

CURRICULUM VITAE OF ANGELA BRACCO

Personal data

Angela Bracco
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Education

Laurea (Master) in Physics (1979, Università degli Studi di Milano)
Ph.D. in Physics (1983, Canada, TRIUMF laboratory at UBC and U.of.
Manitoba)

Current academic position

Full professor of Physics (Experimental Physics) at the University of Milano (since 2002).
Previously assistant (from 1983) and associate (from 1998) professor in Milano.

Teaching Activity

1983-1998 General Physics - Electromagnetism and optics
for Physics students
1992-1994 "Experimental techniques in gamma spectroscopy"
Course for Graduate School
2000-2001 General Physics - Electromagnetism and optics
for Chemistry students
1994-present Laboratory of gamma spectroscopy
for Physics students
2004-present Introductory Nuclear and Particle physics

2003-present Member of the board of Graduate School in Physics
2002-present Responsible of the second level degree with specialization in Nuclear Physics

Supervisor for undergraduate theses for the first level degree : 20 theses
Supervisor for undergraduate theses for the second level degree : 30 theses
Supervisor for graduate theses (Ph.D): 12 theses

Member and chair of several committees for Ph. D graduation in Milano
and in other Universities in Italy and abroad.

Research Topics

Most of the activity in experimental Nuclear Physics, in particular nuclear structure studied with gamma spectroscopy. Developments of detection systems for large arrays employed for gamma spectroscopy using heavy ion reactions from few MeV/A to 600 MeV/A. Research conducted at the LNL laboratory and in several laboratories abroad (see below the short description of the reaserach activity). Developments of analysis techniques to study the spectroscopy in the continuum, in particular giant resonances for nuclear structure at finite temperature.

Experience in Managing Research Funding

- Chair of the Nuclear Physics Board of INFN (CSN3) from April 2005 to September 2011- This responsibility position implied extensive work to organize the funding of many different projects in Nuclear Physics in the Italian laboratories LNL, LNS (and partly in LNGS and LNF), at CERN, and at several foreigner laboratories such as GSI, GANIL, JLAB, and few others. The activity included also the preparation of road map and triennial plans, annual reports of the results and future planning to be presented to the international evaluation committee of INFN.
- Member of the governing board of NupNet (ERANET for Nuclear Physics financed within the FP7) and responsible of one working package -from 2008-2011. I particular I had to prepare a list of projects to be funded jointly by several funding agencies in Europe. The members of NuPNET were the

Current Responsibilities and participation in Scientific committees of Laboratories and Institutes

- Chair of NuPECC - the nuclear Physics expert committee of the European Science Foundation from January 2012.
- MIUR (Ministry of Research and University) representative member in the *Board of directors of INFN* (from August 2011)
- Member of the Physics Expert Panel for the evaluation of the Italian Research (ANVUR agency of MIUR) from 2011 up to December 2012.
- Member of the Scientific Committee of French Institute IN2P3(CNRS Institute for Nuclear, Particle and astroparticle Physics)(2011-) and member of the Scientific Committee of Nuclear Physics Institute at Orsay (IPNO) (2012-)
- Member of the Scientific Committee of the German Laboratory GSI (Darmstadt, Germany) (2009-) and of the Scientific Committee of the center of the Helmholtz Institute at Mainz (Germany) for Nuclear Physics (2009-)
- Member of the Scientific Committee of Nishina Center at the research institute RIKEN (Tokyo, Japan) (from 2008-2012)
- Chair of the International Scientific Committee of the project HE-ISOLDE at CERN (2011-)

Past Responsibilities and participation in Scientific committees of Laboratories, Institutes and Funding agencies

- Member of the 'Working Group of OECD (Global Science Forum Organization for Economic Cooperation and development) on Nuclear Physics (2006-2007)
- Member of the Scientific Committee of the laboratory GANIL (France (from 2007-2010)
- Member of the Scientific Review International Committee of the INFN LNL and LNS laboratories (2004- March 2008)
- Member of the scientific Advisory Committee (SAC) of the ESFRI Facility SPIRAL2 (from 2003 to 2005)
- Member of the Program Advisory Committee of the Laboratory " National Accel.Center of Cape Town " (from 2000 to 2002) and Member of the Program Advisory Committee of the CNRS Laboratory IRES in Strasbourg (from 1998 to 2002).

Evaluation activity in International Review Committees

- Member of the Review panel of the Helmholtz Programme "Physics of Hadrons and Nuclei" (GSI, February 2009)
- Member of the Review Panel of the Helmholtz Institute Mainz"Structure, Symmetry and Stability of Matter and Antimatter" (Mainz, April 2009)
- Member of an evaluation panel for the French activity P2I (Physique des deux infinis) held in April 2010.
- Evaluation panel for excellence Initiative for "Graduate Schools" for the German Research Foundation DFG (November 2011)
- Member of the Evaluator Panel **FP6**, European Commission, Capacities Evaluation of proposals in 2003, in 2004 and in 2005 for Research and Training Networks , Marie Curie fellows. Participation in several meeting in Brussels.
- Evaluation of proposals for the English "Engineering and Phys. Sciences Research Council".
- Chair and member of several committees for selection and promotion of personnels of INFN and Italian Universities and evaluator for MIUR projects.

Panels of Research Funding Agencies

- Member of the expert panel for Nuclear and Particle physics of the Belgian Funding Agency FWO (from 2010-)
- Member of the expert panel of Academy of Finland Centre of Excellence Programme - Nuclear and Accelerator Based Physics (October 2010- September 2012)
- Member of the committee for MICINN (Spanish ministry of Science and Innovation) for " evaluación de proyectos de investigación 2011 del Plan Nacional" (Madrid May 2011).
- Member of the Nuclear Physics Grants Panel of the Science and Technology Facilities Council in the UK (October 2010-June 2011)

Research collaborations

- Member of the Steering Committee of the AGATA European collaboration for nuclear spectroscopy with gamma-rays (from 2009-...)
- Member of the Steering Committee of the RISING collaboration at GSI from 2002 to 2005 (gamma spectroscopy with radioactive beams at GSI).
- Member of the Steering Committee of EUROBALL (Large European Collaboration for gamma spectroscopy) (from 1996 to 1999)
- National responsible of INFN Nuclear Physics experiments (HECTOR, PRIAMO, PARIDE from 1992-1998 dealing with the study of giant resonances) and responsible for Milano of the INFN experiments EUROBALL and AGATA (1999-2005)
- Scientific Responsible of SPES (2001-2005). In 2005 I left the responsibility because of the conflict with the chairship of the scientific committee of Nuclear Physics of INFN (CSN3).

Stays abroad

Visitor Scientist at TRIUMF (1984); at Oak Ridge National Laboratory (in 1985 and in 1986); at the Niels Bohr Institute (Copenhagen) for several periods of 2 to 3 months from 1987 to 2005.

Publications and presentations at international conferences

- Coauthor of more than 190 research papers on scientific journals (including 24 PRL+23 PLB) plus approximately 120 papers on proceeding volumes (many in special volumes of scientific journals), (2300 citations and h factor 31).
- Presentation of 65 invited talks at international conferences and workshops and 25 seminars at Universities or Laboratories
- Author (with two other colleagues) of a book "GiantResonances: Nuclear structure at finite temperature" belonging to the series "Contemporary Concepts in Physics"
- *Member of the editorial board* of the international scientific journal Nuclear Physics A (Elsevier)
- Editor for 4 volumes Conference Proceedings one volume being lectures of the Enrico-Fermi School of the Italian Physical Society in Varenna
- Referee of several papers in scientific journals
- Contributor to more general magazines such as Nuclear Physics News, Asimmetrie of INFN, Notiziario Università di Milano. Member of scientific committee of Energy-Lab in Lombardia.

Activity for Conferences and workshops

- She has organized 4 international conferences plus one Enrico Fermi School in 2010 (Varenna) She has also organized meetings for the EU-Eranet NuPNET project and other collaboration meetings.
- She has been member of the International Advisory Committees of several (25) International Conferences.
- Chair of the Program Committee of the international Nuclear Physics Conference INPC2013

Research Activity

The research activity starting from 1985 is in experimental nuclear physics with focus in the field of Nuclear Structure and reaction dynamics. Before, and in particular during the PH.D work, research was made to study the nucleon force and the nucleon few-body problem with reactions induced by intermediate energy protons (at the laboratory TRIUMF, Vancouver Canada).

Most of the experimental work of her research activity was made employing heavy ions reactions and gamma spectroscopy. In this connection her research was and is being carried out as a member of several European collaborations around large detector arrays for gamma-ray spectroscopy. The most recent collaboration is AGATA, an array for gamma-ray spectroscopy based on a novel tracking technique. The first phase of the AGATA array, called demonstrator, has been realized and pilot experiments carried out in the last two years in LNL.

In the past years she was member of the international collaborations NORBALL and HECTOR (Niels Bohr Institute, Copenhagen) and GASP (LNL-INFN, Legnaro-Padova) and of the much larger European collaboration EUROBALL (operating during 1996-2002 at LNL-INFN and Strasbourg)

After 2002, using a large fraction of the EUROBALL equipment, two new experimental set ups were constructed, RISING(GSI) and PRISMA-CLARA (at LNL). The RISING collaboration has conducted very new studies of unstable nuclei with radioactive beams at the laboratory GSI (Darmstadt-Germany).

As far as experiments with these arrays are concerned, personal contributions of some relevance were given for the study of the properties of collective nuclear excitations at the extreme conditions of thermal excitation, angular momentum and isospin. Interesting results concerning the understanding of nuclear structure at finite temperature were obtained and these were based on experiments with set-ups including above large arrays plus detectors for high energy gamma-rays, developed and constructed with my group in Milano. In particular, in the EUROBALL campaign a number of experiments dedicated to the study of the gamma decay of the giant dipole resonances were performed under the Milano responsibility in which the scintillator detectors were added in the set up. Among the latest investigations of the damping mechanisms and isospin mixing in the giant dipole resonance there are the experiments performed at LNL using the our HECTOR set up combined with the GARFIELD array for the detection of charged particles.

Presently within the AGATA international collaboration, she is committed in the realization of new ancillary detectors to study the nuclear degrees of freedom identified with high-energy gamma-ray emission. These studies are relevant to understand an important aspect of the structure of nuclei, namely the response for high frequency small amplitude vibrations in the region around the nuclear binding energy, but also have relevance in the description of the nucleosynthesis of elements from super-novae explosion.

During the year additional experimental work, still in the field of nuclear structure with gamma spectroscopy, was made at ANL(Chicago,USA) with the array Gammasphere and GANIL(Caen, France) with the array EXOGAM.

With all these activities the group of Milano, that I have been coordinating for the last 25 years, has gained a well recognized expertise in the field of nuclear structure at finite temperature through the development of experimental and analysis techniques to study continuum spectra emitted from nuclear rotations and vibrations. The experimental activity planned for the future concerns collective modes in nuclei far from stability which are mostly created using radioactive beams.

In this research field she supervised the activity of 9 post-doctoral fellows.

A good fraction of the master and Ph.D supervised students, with research projects within the above collaboration, have now positions at the University of Milano, at INFN and in foreigner research institutions, or managerial research positions in companies.

The responsibilities in the managing of these international collaborations are mostly related to the activities as member of the Steering Committees.

The construction phases of the complex detector arrays mentioned above required strong relations and common developments with companies constructing detectors, mechanics, electronics and computers.

Annexes

Short List of selected Publications (below).
Full list of Publications is given in a separate file.

Selected publications of Angela Bracco

- 1) "The Pygmy Dipole Resonance in ^{68}Ni and the neutron skin", O. Wieland and A. Bracco, Progress in Particle and Nuclear Physics Vol. 66(2011)374
- 2) "Constraints on the symmetry energy and neutron skins from pygmy resonances in ^{68}Ni and ^{132}Sn " A. Carbone, G. Colo, A. Bracco, L. Cao, P. F. Bortignon, F. Camera and O. Wieland, Phys. Rev. C 81 (2010) 041301(R)
- 3) "Probing the nature of particle-core couplings in ^{49}Ca with γ spectroscopy and heavy-ion transfer reactions", D. Montanari, S. Leoni, D. Mengoni, G. Benzoni, N. Blasi, G. Bocchi, P.F. Bortignon, A. Bracco, F. Camera, G. Colo, A. Corsi, F.C.L. Crespi, B. Million, R. Nicolini, O. Wieland, J.J. Valiente-Dobon, L. Corradi, G. de Angelis, F. Della Vedova, E. Fioretto, A. Gadea, D.R. Napoli, R. Orlandi, F. Recchia, E. Sahin, R. Silvestri, A.M. Stefanini, R.P. Singh, S. Szilner, D. Bazzacco, E. Farnea, R. Menegazzo, A. Gottardo, S.M. Lenzi, S. Lunardi, G. Montagnoli, F. Scarlassara, C. Ur, G. Lo Bianco, A. Zucchiatti, M. Kmiecik, A. Maj, W. Meczynski, A. Dewald, Th. Pissulla, G. Pollarolo, Phys. Lett. B 697, 288 (2011)
- 4) "Search for the Pygmy Dipole Resonance in ^{68}Ni at 600 MeV/nucleon", Wieland, O; Bracco, A; Camera, F; Benzoni, G; Blasi, N; Brambilla, S; Crespi, F.C.L.; Leoni, S; Million, B; Nicolini, R; Maj, A; Bednarczyk, P; Grebosz, J; Kmiecik, M; Meczynski, W; Styczen, J; Aumann, T; Banu, A; Beck, T; Becker, F; Caceres, L; Doornenbal, P; Emling, H; Gerl, J; Geissel, H; Gorska, M; Kavatsyuk, O; Kavatsyuk, M; Kojouharov, I; Kurz, N; Lozeva, R; Saito, N; Saito, T; Schaffner, H; Wollersheim, HJ; Jolie, J; Reiter, P; Warr, N; deAngelis, G; Gadea, A; Napoli, D; Lenzi, S; Lunardi, S; Balabanski, D; LoBianco, G; Petrache, C; Saltarelli, A; Castoldi, M; Zucchiatti, A; Walker, J; Burger, A, PHYS REV LETT(2009)51
- 5) "Probing the order-to-chaos region in superdeformed Tb-151 and Pb-196 nuclei with continuum gamma transitions", Leoni S, Benzoni G, Blasi N, Bracco A, Brambilla S, Camera F, Corsi A, Crespi F.C.L, Mason P, Million B, Montanari D, Pignanelli M, Vigezzi E, Wieland O, Matsuo M, Shimizu YR, Curien D, Duchene G, Robin J, Bednarczyk P, Castoldi M, Herskind B, Kmiecik M, Maj A, Meczynski W, Styczen J, Zieblinski M, Zuber K, Zucchiatti A, PHYSICAL REVIEW LETTERS 101(14): - 142502 (2008)
- 6) "Giant dipole resonance in the hot and thermalized Ce-132 nucleus: Damping of collective modes at finite temperature " Wieland O, Bracco A, Camera F, Benzoni G, Blasi N, Brambilla S, Crespi F, Giussani A, Leoni S, Mason P, Million B, Moroni A, Barlini S, Kravchuk VL, Gramegna F, Lanchais A, Mastinu P, Maj A, Brekiesz M, Kmiecik M, Bruno M, Geraci E, Casini G, Chiari M, Nannini A, Ordine A, Ormand E, PHYSICAL REVIEW LETTERS 97(1): - 012501 JUL 7 2006
- 7) "Is the K quantum number conserved in the order-to-chaos transition region ?" G. Benzoni, A. Bracco, S. Leoni, N. Blasi, F. Camera, C. Grassi, B. Million, A. Paleni, M. Pignanelli, E. Vigezzi, O. Wieland, M. Matsuo, T. Døssing, B. Herskind, G.B. Hagemann, J. Wilson, A. Maj, M. Kmiecik, G. Lo Bianco, C. M. Petrache, M. Castoldi, A. Zucchiatti, G. De Angelis, D. Napoli, P. Bednarczyk, D. Curien, Phys. Lett. B.615(2005)160.
- 8) "Radiative fusion from very symmetric reactions: the giant dipole resonance in the ^{197}Au nucleus" F.. Camera, A. Bracco, V. Nanal, M.P. Carpenter, F. Della Vedova, S. Leoni, B. Million, S. Mantovani, M. Pignanelli, O. Wieland, B.B. Back, A.M. Heinz, R.V.F. Janssens, D. Jenkins, T.L. Khoo, F.G. Kondev, T. Lauritsen, C.J. Lister, B. McClintock, S. Mitsuoka, E.F. Moore, D. Seweryniak, R.H. Siemssen, R.J. Van Swol, D. Hofman, M. Thoennessen, K. Eisenman, P. Heckman, J. Seitz, R. Varner, M. Halbert, I. Dioszegi, A. Lopez-Martens, Phys. Lett. B560 (2003)155.
- 9) "Effect of $E1$ decay in the population of superdeformed structures"- G. Benzoni, A. Bracco, F. Camera, S. Leoni, B. Million, A. Maj, A. Algora, A. Axelsson, M. Bergstrom, N. Blasi, M. Castoldi, S. Frattini, A. Gadea, B. Herskind, M. Kmiecik, G. Lo Bianco, J. Nyberg, M. Pignanelli, J. Styczen, O. Wieland, M. Zieblinski, A. Zucchiatti, Phys. Lett. B540 (2002)199.
- 10) "Quantum tunneling of the excited rotational bands in the superdeformed nucleus ^{143}Eu " S. Leoni, A. Bracco, F. Camera, B. Million, A. Algora, A. Axelsson, G. Benzoni, M. Bergstrom, N. Blasi, M. Castoldi, S. Frattini, A. Gadea, B. Herskind, M. Kmiecik, G. Lo Bianco, A. Maj, J. Nyberg, M. Pignanelli, J. Styczen, E. Vigezzi, M. Zieblinski, A. Zucchiatti. Phys. Lett. B498(2001)137.
- 11) "Fission hindrance in ^{200}Pb measured from giant dipole resonance γ -ray emission" I. Dioszegi, N.P. Shaw, A. Bracco, F. Camera, S. Tettoni, M. Mattiuzzi and P. Paul, Phys. Rev. C63(2000)014611.
- 12) "The rotational gamma-continuum in the mass region $A 110$ ", A. Bracco, S. Frattini, S. Leoni, F. Camera, B. Million, N. Blasi, G. Falconi, G. LoBianco, M. Pignanelli, E. Vigezzi, B. Herskind, M. Bergstrom, P. Varmette, S. Tormanen, A. Maj, M. Kmiecik, D.R. Napoli and M. Matsuo, Nucl. Phys. A673(2000)64.
- 13) "Measurement of 15 MeV (γ -rays with Ge cluster detectors of EUROBALL " B. Million, A. Bracco, F. Camera, S. Brambilla, A. Gadea, D. Giugni, B. Herskind, M. Kmiecik, R. Isocrate, S. Leoni, A. Maj, F. Preiz and O. Wieland Nucl. Inst. Meth. A452(2000)422
- 14) "Unresolved gamma-rays in ^{114}Te : mass dependence of rotational damping " S. Frattini, A. Bracco, S. Leoni, F. Camera, B. Million, N. Blasi, G. LoBianco, M. Pignanelli, E. Vigezzi, B. Herskind, T. Døssing, M. Bergstrom, P. Varmette and S. Tormanen, A. Maj, M. Kmiecik, D.R. Napoli and M. Matsuo Phys. Rev. Lett. 83 (1999) 5234.
- 15) Nuclear Structure at Finite Temperature P.F. Bortignon, A. Bracco and R.A. Broglia, Harwood Academic Publishers, Amsterdam (1998), volume della collana Contemporary Concepts in Physics.
- 16) "The Rotational Quadrupole Moment of Thermally Excited High Spin States in ^{164}Yb ", S. Frattini, A. Bracco, S. Leoni, P. Bosetti, B. Herskind, T. Døssing, M. Bergstrom, G.B. Hagemann, H. Ryde, J.P. Vivien, A. Bagshaw, D. Smalley and A.G. Smith, Phys. Rev. Lett. 81(1998)2659.
- 17) "Angular momentum dependence of the GDR width in Sn nuclei at fixed excitation energy" M. Mattiuzzi, A. Bracco, F. Camera, W.E. Ormand, J.J. Gaardhoje, A. Maj, B. Million, M. Pignanelli and T.S. Tveter, Nucl. Phys. A612 (1997)262.

- 18) " Possible Conservation of the K-Quantum Number in Excited Rotating Nuclei" P. Bosetti, S. Leoni, A. Bracco, B. Herskind, T. Dossing, G.B. Hagemann, R. Bark, A. Brockstedt, P. Ekstrom, H. Carlsson, A. Nordlund, H. Ryde, F. Camera, S. Frattini, M. Mattiuzzi, B. Million, D. Bazzacco, R. Burch, G. de Angelis, D. De Acuna, M. de Poli and P. Pavan, Phys. Rev. Lett. 76 (1996)1204.
- 19) " *Fluctuation Analysis of Rotational Spectra.*" T. Dossing, B. Herskind, S. Leoni, M. Matsuo, A. Bracco, R. A. Broglia, and E. Vigezzi, Phys. Report 268(1996)1-84.
- 20) " *Thermal fluctuation and collisional damping effects in the GDR observables in hot rotating ^{176}W nuclei*" M. Mattiuzzi, A.Bracco, F.Camera, B.Million, M.Pignanelli, J.J.Gaardhoje, A. Maj, T.Ramsøy, T.Tveter and Z. Zelazny, Phys. Lett. **B364** (1995)13.
- 21) " *Microscopic Simulations of gamma-cascades in warm rotating nuclei*", A. Bracco, P. Bosetti, S. Frattini, E. Vigezzi, S. Leoni, T. Dossing, B. Herskind, M. Matsuo, PRL 76, (1996)4484.
- 22) " *Increase of the width of the Giant Dipole Resonance in hot Nuclei: Shape Change or Collisional Damping ?*" A.Bracco, F.Camera, M.Mattiuzzi, B.Million, M.Pignanelli, J.J.Gaardhoje Z.Zelazny, T.Ramsøy, T.Tveter and A. Maj Phys. Rev. Lett. **74**(1995)3748.
- 23) " *Limiting Temperature for the Existence of Collective Motion in Hot Nuclei.*" P.F. Bortignon, A. Bracco, D. Brink, and R. A. Broglia, Phys. Rev. Lett. **67**(1991)3360.
- 24) " *Saturation of the width of the giant dipole resonance at high temperature*", A. Bracco, J.J. Gaardhoje, A. Bruce, J.D. Garret, B. Herskind, M. Pignanelli, D. Barneoud, H.Nifenecker, J.A. Pinston, C. Ristori, F. Schussler, J. Bacelar, and H. Hofmann, Phys. Rev. Lett. **62** (1989)2080.
- 25) " *Study of the breathing mode of ^{208}Pb through Neutron decay.*" A. Bracco, J.R. Beene, N. Van Giai, P.F. Bortignon, F. Zardi, and R. A. Broglia, Phys. Rev. Lett. **60**(1988)2603.
- 26) " *Study of The Two-Nucleon Wave Function in ^3He .*" A. Bracco, H.P. Gubler, D.K. Hasell, W.T.H. van Oers, M.B. Epstein, D.J. Margaziotis, R. Abegg, C.A. Miller, and P. Schwandt, Phys. Rev. Lett. 50(1983)1741.