar populations”, 23 May 2010, INAF-Oss. Astr. di Napoli;
2. “In pursuit of the true origin of bimodal colour distributions in globular cluster systems”, 5 May 2010, LIV Meeting of the Italian Astronomical Society SAIIt, held in Naples, Italy;
3. “Unveiling the properties of distant stellar populations”, 14 Oct. 2009, University of Utrecht, Holland;
4. “SBF: a tracer of stellar populations in galaxies”, 5 May 2008, LII Meeting SAIIt, held in Teramo;
5. During PhD: several seminars and talks as the Observatory of Teramo and University of Salerno regarding stellar population studies