

ARGYRIOS DELDIS

Atomic Physicist / Engineer



Personal Information¹

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Summary

Senior Atomic Physicist / Engineer with 10 years of experience and a demonstrated history in developing and building quantum sensors. Experience and expertise in building quantum hardware for atomic clocks, magnetometers and precision quantum sensing. Skilled in laser and mm-wave spectroscopy, atomic and molecular physics, optics, and multi-physics FEM simulations. Experienced in managing different phases of the development. Strong technology professional graduated from University of Crete - Department of Physics holding a PhD in atomic physics and former post-doctoral researcher in the National Institute of Standards and Technology having worked in top level companies and in the R&D semiconductors industry.

Work Experience

2019 - : **Kernel**
 Senior Research Scientist / Physicist

Responsible for developing, testing and characterizing TD-fNIRS sensors for BCI and neuroscience. Designing and performing experimental measurements in order to characterize SPADs, pulsed lasers and optical systems and also to perform RnD that lead in improving the performance of the TD-fNIRS sensors. Besides leading the technical efforts described above, I was also responsible creating models for analyzing data.

Responsible for designing, fabricating and characterizing sensors and systems for MEG based on optically pumped magnetometers (OPMs). These system were developed for next-gen MEG-BCI multichannel system and included fabrication of chip scale alkali vapor cells, complicated optical systems, detailed characterization modeling and assembly of laser systems, design and fabrication of phantoms.

Developed and simulated models of OPMs and scripts for automating data analysis and report generation. Involved in depth and details in every aspect of this project: hardware, modeling, data analysis, planning, organizing and prioritizing task

2017 - **TEXAS INSTRUMENTS - KILBY LABS**

¹ Last update: April 2022

- 2019 *System Engineer*
- Responsible for designing, fabricating and characterizing molecular sensors based on mm-wave technology. Interacting and guiding a highly diverse team of electrical, mechanical, packaging, software and manufacturing engineers and researchers for designing and fabricating mm-wave molecular sensors
- 2013 - : **NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY**
2017 **ATOMIC DEVICES AND INSTRUMENTATION GROUP**
Research Associate (Post-Doc)
- Development of chip scale, passively pumped cold atom systems for use as time standards and inertia sensors. This system will be the platform for the next-gen atomic sensors as it is designed for easier adoption by the industry and is highly compatible with current fabrication techniques for mass production
- (Leader: John Kitching)

Education

- 2008 - : **DEPARTMENT OF PHYSICS, UNIVERSITY OF CRETE**
2013 *PhD*
- THESIS TITLE:** *Quantum Measurements of Spin in Alkali Atoms & Biomolecules*
(supervisor: Prof I.Kominis)
- 2005 - : **DEPARTMENT OF PHYSICS, UNIVERSITY OF CRETE**
2008 *Master of Science*
Graduate Studies in "Microelectronics and Optoelectronics"
- THESIS TITLE:** *Construction of a Cesium Magneto-optical Trap and Non-destructive Temperature Measurement Using Spin Polarization Fluctuations*
(supervisor: Prof I.Kominis)
- 2000 - : **DEPARTMENT OF PHYSICS, UNIVERSITY OF CRETE**
2005 *Bachelor of Science in Physics*
- THESIS TITLE:** *Design and Development of Weak Magnetic Field and First Order Gradient Coils*
(supervisor: Prof I.Kominis)
- 2004 : **DEPARTMENT OF PHYSICS, UNIVERSITY OF CRETE**
- 2006 : **DEPARTMENT OF PHYSICS, UNIVERSITY OF CRETE**
Summer School at Solid State Physics
- 2006 : **LENS - FLORENCE (ITALY)**
Summer School at Quantum Physics and Quantum Information
- 2006 : **LENS - FLORENCE (ITALY)**
Training in magneto optical trapping

2011 : (Group of F. Minardi)
: **CHEMISTRY DEPARTMENT, LEIDEN UNIVERSITY**

Erasmus Study-abroad: NMR techniques

Training

PHD THESIS : During my PhD Thesis I studied experimentally and theoretically a novel effect, the transfer of spin noise from one atomic species to another, through the mechanism of spin exchange. Essentially, we extend the foundational studies of spin exchange into the deeper layer of quantum fluctuations. The signature of spin noise exchange is an increase of the total spin noise power at low magnetic fields where the two-species spin noise resonances overlap. I also studied the dynamics of Radical Pair reactions and proposed a concrete experimental test that can clearly discriminate among the fundamental master equations currently attempting to describe the quantum dynamics of these reactions.

MASTER THESIS : During my Master Thesis I developed the first experiment of atom cooling and trapping in the laboratory of Quantum Technology in the Institute of Electronic Structure and Laser in the Foundation for Research and Technology-Hellas. In particular I developed a Magneto-Optical Trap of Caesium (Cs) atoms. I worked on the development of a new non-destructive method for measuring the temperature of the Magneto-Optical Trap, through spin-noise spectroscopy.

DIPLOMA THESIS : During my Diploma Thesis I designed a system of magnetic coils for the generation of weak magnetic fields (3 homogeneous components and five independent gradients) inside a magnetic shielding. I calibrated the system of coils with a fluxgate magnetometer and a lock-in amplifier. The goal of manufacturing this system of eight coils was the elimination of the remaining magnetic fields inside the magnetic shield and the application of magnetic fields in the μG regime.

Teaching Assistance

2005 : Advanced Physics Laboratory I (winter semester – spring semester)
2006 : Physics Lab II (Electromagnetism) (winter semester – spring semester)
2007 : Physics Lab III (Optics) (winter semester)
2007 : Physics Lab III (Optics) (spring semester)

Technical Qualification

EXPERIMENTAL PHYSICS

- Laser Cooling and Trapping
- Spin Noise Spectroscopy
- Coherent Population Trapping
- Laser Frequency Locking Techniques
- Atomic Magnetometry
- Atomic and Molecular Clocks
- Rotational spectroscopy

- mm-wave (20GHz to sub-THz) spectroscopy
 - design of mm-wave systems for sensing applications
 - NIRS spectroscopy (characterization protocols BIP, MEDPHOT, etc)
- LASERS* : • Design and build of Extended Cavity Diode Lasers
• Design and build of Tapared Amplifier setup
• design and build of optical systems
- ELECTRONICS* : • Photo-diode Amplifiers
• Low Noise Trans-impedance Amplifiers
• Current Sources
• PID feedback circuits
• Low Noise Signal Adder
• Low Noise Differential Amplifier
- VACUUM TECHNIQUES* : • High and Ultra High Vacuum techniques
• passively pumped systems High and Ultra High Vacuum
- GAS CELLS FABRICATION* : • Design and Fabrication of anodically bonded chip scale cells of alkali atoms for atomic spectroscopy, CPT clocks and laser cooling
• Design and Fabrication of hermetically sealed wafer level gas cells containing molecules for sensors
- PROGRAMMING DATA ANALYSIS & SIMULATIONS* : • Python
• Mathematica
• LabView
• PyVISA
• Origin
• IGOR Pro
• Fortran
• Matlab(basic level)
• ANSYS Mechanical FEA
• ANSYS Electromagnetic Simulations (HFSS) (basic level)
• COMSOL (basic level)
- DESIGN & MODELING* : • Solidworks
• Autodesk Inventor
• Adobe Illustrator
• FreeCad
• Blender(basic knowledge)
- WORD PROCESSING* : • LATEX • MS-Office • OpenOffice
- COMPUTER OS* : • Windows • Linux

Honors & awards

2019 Best Conference paper (Texas Instruments: Technical Leadership)

- 2005 Conference)
Manasaki Graduate Scholarship for Excellence in Graduate Studies.
University of
Crete.
- 2004 6th award at the Summer School of Advanced Physics of the Physics
Department,
University of Crete.

Theses

- [Quantum Measurements of Spin in Alkali Atoms & Biomolecules](#)
A. T. Dellis (PhD Thesis, 2013)
- [Construction of a Cesium Magneto-optical Trap and Non-destructive Temperature Measurement Using Spin Polarization Fluctuations](#)
A. T. Dellis (Master Theseis, 2008)
- [Design and Development of Weak Magnetic Field and First Order Gradient Coils](#)
A. T. Dellis (Diploma Thesis, 2005)

Patents

More patents filed in the USPTO and pending for publication.

- 11 Molecular Atomic Clock With Wave Propagating Rotational Spectroscopy Cell
US-2020387115-A1
- 10 Compact millimeter wave system
US-10809668-B2
- 9 Molecular atomic clock with wave propagating rotational spectroscopy cell
US-2020272107-A1
- 8 Millimeter wave chip scale atomic clock
US-2020241480-A1
- 7 Molecular atomic clock with wave propagating rotational spectroscopy cell
WO-2019133985-A1
- 6 Millimeter wave molecular sensor
5US-11119038-B1
- 4 Integrated compact MMW spectroscopy cell system and method
US-10900837-B2
- 3 Background suppression for mm-wave spectroscopy
US-2021199702-A1
- 2 Molecular clock with delay compensation
US-2020257250-A1
- 1 Background suppression for doppler-free mm-wave spectroscopy
US-2021199598-A1

Research Publications

- 12 [Kernel Flux: a whole-head 432-magnetometer optically-pumped magnetoencephalography \(OP-MEG\) system for brain activity imaging during natural human experiences](#)
Ethan J. Pratt et.al, Proc. SPIE 11700, Optical and Quantum Sensing and Precision Metrology, 1170032 (5 March 2021)
- 11 [Laser cooling in a chip-scale platform](#)
J. P. McGilligan, K. R. Moore, A. Dellis, G. D. Martinez, E. de Clercq, P. F. Griffin, A. S. Arnold, E. Riis, R. Boudot, and J. Kitching, Appl. Phys. Lett. 117, 054001 (2020)
- 10 [NIST on a chip with alkali vapor cells: Initial results](#)
J. Kitching *et al.*, 2016 Conference on Precision Electromagnetic Measurements (CPEM 2016), 2016, pp. 1-2
- 9 [Low helium permeation cells for atomic microsystems technology](#)
Dellis, A. T., Shah, V., Donley, E. A., Knappe, S., & Kitching, J, Optics Letters 41(12), 2775.
- 8 [NIST on a Chip with Alkali Vapor Cells: Initial Results](#)
J. Kitching, E. A. Donley, S. Knappe, M. Hummon, A. T. Dellis, S. Kang, Q. Li, D. Westly, B. Roxworthy, V. A. Aksyuk and K. Srinivasan
Conference on Precision Electromagnetic Measurements (CPEM) .
- 7 [NIST on a Chip: Realizing SI units with microfabricated alkali vapour cells](#)
J Kitching, E A Donley, S Knappe, M Hummon, A T Dellis, J Sherman, K Srinivasan, V A Aksyuk, Q Li, D Westly, B Roxworthy and A Lal
Journal of Physics: Conference Series 723(1), 12056.
- 6 [Spin-noise correlations and spin-noise exchange driven by low field spin-exchange collisions](#)
A. T. Dellis, M. Loulakis and I. K. Kominis, Phys. Rev. A 90, 032705.
- 5 [The quantum Zeno effect immunizes the avian compass against the deleterious effects of exchange and dipolar interactions](#)
A.T. Dellis, I.K. Kominis, Biosystems 107, 153 (2012).
- 4 [Photon statistics as an experimental test discriminating between theories of spin-selective radical-ion-pair reactions](#)
A. T. Dellis, I. K. Kominis, Chem. Phys. Lett. 543, 170 (2012).
- 3 [Coherent Triplet Excitation Suppresses the Heading Error of the Avian Compass](#)
G. E. Katsoprinakis, A. T. Dellis and I. K. Kominis, New J. Phys. 12, 085016 (2010).
- 2 [Quantum random number generator based on spin noise](#)
G. E. Katsoprinakis, M. Polis, A. Tavernarakis, A. T. Dellis and I. K. Kominis, Phys. Rev. A 77, 054101 (2008).
- 1 [Measurement of transverse spin-relaxation rates in a rubidium vapor by use of spin-noise spectroscopy](#)
G. E. Katsoprinakis, A. T. Dellis and I. K. Kominis, Phys. Rev. A 75, 042502 (2007).

Conferences

- 14 **SPIE – Photonics West 2017**
January 2017, San Francisco, CA USA
Invited Talk: “Chip Scale MOT for Microsystems Technology”
(A. T. Dellis, Liz Donley, John Kitching)
- 13 **MICRO-PNT PI MEETING 2016**
November 2016, New Orleans, LA USA
- 12 **Frontiers in Optics / Laser Science 2016**
October 2016, Rochester, NY USA
Talk: “Chip Scale MOT for Microsystems Technology”
(A. T. Dellis, M. T. Hummon, S Kang, Liz Donley, John Kitching)
- 11 **12th EUROPEAN CONFERENCE ON ATOMS MOLECULES AND PHOTONS**
September 2016, Frankfurt, Germany
Poster: “Chip Scale MOT for Microsystems Technology”
(A. T. Dellis, M. T. Hummon, S Kang, Liz Donley, John Kitching)
- 10 **8TH SYMPOSIUM ON FREQUENCY STANDARDS AND TECHNOLOGY**
October 2015, Potsdam, Germany
Poster: “Low He Permeation Cells for CSACs”
(A. T. Dellis, M. T. Hummon, Svenja Knappe, Liz Donley, John Kitching)
- 9 **MICRO-PNT PI MEETING 2015**
October 2015, San Diego, CA USA
Poster: “Cold Atom Microsystems Technology”
(A. T. Dellis, Liz Donley, Svenja Knappe, John Kitching)
- 8 **MICRO-PNT PI MEETING 2014**
May 2014, Arlington, VA USA
Poster: “Cold Atom Microsystems Technology”
(A. T. Dellis, Liz Donley, Svenja Knappe, John Kitching)
- 7 **APS MARCH MEETING 2014**
March 2014, Denver CO USA
Talk: “Radical-Ion-Pair Spin Decoherence and the Quantum Efficiency of Photosynthetic Charge Separation”
(I. K. Kominis, A. T. Dellis)
- 6 **HERAKLITUS - 2 WORKSHOP**
December 2012, University of Crete, Greece
Talk: “Quantum Measurements of Spin in Biomolecules and Alkali Vapors”
Poster: “Quantum Dynamics of the Chemical Compass”
(A.T Dellis and I.K Kominis)
- 5 **QUANTUM SCIENCE SYMPOSIUM-2012**
November 2012, Peterhouse, University of Cambridge, UK
Poster: “Quantum Dynamics of the Chemical Compass”
(A.T Dellis and I.K Kominis)
- 4 **SPIN CHEMISTRY MEETING**
May 2011, Noordwijk in The Netherlands
Poster: “Photon Statistics as an experimental test discriminating between theories of spin-selective radical-ion-pair reactions”
(A. T. Dellis and I. K. Kominis)
- 3 **QUANTUM MEASUREMENT AND CHEMICAL SPIN DYNAMICS**
February 2010, Leiden University, Netherlands
- 2 **SPIN CHEMISTRY MEETING**
August 2009, St. Catharines Canada

- 1 Poster: “Explanation of Deuteration Effects in Radical-Ion-Pair Reactions ”
(A. T. Dellis and I. K. Kominis)
ECAMP 9
May 2007, Heraklion, Greece)
Poster: “Quantum random number generator based on spin noise”
(G. E. Katsoprinakis, A. T. Dellis, M. Polis and I. K. Kominis)
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