

**PERSONAL INFORMATION** **Filippo Levi**

 **Affiliation**  
 Istituto Nazionale di Ricerca Metrologica  
 Quantum Metrology and Nanotechnology Division  
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*Gender: Male - Nationality: Italian*

PhD date 1996	<input type="checkbox"/> <b>&lt;10 years</b> from the date of the first PhD	<input checked="" type="checkbox"/> <b>&gt;10 years</b> from the date of the first PhD
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Enterprise	University	EPR
<input type="checkbox"/> Management Level	<input type="checkbox"/> Full professor	<input checked="" type="checkbox"/> Research Director and 1st level Technologist / First Researcher and 2nd level Technologist / Principal Investigator
<input type="checkbox"/> Mid-Management Level	<input type="checkbox"/> Associate Professor	<input type="checkbox"/> Level III Researcher and Technologist
<input type="checkbox"/> Employee / worker level	<input type="checkbox"/> Researcher	<input type="checkbox"/> Researcher and Technologist of IV, V, VI and VII level / Technical collaborator

**WORK EXPERIENCE**

**CURRENT POSITION(S)**  
 from 2016- to present

**Research Director**  
**INRIM**

Head of Time and Frequency Section.

Realization of the SI unit of the second with cryogenic Cs fountain, realization of Italian timescale UTC(IT), development of pulsed Rb cell clock prototypes for space application, time and frequency dissemination through optical fiber link, optical lattice clock.

**CURRENT POSITION(S)**  
 from 2018- to present

**Visiting Scientist**  
**Ben Gurion University of the Negev (Israel)**

Consulting for time and frequency activities

**PREVIOUS POSITION(S)**  
 from 2006- to2016

**Senior Researcher**  
**INRIM**

Head of frequency activity.

Development of CPT clocks with Rb vapour cell. Development of cryogenic Cs fountain, development of Yb optical lattice clock, frequency fiber link.

**PREVIOUS POSITION(S)**  
 from 2004- to2005

**Guest Researcher NIST (14 months)**  
**NIST, Time and frequency Division, Boulder (Co) USA**

Research activity in atomic clocks: Development of the Us and Italian cryogenic Cs fountains

- PREVIOUS POSITION(S)** **Guest Researcher NIST (1 month each year)**  
From 1999 to 2001 **NIST, Time and frequency Division, Boulder (Co) USA**  
Research activity in atomic clocks: Development of the cs fountain
- PREVIOUS POSITION(S)** **Guest Researcher NIST (7 months)**  
1998 **NIST, Time and frequency Division, Boulder (Co) USA**  
Research activity in atomic clocks: laser cooling and Cs fountain realization
- PREVIOUS POSITION(S)** **Researcher**  
from 1995- to2006 **INRIM (before 2005 was Istituto Elettrotecnico Nazionale Galileo Ferraris)**  
Research activity in atomic clocks. Development of microwave clocks.

## EDUCATION AND TRAINING

- 1996 PhD in metrology at Politecnico di Torino, discussing a thesis entitled: "Stabilization of semiconductor laser sources in the near infrared on atomic transitions. Optically pumped atomic frequency standard on 87Rb vapor cell
- 1992 Degree in Physics University of Torino with a mark of 110/110, discussing a thesis entitled: "Contribution of gluons to the structure function  $g_1$  of the proton".

## WORK ACTIVITIES

### Institutional responsibilities

- From 2005 to 2015 Responsible of INRIM frequency activities, and of Italian Cs Fountain Primary Frequency Standard Development and Maintenance.
- 2015 Responsible of INRIM's Optics Division.
- From 2016 to present Head of the Time and Frequency sector of INRIM
- Commission of trust**  
From 2018 to present Evaluator of the research proposals of the research programmes of EURAMET (Jointly funded by EU and participating countries).
- Member of international scientific body**  
From 2015 to present Member of the CCTF (Consultative Committee Time and Frequency) of the CIPM. Within the CCTF: member of the Working group on TAI (Atomic International Time) and WG PSFS (primary and Secondary Frequency Standards). Member of the task force for the redefinition of the second.
- From 2018 to present Italian delegate of EMPIR Committee (steering committee of the Jointly funded by EU and participating countries research program European Metrology Programme Innovation and Research, managed by EURAMET). Within the Committee, elected member of the sub-committee for research
- From 2021 to present Italian delegate of EPM Board of Director (steering committee of Jointly funded by EU and participating countries program European Partnership on Metrology, managed by EURAMET). Within the Committee, elected member of the sub-committee for research.

### Third level formation

- From 2017 to present Member of the Professor Council of the PhD course in Metrology, jointly managed by Politecnico di Torino and INRIM
- From 2018 to present Teacher of the course Foundation of metrology for the third degree formation school of Politecnico di Torino
- Tutor of 6 PhD students: S. Micalizio (researcher at INRIM), D. Calonico (Senior researcher at INRIM), B. Mongino (employed in a private company), M. Pizzocaro (researcher at INRIM), M. Barbiero (Post doc at INRIM), M. Gozellino (Researcher TD at IRIM).

**Organisation of conferences/scientific meetings**

- CPEM 2006, Torino, 2006, member of organizing committee
- BIPM workshop on primary frequency standards, Geneva 2007
- Member of Scientific Committee EFTF 2008-2012
- Member of the organizing committee of the workshop "Modern Problems of Laser Metrology": Lerici 2009.
- Chairman e of the international workshop: Optical clocks: a new frontier in high accuracy metrology. Torino 2010
- Member of the international steering committee of International Symposium on Modern Problems in Laser Physics (Novosibirsk, Russia), 2013
- Member of the Technical Program Committee of the IEEE-Frequency Control Symposium NRIM, December 2012-2016
- Co-Chair of the ICAP's satellite meeting on Optical Clocks. Daejeong (Korea), 2016.
- 38 EFTF Chair of the conference, Torino, 2018.
- 2022-2023, Chair of the Scientific Committee of EFTF

**Major invited presentations**

- A. Godone, F. Levi, J. Vanier, A new atomic frequency standard. The coherent population trapping Cs Maser CPEM 1998 Washington
- Cesium Maser Without Population Inversion, NIST Boulder (Co - USA), May 1998.
- A. Godone, F. Levi, Orologi Atomici LXXXV congresso SIF, Pavia20-24-settembre 1999
- Development of a fountain frequency standard, Polytechnic of Torino, February 1999.
- F. Levi, A. Godone The use of coherent multilevel transitions in atomic frequency standards. 31st PTTI - Dana Point (CA) december 1999
- D. Calonico, A. Godone, F. Levi, L.Lorini Realizzazione di un campione primario di frequenza in Italia LXXXVI congresso nazionale SIF Palermo ottobre 2000
- A. Godone, F. Levi, S. Micalizio and J. Vanier, The CPT Maser, 6th symposium frequency standards and metrology, 2001, St Andrews (UK)
- Aldo Godone, Filippo Levi, Salvatore Micalizio and Jacques Vanier Coherent Population Trapping Based Microwave Clocks International conference on laser Albuquerque December 2000
- Vanier A. Godone, F. Levi, and S. Micalizio Atomic Clocks Based on Coherent Population Trapping: Basic Theoretical Models and Frequency Stability FCS 2003 Tampa.
- Cesium fountain frequency standard, IEN 'G.Ferraris cycle: "Time of Science" - January 2004.
- The Blackbody effect in Cs primary frequency standards, NIST Boulder (Co -USA) December 2004.
- Laser pumping in vapor cell frequency standards: beating the laser noise. Bar-Ilan University, Ramat-Gan (Israel), January 2007.
- Filippo Levi, INRIM Contribution to TAI, Workshop on Primary Frequency Standards, Organized by the CCTF Working Group on Primary Frequency Standards, Geneva Switzerland May 28, 2007
- Frequency Standards at INRIM: toward 10<sup>-16</sup> accuracy, Weizmann Institute of Science, Rehovot (Israel), January 2007.
- Cryogenic Fountain at INRIM, toward 10<sup>-16</sup> accuracy, VII Taller Conjunto de Óptica y Fotofísica - Universidad Tucuman, Tucuman (Argentina), May 2011.
- Time and frequency activity at INRIM, INTI Buenos Aires (Argentina), May 2011.
- Accurate frequency transfer via optical fiber. Implementation and scientific applications. INFN Torino, April 2014.
- Frequency standards: current status and perspectives using nuclear transitions, INFN Legnaro, July 2014.
- Optical clocks: the most accurate measurement of light. SIF celebration of international year of light. Varenna, July 2015.
- Optical clock Development at INRIM, RIKEN, Tokyo, November 2016
- Time moving forward to optical clocks, Ben Gurion University, Beer-Sheva (Israel), November 2016
- 10<sup>-18</sup> accuracy delivered at home: new frontiers in Time-Frequency metrology and timing signal distribution over optical fiber. RBNI colloquium, Technion, Haifa (Israel), November 2016.
- Quantum Metrology for ICT, US-ITALY Working Group on Information & Communication Technology, Embassy of Italy, Washington, DC, December 3rd, 2018
- Quantum Metrology in Time and Frequency, MCQST-Technion Symposium – Garching, 26-27 November 2019
- Current status and future of atomic clocks, Ben Gurion University of the Negev, 2020.
- The Fully Automated Generation of the Italian Time Scale UTC(IT), Workshop of CCTF WG TAI, June 2021
- VCSELs for chip scale atomic clocks Israel Innovation Authority, Technology Park, VCSEL Consortium Annual Meeting 27.10.2021

**Editorial and Reviewing activities**

Reviewer of the following journals: Metrologia, Nature Photonics, IEEE UFFC, Physical review A and Physical Review Letters, Optics Communication.

**ACHIEVEMENTS AND AWARD**

**Awards**

1999 European Frequency and Time and Forum Young Scientist Award, For crucial experiments on dark lines in alkali vapours leading to the development of a cesium maser and other light-shift-free microwave frequency standards

**Grants (last 10 years)**

- INRIM coordinator, EU H2020 Infra-Innov contract "Clonets: CLOck NETwork Services" 2016-2018, € 250 000.
- Coordinator and PI, ASI contract "DTF-GALILEO: Distribution of T/F reference signals through optical fibers for space applications in support of Galileo Timing". 2016-2018, €500 000.
- Coordinator and PI, MIUR National Project LIFT "Italian Link for Time and Frequency" of the Italian Research Ministry. 2012-2014, total amount € 2 719 000.
- PRIN 2015, Responsabile unità INRIM, Hg Doppler Spectroscopy, €250 000
- Coordinator and PI, EU H2020, EMPIR 03FUN17 USOQS: €1 800 000 (2018-2022)
- Coordinator and PI EU QuantERA, Q-Clocks, €1 200 000 (2018-2022)
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**Patents**

2002, granted an Italian and European patent on the realization of a frequency standard based on the CPT Maser. Italian Pat. n° 1303228. Europe Pat. n° 99115824.7  
In 2008, granted a US patent on the realization of a CPT cesium beam.  
US Patent: Atomic Beam Tube with counter optical or atomic beams.  
Publication N° US-2009-0302957

**PUBLICATIONS**

**Bibliometric parameters**

(Scopus) Total number of publications in peer-review journals: 102  
Total number of citations: **4800**  
H index: **32**

**Relevant publications  
(last 10 years)**

1. Pizzocaro, M; Bregolin, F; Barbieri, P; Rauf, B; Levi, F; Calonico, D, Absolute frequency measurement of the S-1(0)-P-3(0) transition of Yb-171 with a link to international atomic time, METROLOGIA, 57, 3, 2020
2. Grotti, J; Koller, S; Vogt, S; Hafner, S; Sterr, U; Lisdat, C; Denker, H; Voigt, C; Timmen, L; Rolland, A; Baynes, FN; Margolis, HS; Zampaolo, M; Thoumany, P; Pizzocaro, M; Rauf, B; Bregolin, F; Tampellini, A; Barbieri, P; Zucco, M; Costanzo, GA; Clivati, C; Levi, F; Calonico, D. Geodesy and metrology with a transportable optical clock, NATURE PHYSICS 14 – 5, 2018
3. Marra, G; Clivati, C; Lockett, R; Tampellini, A; Kronjager, J; Wright, L; Mura, A; Levi, F; Robinson, S; Xuereb, A; Baptie, B; Calonico, D, Ultrastable laser interferometry for earthquake detection with terrestrial and submarine cables, SCIENCE, 361, 6401, 2018
4. Pizzocaro, M; Thoumany, P; Rauf, B; Bregolin, F; Milani, G; Clivati, C; Costanzo, GA; Levi, F; Calonico, D, Absolute frequency measurement of the S-1(0) - P-3(0) transition of Yb-171, METROLOGIA, 54, 1, 2017
5. Livi, LF; Cappellini, G; Diem, M; Franchi, L; Clivati, C; Frittelli, M; Levi, F; Calonico, D; Catani, J; Inguscio, M; Fallani, L, Synthetic Dimensions and Spin-Orbit Coupling with an Optical Clock Transition, PHYSICAL REVIEW LETTERS, 117, 22, 2016
6. Cappellini, G; Mancini, M; Pagano, G; Lombardi, P; Livi, L; de Cumis, MS; Cancio, P; Pizzocaro, M; Calonico, D; Levi, F; Sias, C; Catani, J; Inguscio, M; Fallani, L, Direct Observation of Coherent Interorbital Spin-Exchange Dynamics, PHYSICAL REVIEW LETTERS, 113, 12, 2014
7. Levi, F; Calonico, D; Calosso, CE; Godone, A; Micalizio, S; Costanzo, GA, Accuracy evaluation of ITCsF2: a nitrogen cooled caesium fountain, METROLOGIA, 51, 3, 2014
8. Jefferts, SR; Heavner, TP; Parker, TE; Shirley, JH; Donley, EA; Ashby, N; Levi, F; Calonico, D; Costanzo, GA, High-Accuracy Measurement of the Blackbody Radiation Frequency Shift of the Ground-State Hyperfine Transition in Cs-133, PHYSICAL REVIEW LETTERS, 112, 5, 2014
9. Calonico, D; Bertacco, EK; Calosso, CE; Clivati, C; Costanzo, GA; Frittelli, M; Godone, A; Mura, A; Poli, N; Sutyrin, DV; Tino, GM; Zucco, ME; Levi, F, High-accuracy coherent optical frequency transfer over a doubled 642-km fiber link, APPLIED PHYSICS B-LASERS AND OPTICS, 117, 3, 2014
10. Micalizio, S; Calosso, CE; Godone, A; Levi, F, Metrological characterization of the pulsed Rb clock with optical detection, METROLOGIA, 49, 4, 2012

**Book chapters and  
monographs**

A. Godone, F. Levi, S. Micalizio, Coherent population trapping maser, CLUT, Torino, 2002. ISBN 88-7992-166. Monographie.

*"According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV "*

