

# Giuseppe Bevilacqua

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## Curriculum Vitae

### Personal information

first name Giuseppe  
last name Bevilacqua  
place and date of birth Melissa (Italy), 11 February 1971  
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address Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, via Roma 56, 53100 Siena, Italy  
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### Education

- 2000 **Ph.D. in Physics**, *University of Pisa*, Italy.  
◦ Advisor: Prof. Liana Martinelli  
◦ Title: Optical properties in vibronic localized systems
- 1995 **Master Degree (Laurea) in Physics**, *University of Pisa*, Italy.  
◦ Advisor: Prof. Liana Martinelli  
◦ Title: Studio dell'effetto Jahn-Teller in  $\text{ZnS:Fe}^{2+}$  con un nuovo metodo ricorsivo

### Current and previous positions

- nov06 – pres **Assistant Professor in Physics (SSD: FIS/01 – 02/B1)**, *University of Siena*, Italy.
- oct05–oct06 **Assegnista di ricerca**, *Dipartimento di Fisica dell'Università di Siena*, Italy.
- jun02–sep05 **Contrattista**, *Dipartimento di Fisica dell'università di Siena nell'ambito del progetto europeo G6RD-CT-2001-00642 "New Magnetometer"*, Italy.
- jun00–jun02 **Assegnista di Ricerca**, *Dipartimento di Fisica dell'università di Pisa*, Italy.

### Scientific Interests

*Department of Physical Sciences, Earth and Environment  
University of Siena*

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My research interests are of theoretical nature and spans a range of different phenomena from quantum optics, solid state physics and phase transitions in liquid crystals. I am also interested in developing applications of quantum optical phenomena. This results in a large modelling activity of optical atomic magnetometers, whose working principle relies on optical pumping and quantum interference. I am interested in Coherent Population Trapping in multilevel atomic systems, and in the possibility of using the related Stimulated Raman Adiabatic Passage to control the quantum state of cavity-QED systems. I am also interested in the Fredericksz transition in both nematic and smectic liquid crystals. During my PhD I worked on solid state physics topics like the electron-phonon interaction and the Jahn-Teller effect. More recently I am working on the modeling of the thermoelectrics efficiency of nanoscale devices.

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## Membership

- 2023-pres Member of the *VIRGO Collaboration*
- 1999-pres Member of the Italian *Gruppo Nazionale per la Fisica Matematica (GNFM)*.
- 1999-2005 Member of the Italian *Istituto Nazionale per la Fisica della Materia (INFN)*.

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## Research Grants

- 2021-2022 Progetto PhAST finanziato dalla Regione Toscana (soggetto capofila Aerospazio Tecnologie)
- 2014-2015 GNFM project *Collasso meccanico di membrane biologiche confinate*, P.I. Dr. S. Turzi.
- 2012-2015 Progetto FIRB RBAP11ZJFA *Idrogeli nanocompositi ibridi contenenti nanoparticelle ferromagnetiche per il trattamento di tumori ossei primitivi e secondari*
- 2002-2005 European project *New Magnetometer* G6RD-CT-2001-00642, P.I. Prof. L. Moi

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## Teaching Experience

- 2023-pres Università di Siena, Course of *Meccanica Statistica*, undergraduate programme in *Fisica e Tecnologie Avanzate*
- 2019-pres Università di Siena, Course of *Mathematical Physics*, graduate programme in *Applied Mathematics*
- 2011-19 Università di Siena, Course of *Probabilità e Statistica*, undergraduate programme in *Ingegneria Gestionale*
- 2009-11 Università di Siena, Course of *Fisica dei Semiconduttori*, graduate programme in *Ingegneria Elettronica e delle Telecomunicazioni*
- 2005-06 Università di Siena, Course of *Fisica dello Stato Solido*, graduate programme in *Fisica e Tecnologie Avanzate*

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*University of Siena*

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- 2005 Università di Siena, Course of *Complementi di Elettromagnetismo Classico*, undergraduate programme in *Fisica e Tecnologie Avanzate*
- 2004 Università di Siena, Course of *Fisica Moderna*, undergraduate programme in *Fisica e Tecnologie Avanzate*
- 2002-11 Università di Siena, Course of *Fisica Generale I*, undergraduate programme in *Ingegneria dell'Automazione*

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## Students

- Bachelor 2020 – Espansione di Floquet-Magnus applicata alla dinamica di spin inequivalenti (E. Pannini)
- Bachelor 2013 – Sviluppi non-Lineari in un Magnetometro Atomico Ottico Auto-Oscillante (B. De Ieso)
- PhD 2010 – Supervision of the activity of K. Khanbekyan – Advisor Prof. L. Moi
- Master 2010 – Coherent Population Trapping con campo modulato. (E. Cali)

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## Conferences Organization

- 1998 Scientific secretary in the local organizing committee of the *XIV International Symposium on Electron-Phonon Dynamics and Jahn-Teller Effect* – Erice 7–13 july, 1998.

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## Referee Activity

Served as referee for the journals: *Phys. Rev. B*, *Phys. Rev. A*, *Phys. Rev. Lett.*, *Review of Scientific Instruments*, *Journal of Phys.: Condensed Matter*, *Optics Express*, *Optics Letter*, *European Physical Journal Plus* .

Served as referee for the *Polish National Research Agency*.

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## Publications

- 2023 Bevilacqua, Giuseppe, Valerio Biancalana, Mario Carucci, et al. (2023). “A Wearable Wireless Magnetic Eye-Tracker, in-vitro and in-vivo tests”. In: *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*, pp. 1–10. DOI: 10.1109/TBME.2023.3286424. URL: <https://ieeexplore.ieee.org/document/10153628>.
- Bevilacqua, Giuseppe, Valerio Biancalana, and Yordanka Dancheva (2023). “Dynamic Response of a Light-Modulated Magnetometer to Time-Dependent Fields”. In: *ATOMS* 11.8. DOI: 10.3390/atoms11080111.
- 2022 Bellizzi, Lorenzo et al. (2022). “An innovative eye-tracker: Main features and demonstrative tests”. In: *Review of Scientific Instruments* 93.3, p. 035006. DOI: 10.1063/5.0079779. URL: <https://doi.org/10.1063/5.0079779>.
- Bevilacqua, Giuseppe and Ennio Arimondo (June 2022). “Bright and dark Autler–Townes states in the atomic Rydberg multilevel spectroscopy”. In: *Journal of Physics B: Atomic, Molecular and Optical Physics* 55.15, p. 154001. DOI: 10.1088/1361-6455/ac7684. URL: <https://doi.org/10.1088/1361-6455/ac7684>.
- Bevilacqua, Giuseppe, Valerio Biancalana, T. Zanon-Willette, et al. (Feb. 2022). “Harmonic dual dressing of spin-1/2 systems”. In: *Phys. Rev. A* 105, p. 022619. DOI: 10.1103/PhysRevA.105.022619. URL: <https://link.aps.org/doi/10.1103/PhysRevA.105.022619>.
- Bevilacqua, Giuseppe, Alessandro Cresti, Giuseppe Grosso, Guido Menichetti, and Giuseppe Pastori Parravicini (2022). *Quantum bounds for power production, efficiency and thermal currents in thermoelectric nanostructures*. DOI: 10.48550/ARXIV.2206.00294. URL: <https://arxiv.org/abs/2206.00294>.
- Bevilacqua, Giuseppe, Alessandro Cresti, Giuseppe Grosso, Guido Menichetti, and Giuseppe Pastori Parravicini (2022). “Regimes and quantum bounds of nanoscale thermoelectrics with peaked transmission function”. In: *Physica E: Low-dimensional Systems and Nanostructures* 138, p. 115105. ISSN: 1386-9477. DOI: <https://doi.org/10.1016/j.physe.2021.115105>. URL: <https://www.sciencedirect.com/science/article/pii/S1386947721004550>.
- 2021 Bevilacqua, G, V Biancalana, et al. (Mar. 2021). “Studying and applying magnetic dressing with a Bell and Bloom magnetometer”. In: *Journal of Physics: Conference Series* 1859.1, p. 012018. ISSN: 1742-6596. DOI: 10.1088/1742-6596/1859/1/012018. URL: <http://dx.doi.org/10.1088/1742-6596/1859/1/012018>.
- Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, Alessandro Fregosi, Gaetano Napoli, et al. (Nov. 2021). “Electromagnetic induction imaging: signal detection based on tuned-dressed optical magnetometry”. In: *Opt. Express* 29.23, pp. 37081–37090. DOI: 10.1364/OE.437930. URL: <http://www.osapublishing.org/oe/abstract.cfm?URI=oe-29-23-37081>.

- Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, Alessandro Fregosi, and Antonio Vigilante (Aug. 2021). “Spin dynamic response to a time dependent field”. In: *Applied Physics B* 127.9, p. 128. ISSN: 1432-0649. DOI: 10.1007/s00340-021-07673-y. URL: <https://doi.org/10.1007/s00340-021-07673-y>.
- Biancalana, Valerio, Roberto Cecchi, Piero Chessa, Marco Mandalà, et al. (Mar. 2021). “Validation of a Fast and Accurate Magnetic Tracker Operating in the Environmental Field”. In: *Instruments* 5.1, p. 11. ISSN: 2410-390X. DOI: 10.3390/instruments5010011. URL: <http://dx.doi.org/10.3390/instruments5010011>.
- Guarrera, V., R. Gartman, G. Bevilacqua, and W. Chalupczak (July 2021). “Spin-noise spectroscopy of a noise-squeezed atomic state”. In: *Phys. Rev. Research* 3, p. L032015. DOI: 10.1103/PhysRevResearch.3.L032015. URL: <https://link.aps.org/doi/10.1103/PhysRevResearch.3.L032015>.
- 2020 Bevilacqua, Giuseppe, Valerio Biancalana, Marco Consumi, et al. (2020). “Ferromagnetic contamination of ultra-low-field-NMR sample containers. Quantification of the problem and possible solutions”. In: *Journal of Magnetism and Magnetic Materials* 514, p. 167220. ISSN: 0304-8853. DOI: <https://doi.org/10.1016/j.jmmm.2020.167220>. URL: <http://www.sciencedirect.com/science/article/pii/S0304885320315651>.
- Bevilacqua, Giuseppe, Valerio Biancalana, Antonio Vigilante, et al. (Aug. 2020). “Harmonic Fine Tuning and Triaxial Spatial Anisotropy of Dressed Atomic Spins”. In: *Phys. Rev. Lett.* 125, p. 093203. DOI: 10.1103/PhysRevLett.125.093203. URL: <https://link.aps.org/doi/10.1103/PhysRevLett.125.093203>.
- Biancalana, Valerio, Roberto Cecchi, Piero Chessa, Giuseppe Bevilacqua, et al. (Dec. 2020). “Fast, Cheap, and Scalable Magnetic Tracker with an Array of Magnetoresistors”. In: *Instruments* 5.1, p. 3. ISSN: 2410-390X. DOI: 10.3390/instruments5010003. URL: <http://dx.doi.org/10.3390/instruments5010003>.
- 2019 Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, Leonardo Staccini, et al. (Sept. 2019). “Spurious ferromagnetic remanence detected by hybrid magnetometer”. In: *Review of Scientific Instruments* 90, p. 046106. DOI: <https://doi.org/10.1063/1.5094623>. URL: <https://doi.org/10.1063/1.5094623>.
- Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, and Antonio Vigilante (Feb. 2019a). “Restoring Narrow Linewidth to a Gradient-Broadened Magnetic Resonance by Inhomogeneous Dressing”. In: *Phys. Rev. Applied* 11, p. 024049. DOI: 10.1103/PhysRevApplied.11.024049. URL: <https://link.aps.org/doi/10.1103/PhysRevApplied.11.024049>.
- Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, and Antonio Vigilante (Jan. 2019b). “Self-Adaptive Loop for External-Disturbance Reduction in a Differential Measurement Setup”. In: *Phys. Rev. Applied* 11, p. 014029. DOI: 10.1103/PhysRevApplied.11.014029. URL: <https://link.aps.org/doi/10.1103/PhysRevApplied.11.014029>.

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- Guarrera, V., R. Gartman, G. Bevilacqua, G. Barontini, et al. (July 2019). “Parametric Amplification and Noise Squeezing in Room Temperature Atomic Vapors”. In: *Phys. Rev. Lett.* 123, p. 033601. DOI: 10.1103/PhysRevLett.123.033601. URL: <https://link.aps.org/doi/10.1103/PhysRevLett.123.033601>.
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- 2018 Gartman, R. et al. (Dec. 2018). “Linear and nonlinear coherent coupling in a Bell-Bloom magnetometer”. In: *Phys. Rev. A* 98, p. 061401. DOI: 10.1103/PhysRevA.98.061401. URL: <https://link.aps.org/doi/10.1103/PhysRevA.98.061401>.
- 2017 Bevilacqua, Giuseppe, Valerio Biancalana, Yordanka Dancheva, Antonio Vigilante, et al. (2017). “Simultaneous Detection of H and D NMR Signals in a Micro-Tesla Field”. In: *The Journal of Physical Chemistry Letters* 8.24. PMID: 29211488, pp. 6176–6179. DOI: 10.1021/acs.jpcllett.7b02854. eprint: <http://dx.doi.org/10.1021/acs.jpcllett.7b02854>. URL: <http://dx.doi.org/10.1021/acs.jpcllett.7b02854>.
- Biancalana, Valerio, Giuseppe Bevilacqua, et al. (2017). “A low noise modular current source for stable magnetic field control”. In: *Review of Scientific Instruments* 88.3, p. 035107. DOI: 10.1063/1.4977931. URL: <https://doi.org/10.1063/1.4977931>.
- 2016 Bevilacqua, G., V. Biancalana, and Y. Dancheva (July 2016). “Atomic orientation driven by broadly-frequency-modulated radiation: Theory and experiment”. In: *Phys. Rev. A* 94, p. 012501. DOI: 10.1103/PhysRevA.94.012501. URL: <http://link.aps.org/doi/10.1103/PhysRevA.94.012501>.
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- Bevilacqua, Giuseppe, Valerio Biancalana, Andrei Ben-Amar Baranga, et al. (2016). “Microtesla NMR J-coupling spectroscopy with an unshielded atomic magnetometer”. In: *Journal of Magnetic Resonance* 263, pp. 65–70. ISSN: 1090-7807. DOI: <https://doi.org/10.1016/j.jmr.2015.12.018>. URL: <http://www.sciencedirect.com/science/article/pii/S1090780715003195>.

- Bevilacqua, Giuseppe, Valerio Biancalana, Piero Chessa, et al. (Mar. 2016). “Multichannel optical atomic magnetometer operating in unshielded environment”. In: *Applied Physics B* 122.4, pp. 1–9. ISSN: 1432-0649. DOI: 10.1007/s00340-016-6375-2. URL: <http://dx.doi.org/10.1007/s00340-016-6375-2>.
- Bevilacqua, Giuseppe, Menichetti, Guido, and Parravicini, Giuseppe Pastori (2016). “Hilbert transform evaluation for electron-phonon self-energies”. In: *Eur. Phys. J. B* 89.1, p. 3. DOI: 10.1140/epjb/e2015-60730-0. URL: <http://dx.doi.org/10.1140/epjb/e2015-60730-0>.
- 2014 Bevilacqua, G. and E. Breschi (June 2014). “Magneto-optic spectroscopy with linearly polarized modulated light: Theory and experiment”. In: *Phys. Rev. A* 89, p. 062507. DOI: 10.1103/PhysRevA.89.062507. URL: <http://link.aps.org/doi/10.1103/PhysRevA.89.062507>.
- Bevilacqua, G., E. Breschi, and A. Weis (Mar. 2014). “Steady-state solutions for atomic multipole moments in an arbitrarily oriented static magnetic field”. In: *Phys. Rev. A* 89, p. 033406. DOI: 10.1103/PhysRevA.89.033406. URL: <http://link.aps.org/doi/10.1103/PhysRevA.89.033406>.
- 2013 Alderighi, M. et al. (2013). “A room-temperature alternating current susceptometer – Data analysis, calibration, and test”. In: *Review of Scientific Instruments* 84.12, 125105, pp. -. DOI: <http://dx.doi.org/10.1063/1.4842255>. URL: <http://scitation.aip.org/content/aip/journal/rsi/84/12/10.1063/1.4842255>.
- Bevilacqua, G., V. Biancalana, Y. Dancheva, and L. Moi (2013). “Chapter Three - Optical Atomic Magnetometry for Ultra-Low-Field NMR Detection”. In: ed. by Graham A. Webb. Vol. 78. Annual Reports on NMR Spectroscopy. Academic Press, pp. 103–148. DOI: 10.1016/B978-0-12-404716-7.00003-1. URL: <http://www.sciencedirect.com/science/article/pii/B9780124047167000031>.
- Bevilacqua, G. and F. Renzoni (Sept. 2013). “Quantum-state transfer between tripod atoms over a dark fiber”. In: *Phys. Rev. A* 88, p. 033817. DOI: 10.1103/PhysRevA.88.033817. URL: <http://link.aps.org/doi/10.1103/PhysRevA.88.033817>.
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- Martinelli, Liana, Giuseppe Bevilacqua, and Eugenio E. Vogel (2013). “Optical Properties of 3d-Ions in Crystals”. In: ed. by Nicolae M. Avram and Mikhail G. Brik. Springer. Chap. Dynamic Jahn-Teller effect in crystals doped with 3d ions. ISBN: 978-3-642-30837-6. URL: <http://www.springer.com/physics/optics+%5C%26+lasers/book/978-3-642-30837-6>.
- 2012 Bevilacqua, G., V. Biancalana, Y. Dancheva, and L. Moi (Apr. 2012). “Larmor frequency dressing by a nonharmonic transverse magnetic field”. In: *Phys. Rev. A* 85, p. 042510. DOI: 10.1103/PhysRevA.85.042510. URL: <http://link.aps.org/doi/10.1103/PhysRevA.85.042510>.

- Bevilacqua, Giuseppe and Gaetano Napoli (2012). “Parity of the weak Freedericksz transition”. English. In: *The European Physical Journal E* 35, p. 133. ISSN: 1292-8941. DOI: 10.1140/epje/i2012-12133-7. URL: <http://dx.doi.org/10.1140/epje/i2012-12133-7>.
- 2011 Bevilacqua, G., V. Biancalana, Y. Dancheva, T. Mansour, et al. (2011). “A new class of sum rules for products of Bessel functions”. In: *Journal of Mathematical Physics* 52, p. 033508. DOI: 10.1063/1.3567410.
- Khanbekyan1, K. et al. (2011). “A phenomenological model for collisional coherence transfer in an optically pumped atomic system”. In: *J. Phys. B: At. Mol. Phys.* 44, 055502 (7pp). DOI: 10.1088/0953-4075/44/5/055502. URL: <http://stacks.iop.org/0953-4075/44/i=5/a=055502>.
- 2010 Belfi, J., G. Bevilacqua, V. Biancalana, R. Cecchi, et al. (2010). “Stray magnetic field compensation with a scalar atomic magnetometer”. In: *Review of Scientific Instruments* 81, p. 065103. DOI: 10.1063/1.3441980.
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- 2008 Ippolito, D., L. Martinelli, and G. Bevilacqua (2008). “Cooperative Jahn-Teller effects in  $PrO_2$ ”. In: *J. Phys.: Condens. Matter* 20, 175218 (8pp). DOI: 10.1088/0953-8984/20/17/175218. URL: <http://stacks.iop.org/JPhysCM/20/175218>.
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- 2006 Bevilacqua, G., V. Biancalana, Y. Dancheva, B. Grishanin, et al. (2006). “Computer Modeling of Frequency-modulation spectra of coherent dark resonances”. In: *Laser Physics Letters* 3, p. 427. DOI: 10.1002/lapl.200610036.



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- 2004 Bevilacqua, G., D. Ippolito, and L. Martinelli (2004). “Jahn-Teller effect on  $PrO_2$ : a multimode vibronic model”. In: *Phys. Rev. B* 69, 155208 (6 pp). DOI: 10.1103/PhysRevB.69.155208. URL: <http://link.aps.org/doi/10.1103/PhysRevB.69.155208>.
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