

Curriculum Vitae et Studiorum

Prof. Pietro Patimisco

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PERSONAL DATA

Name: Pietro Patimisco
Sex: Male
Place of Birth: Castellaneta (TA), Italy
Date of Birth: March 24, 1984

RESEARCH INTERESTS

My research activities have been mainly devoted to the study of trace gas optical sensors based on quartz enhanced photoacoustic spectroscopy (QEPAS) in the near- and mid-infrared spectral region, as well as development of devices for outdoor gas sensing applications. My results led to several publications, including a cover paper in the July 2013 issue of Applied Physics Letters. I am Assistant Professor at the Physics Department, University of Bari. I am a member of Technical Committee of the joint-research laboratory, PolySense, between Physics Department and Thorlabs GmbH, aimed to the realization of trace gas QEPAS sensors.

EDUCATION

- **Ph.D. in Physics, May 2013**
Place: Physics Department, University of Bari
Advisor: Prof. Gaetano Scamarcio
Thesis: *THz and Mid-IR Quantum Cascade Lasers: study of the electronic properties and waveguide coupling for trace gas sensing applications*
 - **M.Sc. in Physics, September 2009**
Place: Physics Department, University of Bari
Advisor: Prof. Gaetano Scamarcio
Thesis: *Study of optical feedback in semiconductor optical devices*
 - **B.Sc. in Physics, July 2007**
Place: Physics Department, University of Bari
Advisor: Prof. Gaetano Scamarcio
Thesis: *Realization of LabVIEW-based software for electro-optical characterization of semiconductor devices*
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EMPLOYMENT RECORD

25/01/2020 ---	Assistant Professor Physics Department, University of Bari
16/02/2018 – 24/01/2020	Assistant Professor Technical University of Bari
16/02/2017 – 15/02/2018	Post-Doctoral Research Associate Physics Department, University of Bari <i>Affiliated with Prof. Vincenzo Spagnolo</i> <i>Topic:</i> Realization of optical sensors for trace gas detection
01/02/2016 – 31/01/2017	Post-Doctoral Research Fellowship Laser Science Group, Electrical and Computer Engineering Department, Rice University, Houston, Texas <i>Affiliated with Prof. Frank K. Tittel</i> <i>Topic:</i> Development of innovative optical gas sensor systems and their application to environmental monitoring, industrial process analysis, control as well as medical diagnostics.
31/01/2013 – 31/01/2016	Post-Doctoral Research Associate Physics Department, University of Bari <i>Affiliated with Prof. Gaetano Scamarcio and Vincenzo Spagnolo</i> <i>Topic:</i> Study and development of Quartz-enhanced photoacoustic sensors for SF ₆ detection

TEACHING ACTIVITIES – UNIVERSITY COURSES

XXXXIII, XXXIV and XXXV cycle	Class: Optical sensors and spectroscopic techniques Post-Graduate Doctorate's Course Physics Department, University of Bari 16 hours <i>Website:</i> http://phdphysics.cloud.ba.infn.it/?page_id=3778#
Academic Year 2019-2020	Class: Solid State Physics Master Degree's Course Physics Department, University of Bari II Semester, 48 hours <i>Website:</i> http://polysense.poliba.it/index.php/solid-state-physics/
Academic Year 2019-2020	Class: Physics of Sensors and Spectroscopy Laboratory Master Degree's Course Physics Department, University of Bari I Semester, 60 hours <i>Website:</i> http://polysense.poliba.it/index.php/physics-of-sensors-and-laboratory-of-spectroscopy/
A. Y. 2017-2018 and 2018-2019	Class: General Physics Three-year Bachelor Degree's Course Technical University of Bari II Semester, 60 hours <i>Website:</i> http://polysense.poliba.it/index.php/didattica-prof-patimisco/

ACADEMIC SKILLS

- From April 2017, **Member of Technical Committee** of joint-research laboratory PolySense (<http://polysense.poliba.it/>) between the Physics Department and Thorlabs GmbH. The main activity is the development of trace gas optical sensors based on quartz-enhanced photoacoustic spectroscopy (QEPAS) in the near- and mid-infrared spectral range. Main results reached so far:
 - January 2018, Photonics West Expo, first demonstration of QEPAS sensor for ethylene detection;
 - June 2019, CLEO EUROPE Expo, first demonstration of QEPAS sensor for methane detection;
 - September 2019, the acoustic detection module, the core of a QEPAS sensor, is on the market (https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=11241);
 - February 2020, Photonics West Expo, First demonstration of QEPAS sensor for methane detection in air;
- **Co-tutor** of a PhD student, XXXIV cycle, Physics Department, University of Bari. Project title: *Study of the electro-thermal properties and acoustic coupling of quartz tuning forks*
- **Co-tutor** of a PhD student, XXXIV cycle, Physics Department, University of Bari. Project title: *Quartz enhanced photoacoustic spectroscopy with non-conventional laser sources*
- From March 2019, **Member of Council of Science and Technology School**, University of Bari.
- From February 2018, **Member of Council of the Physics Department**, University of Bari.
- From 01/10/2018 to 31/10/2018, from 29/03/2019 to 13/04/2019, from 28/06/2019 to 14/07/2019, and from 23/09/2019 to 13/10/2019, **Visiting Researcher** at Institute of Laser Spectroscopy in Shanxi University, Taiyuan, China, within the “Hundred Talents” project of Chinese Academy of Science.
- From 15/09/2013 to 31/05/2014 and from 01/09/2017 to 01/12/2017 **Visiting Researcher** at Laser Science Group, Electrical and Computer Engineering Department, Rice University, Houston, Texas)

MEMBERSHIPS IN EDITORIAL BOARDS

- **Member of Editorial Board** of “Sensors” journal, MDPI, <https://www.mdpi.com/journal/sensors/editors>
- **Guest Editor** of Special Issue in Sensors journal, MDPI: *Optical Spectroscopy, Sensing, and Imaging from UV to THz Range* https://www.mdpi.com/journal/sensors/special_issues/OSSITR
- **Referee** for peer-reviewed international journals: Scientific Reports, Analyst, Sensors & Actuators: B Chemical, Applied Physics Letters, Optics Letters, Applied Physics B: Lasers and Optics, Journal of Applied Physics, Sensors, Journal of Optics, Optics Communications, Photonics, IEEE Sensors.

RESEARCH PROJECT

- **Team Member** in the European Project ITN- OPTAPHI (Marie Skłodowska-Curie Innovative Training Networks, H2020-MSCA-ITN-2019). The main activities in which I am involved are:
 - Supervisor of a PhD student, *Project title*: Intra-cavity QEPAS for isotope analysis. <https://www.optaphi.eu/projects/project-3-1/>
 - Responsibility of Commercialization
 - IP manager

ACADEMIC SKILLS

- Author of **103 scientific papers** published on international journals with impact factor. His bibliometric indicators are: **Hirsch index** of **26** and total number of **citations 1861** (SCOPUS source).
- Main results achieved during my scientific career include:
 - realization of a QEPAS sensor for the detection of sulfur hexafluoride with a world-record ultimate detection limit of 50 part-per-trillion (#2 selected publications);
 - first realization of a mid-infrared fiber-coupled QEPAS sensor (#8 selected publications);
 - first demonstration of a QEPAS sensor operating in the Terahertz spectral range (#3 selected publications);
 - first development of a QEPAS sensor optically coupled with a high finesse cavity (#4 selected publications);
 - first demonstration of simultaneous detection of two gas species using a single diode laser source and a single detection module (#8 other publications);

In addition, specific laboratory-prototype QEPAS sensors have been demonstrated to target several applications, including environmental monitoring (CO, CO₂, CH₄, N₂O, NO₂), industrial processes control (CH₄, C₂H₆, H₂S, SF₆, C₃H₂), and biomedical applications (NO, CO, C₂H₆, H₂S). (#1 and #6 selected publications, as representative);

Finally, outdoor operations for QEPAS sensors have demonstrated. In detail:

- a QEPAS sensor capable to target both N₂O and CH₄, installed on a mobile station of Aerodyne, Inc. (Massachusetts) for air quality monitoring near a landfill in Houston (TX) (#9 selected publications);
- a QEPAS sensor for gas leak detection for mechatronic components, installed in MASMEC, S.p.a., Modugno, Italy (#29 other publications);
- a QEPAS sensor for simultaneous detection of three hydrocarbons (methane, ethane, propane), in collaboration with Aramco Research Center, Houston, TX (#17 other publications);
- a QEPAS sensor installed on a mobile station for detection of methane in landfills in Taiyuan, China (#11 other publications).

INVITED TALKS

1. **P. Patimisco**, A. Sampaolo, M. Giglio, G. Menduni, A. Elefante, S. Dello Russo, A. Zifarelli, F. Sgobba, L. Dong, H. Wu, F. K. Tittel and V. Spagnolo, “*Trace Gas Detection with Quartz-enhanced Photoacoustic Spectroscopy for Real World Application*”, PIERS 2019, Roma, ITALIA (June 17-20, 2019).
2. **P. Patimisco**, A. Sampaolo, M. Giglio, S. Dello Russo, G. Menduni, A. Zifarelli, H. Zheng, L. Dong, V. Mackowiak, H. Rossmadl, B. Gross, A. Cable, F.K. Tittel, V. Spagnolo, “*Quartz-enhanced Photoacoustic Spectroscopy Exploiting the First Overtone Mode of Quartz Tuning Forks*” Progress In Electromagnetics Research Symposium PIERS 2018, Toyama (2018).

3. **P. Patimisco**, A. Sampaolo, M. Giglio, F. Sgobba, H. Rossmadl, V. Mackowiak, B. Gross, A. Cable, F. K. Tittel, and V. Spagnolo, “*Compact and low-noise quartz-enhanced photoacoustic sensor for sub-ppm ethylene detection in atmosphere*”, Proceedings of SPIE - The International Society for Optical Engineering, 105401Q, doi: 10.1117/12.2288368, (26 January 2018).
4. **P. Patimisco**, A. Sampaolo, Y. Bidaux, A. Bismuto, M. Scott, J. Jiang, F. K. Tittel, and V. Spagnolo, “*Pure amplitude and wavelength modulation spectroscopy for detection of N₂O using a three-section quantum cascade laser*”, Photonic West 2017, San Francisco USA - Proc. SPIE, 1011109 doi:10.1117/12.2252352, (January 27, 2017).
5. **P. Patimisco**, A. Sampaolo, Y. Bidaux, A. Bismuto, M. Scott, J. Jiang, F. K. Tittel and V. Spagnolo, “*Quartz-enhanced Photoacoustic Sensing Operating in Pure Amplitude and Wavelength Modulation with a 3-section Quantum Cascade Laser*”, PIERS 2017, St. Petersburg, RUSSIA (May 24, 2017).
6. **P. Patimisco**, L. Mihai, M. Giglio, A. Sampaolo, P.P. Calabrese, J.M. Kriesel, D. Sporea, G. Scamarcio, F. K. Tittel, and V. Spagnolo, “*Hollow-core waveguide for single-mode laser beam propagation in the spectral range of 3.7-7.3 μm*”, Photonic West 2016, San Francisco USA - Proc. SPIE Vol. 9755, 97552M1-8 (2016).

10 SELECTED PUBLICATIONS

1. **P. Patimisco**, G. Scamarcio, F.K. Tittel and V. Spagnolo, “Quartz-Enhanced Photoacoustic Spectroscopy: A Review”, Sensors 14, 6165-6206, 2014 (206 citations).
2. V. Spagnolo, **P. Patimisco**, S. Borri, G. Scamarcio, B.E. Bernacki, J.Kriesel, “Part-per-trillion level SF₆ detection using a quartz enhanced photoacoustic spectroscopy based sensor with single-mode fiber-coupled quantum cascade laser excitation”, Optic Letters Vol. 37, 460-462, 2012 (108 citations).
3. S. Borri, **P. Patimisco**, A. Sampaolo, H. E. Beere, D. A. Ritchie, M. S. Vitiello, G. Scamarcio, and V. Spagnolo, “Terahertz quartz enhanced photo-acoustic sensor”, Appl. Phys. Lett. 103, 021105, 2013 (80 citations).
4. S. Borri, **P. Patimisco**, I. Galli, D. Mazzotti, G. Giusfredi, N. Akikusa, M. Yamanishi, G. Scamarcio, P. De Natale and V. Spagnolo, “Intracavity quartz-enhanced photoacoustic sensor” Applied Physics Letters 104, 091114, 2014 (79 citations).
5. **P. Patimisco**, A. Sampaolo, L. Dong, M. Giglio, G. Scamarcio, F. K. Tittel, and V. Spagnolo, “Analysis of the electro-elastic properties of custom quartz tuning forks for optoacoustic gas sensing”, Sensors and Actuators B 227, 539-546, 2016 (73 citations).
6. **Patimisco**, A. Sampaolo, L. Dong, F.K. Tittel, Vincenzo Spagnolo, “Recent advances in quartz enhanced photoacoustic sensing, Appl. Phys. Rev. 5, 011106, 2018 (63 citations).
7. **P. Patimisco**, S. Borri, A. Sampaolo, H. E. Beere, D. A. Ritchie, M. S. Vitiello, G. Scamarcio, and V. Spagnolo, “Quartz enhanced photo-acoustic gas sensor based on custom tuning fork and terahertz quantum cascade laser”, Analyst 139, 2079-2087, 2014 (61 citations).
8. V. Spagnolo, **P. Patimisco**, S. Borri, G. Scamarcio, B.E. Bernacki, J.Kriesel, “Mid-infrared fiber-coupled QCL-QEPAS sensor”, Appl. Phys. B 122, 25-33, 2013 (57 citations).
9. M. Jahjah, W. Kiang, N.P. Sanchez, W. Ren, **P. Patimisco**, V. Spagnolo, S.C. Herndon, R.J. Griffin, F.K. Tittel, “Atmospheric CH₄ and N₂O measurements near Greater Houston area landfills using QCL-based QEPAS sensor system during DISCOVERY-AQ 2013”, Optics Letters 39, 957, 2014. (48 citations).
10. **P. Patimisco**, A. Sampaolo, H. Zheng, L. Dong, F.K. Tittel, V. Spagnolo, “Quartz-enhanced photoacoustic spectrophones exploiting custom tuning forks: a review”, Advances in Physics X 2, 169-187, 2016 (48 citations).

BOOK CHAPTERS

1. **P. Patimisco**, S. Borri, A. Sampaolo, M.S. Vitiello, G. Scamarcio, V. Spagnolo, “Quartz Enhanced Photoacoustic Sensors for Trace Gas Detection in the IR and THz Spectral Range”, THz and

- Security Applications, NATO Science for Peace and Security Series B: Physics and Biophysics, Chapter 8, Pages 139-151 Editors: C. Corsi and F. Sizov, Springer Science+Business Media Dordrecht (2014). ISBN 978-94-017-8828-1
2. V. Spagnolo, **P. Patimisco**, F.K. Tittel, “Quartz-enhanced photoacoustic spectroscopy for gas sensing applications”, in Mid-infrared Optoelectronics Materials, Devices, and Applications 1st Edition– Chapter 15, Pages 597-659. Editors: Eric Tournié, Laurent Cerutti, Elsevier -Woodhead Publishing Series in Electronic and Optical Materials, Paperback ISBN: 9780081027097 – eBook ISBN: 9780081027387.

OTHER PUBLICATIONS

1. G. Menduni, A. Sampaolo, **P. Patimisco**, M. Giglio, S. Dello Russo, A. Zifarelli, A. Elefante, P.Z. Wieczorek, T. Starecki, V.M.N. Passaro, F.K. Tittel and Vincenzo Spagnolo, “Front-End Amplifiers for Tuning Forks in Quartz Enhanced PhotoAcoustic Spectroscopy”, Appl. Sci. 10, 2947 (2020).
2. F. Sgobba, G. Menduni, S. Dello Russo, A. Sampaolo, **P. Patimisco**, M. Giglio, E. Ranieri, V.M.N. Passaro, F.K. Tittel and V. Spagnolo, “Quartz-Enhanced Photoacoustic Detection of Ethane in the Near-IR Exploiting a Highly Performant Spectrophone”, Appl. Sci. 10, 2447 (2020).
3. Y. Ma, S. Qiao, **P. Patimisco**, A. Sampaolo, Y. Wang, F.K. Tittel, V. Spagnolo, “In-plane quartz-enhanced photoacoustic spectroscopy”, Applied Physics Letters 116, 061101 (2020).
4. S. Dello Russo, S. Zhou, A. Zifarelli, **P. Patimisco**, A. Sampaolo, M. Giglio, D. Iannuzzi, V. Spagnolo, “Photoacoustic spectroscopy for gas sensing: A comparison between piezoelectric and interferometric readout in custom quartz tuning forks”, Photoacoustics 17, 100155 (2020).
5. M. Giglio, A. Zifarelli, A. Sampaolo, G. Menduni, A. Elefante, R. Blanchard, C. Pfluegl, M.F. Witinski, D. Vakhshoori, H. Wu, V.M.N. Passaro, **P. Patimisco**, F.K. Tittel, L. Dong, V. Spagnolo, “Broadband detection of methane and nitrous oxide using a distributed feedback quantum cascade laser array and quartz-enhanced photoacoustic sensing”, Photoacoustics 17, 100159 (2020).
6. Y. Ma, Y. He, **P. Patimisco**, A. Sampaolo, S. Qiao, X. Yu, F.K. Tittel, V. Spagnolo, “Ultra-high sensitive trace gas detection based on light-induced thermoelastic spectroscopy and a custom quartz tuning fork”, Applied Physics Letters 116, 011103 (2020).
7. S. Li, H. Wu, R. Cui, A. Sampaolo, **P. Patimisco**, V. Spagnolo, F.K. Tittel, L. Dong, “Piezo-enhanced acoustic detection module for mid-infrared trace gas sensing using a grooved quartz tuning fork”, Optics Express 27, 35267-35278 (2019).
8. Elefante, M. Giglio, A. Sampaolo, G. Menduni, **P. Patimisco**, V. M.N. Passaro, H. Wu, H. Rossmadl, V. Mackowiak, A. Cable, F.K. Tittel, L. Dong and V. Spagnolo, “Dual-Gas Quartz-Enhanced Photoacoustic Sensor for Simultaneous Detection of Methane/Nitrous Oxide and Water Vapor”, Anal. Chem. 91, 12866-12873 (2019).
9. S. Dello Russo, M. Giglio, A. Sampaolo, **P. Patimisco**, G. Menduni, H. Wu, L. Dong, V. M. N. Passaro and V. Spagnolo, “Acoustic Coupling between Resonator Tubes in Quartz-Enhanced Photoacoustic Spectrophones Employing a Large Prong Spacing Tuning Fork”, Sensors 19, 4109 (2019).
10. H. Zheng, H. Lin, L. Dong, Y. Liu, **P. Patimisco**, J. Zweck, A. Mozumder, A. Sampaolo, V. Spagnolo, B. Huang, J. Tang, L. Dong, W. Zhu, J. Yu, Z. Chen, F.K. Tittel, “Influence of Tuning Fork Resonance Properties on Quartz-Enhanced Photoacoustic Spectroscopy Performance”, Sensors 19, 3285 (2019).
11. H. Wu, L. Dong, X. Yin, A. Sampaolo, **P. Patimisco**, W. Ma, L. Zhang, W. Yin, L. Xiao, V. Spagnolo, S. Jia, “Atmospheric CH₄ measurement near a landfill using an ICL-based QEPAS sensor with V-T relaxation self-calibration”, Sens. Act. B Chem. 297, 126753 (2019).
12. S. Li, L. Dong, H. Wu, A. Sampaolo, **P. Patimisco**, V. Spagnolo, F.K. Tittel, “Ppb-Level Quartz-Enhanced Photoacoustic Detection of Carbon Monoxide Exploiting a Surface Grooved Tuning Fork”, Anal. Chem. 91, 5834-5840 (2019).

13. S. Li, L. Dong, H. Wu, X. Yin, W. Ma, L. Zhang, W. Yin, A. Sampaolo, **P. Patimisco**, V. Spagnolo, S. Jia, F.K. Tittel, "Simultaneous multi-gas detection between 3 and 4 μm based on a 2.5-m multipass cell and a tunable Fabry-Pérot filter detector", *Spectrochimica Acta A* 216, 154-160- (2019).
14. M. Giglio, A. Elefante, **P. Patimisco**, A. Sampaolo, F. Sgobba, H. Rossmadl, V. Mackowiak, H. Wu, F.K. Tittel, L. Dong, V. Spagnolo, "Quartz-enhanced photoacoustic sensor for ethylene detection implementing optimized custom tuning fork-based spectrophone", *Optics Express* 27, 4271-4280 (2019).
15. **P. Patimisco**, A. Sampaolo, M. Giglio, S. Dello Russo, V. Mackowiak, H. Rossmadl, A. Cable, F.K. Tittel, V. Spagnolo, "Tuning forks with optimized geometries for quartz-enhanced photoacoustic spectroscopy", *Optics Express* 27, 1401-1415 (2019).
16. M. Giglio, G. Menduni, **P. Patimisco**, A. Sampaolo, A. Elefante, V.M.N. Passaro, and V. Spagnolo, "Damping Mechanisms of Piezoelectric Quartz Tuning Forks Employed in Photoacoustic Spectroscopy for Trace Gas Sensing", *Phys. Status Solidi A*, 216, 1800552 (2019).
17. A. Sampaolo, S. Csutak, **P. Patimisco**, M. Giglio, G. Menduni, V. Passaro, F.K. Tittel, M. Deffenbaugh, V. Spagnolo, "Methane, ethane and propane detection using a compact quartz enhanced photoacoustic sensors and a single interband cascade laser", *Sens. Act. B Chem.* 282, 952-960 (2019).
18. M. Giglio, **P. Patimisco**, A. Sampaolo, A. Zifarelli, R. Blanchard, C. Pfluegl, M.F. Witinski, D. Vakhshoori, F.K. Tittel, and V. Spagnolo, "Nitrous oxide quartz-enhanced photoacoustic detection employing a broadband distributed-feedback quantum cascade laser array", *App. Phys. Lett.* 113, 171101 (2018).
19. **P. Patimisco**, A. Sampaolo, V. Mackowiak, H. Rossmadl, A. Cable, F.K. Tittel, and V. Spagnolo, "Loss Mechanisms Determining the Quality Factors in Quartz Tuning Forks Vibrating at the Fundamental and First Overtone Modes, IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL, 65, 1951-1957 (2018).
20. Q. Wang, Z. Wang, W. Ren, **P. Patimisco**, A. Sampaolo, V. Spagnolo, "Fiber-ring laser intracavity QEPAS gas sensor using a 7.2 kHz quartz tuning fork", *Sens. Act. B Chem.* 268, 512-518 (2018).
21. **P. Patimisco**, A. Sampaolo, M. Giglio, V. Mackowiak, H. Rossmadl, B. Gross, A. Cable, F.K. Tittel, V. Spagnolo, "Octupole electrode pattern for tuning forks vibrating at the first overtone mode in quartz-enhanced photoacoustic spectroscopy", *Optics Letters* 43, 1854-1857 (2018).
22. **P. Patimisco**, A. Sampaolo, F.K. Tittel, Vincenzo Spagnolo, "Mode matching of a laser-beam to a compact high finesse bow-tie optical cavity for quartz enhanced photoacoustic gas sensing", *Sens. Actuators A* 267, 70-75 (2017).
23. M. Giglio, **P. Patimisco**, A. Sampaolo, J. Kriesel, F.K. Tittel and V. Spagnolo, "Low-loss and single-mode tapered hollow-core waveguides optically coupled with interband and quantum cascade lasers", *Opt. Eng.* 57, 011004 (2017).
24. H. Wu, X. Yin, L. Dong, K. Pei, A. Sampaolo, **P. Patimisco**, H. Zheng, W. Ma, L. Zhang, W. Yin, L. Xiao, V. Spagnolo, S. Jia, and Frank K. Tittel, "Simultaneous dual-gas QEPAS detection based on a fundamental and overtone combined vibration of quartz tuning fork", *Applied Physics Letters* 110, 121104 (2017).
25. H. Zheng, L. Dong, **P. Patimisco**, H. Wu, A. Sampaolo, X. Yin, S. Li, W. Ma, L. Zhang, W. Yin, L. Xiao, V. Spagnolo, S. Jia, and F.K. Tittel, "Double antinode excited quartz-enhanced photoacoustic spectrophone", *Applied Physics Letters* 110, 021110 (2017).
26. Y. Bidaux, A. Bismuto, **P. Patimisco**, A. Sampaolo, T. Gresch, G. Strubi, S. Blaser, F.K. Tittel, V. Spagnolo, A. Muller, J. Faist, "Mid infrared quantum cascade laser operating in pure amplitude modulation for background-free trace gas spectroscopy", *Optics Express* 24, 26464-26471 (2016).
27. **P. Patimisco**, A. Sampaolo, Y. Bidaux, A. Bismuto, M. Schott, J. Jiang, A. Muller, J. Faist, F.K. Tittel and V. Spagnolo, "Purely wavelength- and amplitude-modulated quartz-enhanced photoacoustic spectroscopy", *Optics Express* 24, 25943-25954 (2016).
28. H. Zheng, L. Dong, A. Sampaolo, **P. Patimisco**, W. Ma, L. Zhang, W. Yin, L. Xiao, V. Spagnolo, S. Jia, F.K. Tittel, "Overtone resonance enhanced single-tube on-beam quartz enhanced photoacoustic spectrophone", *Applied Physics Letters* 109, 111103 (2016).

29. A. Sampaolo, **P. Patimisco**, M. Giglio, L. Chieco, G. Scamarcio, F.K. Tittel, and V. Spagnolo, “Highly sensitive gas leak detector based on a quartz-enhanced photoacoustic SF₆ sensor”, *Optics Express* 24, 15872-15881 (2016).
30. **P. Patimisco**, A. Sampaolo, L. Mihai, M. Giglio, J. Kriesel, D. Sporea, G. Scamarcio, F.K. Tittel and V. Spagnolo, “Low-Loss Coupling of Quantum Cascade Lasers into Hollow-Core Waveguides with Single-Mode Output in the 3.7–7.6 μm Spectral Range”, *Sensors* 16, 533 (2016).
31. A. Sampaolo, **P. Patimisco**, M. Giglio, M.S. Vitiello, H.E. Beere, D.A. Ritchie, G. Scamarcio, F.K. Tittel and V. Spagnolo, “Improved Tuning Fork for Terahertz Quartz-Enhanced Photoacoustic Spectroscopy”, *Sensors* , 16, 439 (2016).
32. F.K. Tittel, A. Sampaolo, **P. Patimisco**, L. Dong, A. Geras, T. Starecki, and V. Spagnolo, “Analysis of overtone flexural modes operation in quartz-enhanced photoacoustic spectroscopy”, *Optics Express* 24, A682-A692 (2016).
33. H. Zheng, L. Dong, A. Sampaolo, H. Wu, **P. Patimisco**, X. Yin, W. Ma, L. Zhang, W. Yin, V. Spagnolo, S. Jia, and F. K. Tittel, “Single-tube on-beam quartz-enhanced photoacoustic spectroscopy”, *Optics Letters* 41, 978-981 (2016)
34. M. Giglio, **P. Patimisco**, A. Sampaolo, G. Scamarcio, F.K. Tittel and V. Spagnolo, “Allan Deviation Plot as a Tool for Quartz Enhanced Photoacoustic Sensors Noise Analysis”, *IEEE transactions on ultrasonics, ferroelectrics, and frequency control* 63, 555-560 (2016).
35. A. Sampaolo, **P. Patimisco**, L. Dong, A. Geras, G. Scamarcio, T. Starecki, F. K. Tittel, and V. Spagnolo, “Quartz-enhanced photoacoustic spectroscopy exploiting tuning fork overtone modes”, *Applied Physics Letters* 107, 231102 (2015).
36. H. Wu, A. Sampaolo, L. Dong, **P. Patimisco**, X. Liu, H. Zheng, X. Yin, W. Ma, L. Zhang, W. Yin, V. Spagnolo, S. Jia, and F.K. Tittel, “Quartz enhanced photoacoustic H₂S gas sensor based on a fiber-amplifier source and a custom tuning fork with large prong spacing”, *Applied Physics Letters* 107, 111104 (2015).
37. **P. Patimisco**, A. Sampaolo, M. Giglio, J.M. Kriesel, F.K. Tittel and V. Spagnolo, “Hollow core waveguide as mid-infrared laser modal beam filter”, *Journal of Applied Physics* 118, 113102 (2015).
38. V. Spagnolo, **P. Patimisco**, R. Pennetta, A. Sampaolo, G. Scamarcio, M.S. Vitiello and F.K. Tittel, “THz Quartz-enhanced photoacoustic sensor for H₂S trace gas detection”, *Optics Express* 23, pp. 7574-7582 (2015).
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