

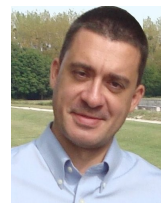
Curriculum Vitae

Iannis K. Kominis

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Research Group Website: <http://www.quantum-technology.gr>



BIOGRAPHICAL DATA

<i>Place - Date of Birth</i>	Athens, Greece – 24/10/1972
<i>High-school</i>	German School of Athens, Dörpfeldgymnasium
<i>Military Service</i>	Greek Air Force, 03/2001 – 03/2002
<i>Languages</i>	Greek (native), English (fluent), German (fluent)

ACADEMIC APPOINTMENTS

<i>01/2012 – 07/2012</i>	Visiting Research Scholar Department of Physics, Princeton University, Princeton, USA.
<i>03/2009 – present</i> <i>11/2003 – 03/2009</i>	Assistant Professor Lecturer Department of Physics, University of Crete, Heraklion, Greece.
<i>11/2002 – 11/2003</i>	Postdoctoral Research Fellow, Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, USA.
<i>03/2002 – 10/2002</i>	Postdoctoral Researcher Department of Physics, Princeton University, Princeton, USA.
<i>09/1996 – 12/2000</i>	Research Assistant, Department of Physics, Princeton University, Princeton, USA.

ACADEMIC EDUCATION

<i>09/1996 – 12/2000</i>	PhD, Physics, Princeton University, USA <i>Thesis Title:</i> Measurement of the Neutron (^3He) Spin Structure at Low Q^2 and the Extended Gerasimov-Drell-Hearn Sum Rule <i>Supervisor:</i> Prof. G. D. Cates
<i>01/1999</i>	US Particle Accelerator School, Vanderbilt University, Nashville, USA
<i>06/1997 – 08/1997</i>	L3 Collaboration, CERN, Geneva, Switzerland
<i>01/1997</i>	US Particle Accelerator School, University of California at Berkeley
<i>09/1990 – 02/1996</i>	BS, MS, Electrical Engineering, National Technical University of Athens, Greece (GPA=8.6/10).
<i>09/1995 – 11/1995</i>	Solid State NMR Group, University of Leipzig, Germany
<i>07/1994</i>	Advanced Physics School, University of Crete, Greece
<i>07/1993</i>	Advanced Physics School, N.C.S.R. “Demokritos”, Athens, Greece

RESEARCH INTERESTS

Production of spin-polarized noble gases (^3He) through spin-exchange optical pumping

High energy polarized electron scattering off polarized ^3He – study of nucleon spin structure

Laser cooling and trapping of radioactive atoms – tests of the electroweak interaction

Ultra-sensitive atomic magnetometers

Spin-noise and spin-squeezing in thermal and ultra-cold alkali-metal vapors

Quantum biology, biochemical magnetometers, quantum measurement theory in biochemical reactions

RESEARCH DESCRIPTION

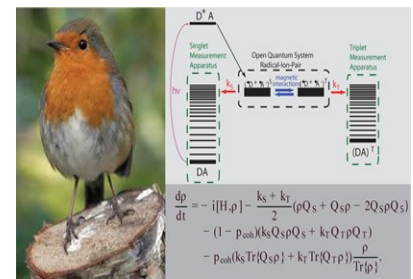
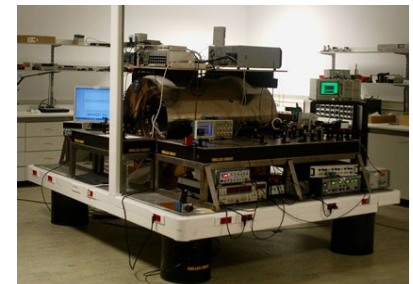
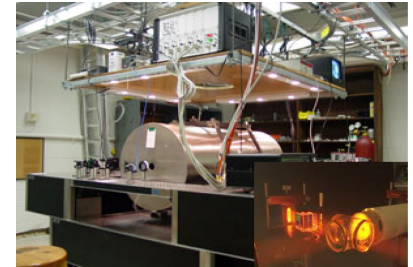
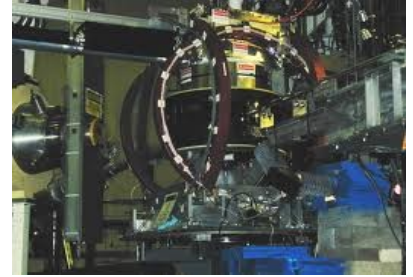
PhD Research at Princeton Under the supervision of Prof. Cates I developed a new polarized ^3He target facility that was used at Thomas Jefferson National Accelerator Facility (TJNAF) for the first low-energy polarized-electron polarized- ^3He scattering experiments, which produced the first tests of QCD sum rules at the theoretically challenging transition regime between the hadronic and the quark degrees of freedom. As a direct result of my efforts, a successful ^3He program was launched at TJNAF, with many other scattering experiments successfully completed.

Postdoctoral Research at Princeton Under the guidance of Prof. Romalis I developed a new atomic magnetometer that has set a record sensitivity in detecting feeble magnetic fields. Its performance has surpassed that of solid state magnetometers (SQUIDs) which have dominated sensitive magnetometry for the last 30 years. As stated by U.C. Berkeley Prof. D. Budker ([Nature 422, 574, 2003](#)), “*The work of Kominis et al. continues a productive tradition in atomic physics of synergy between fundamental and applied science*”.

Postdoctoral Research at Berkeley Under the guidance of Prof. Freedman and Dr. Vetter I worked on laser cooling and trapping of radioactive atoms in order to perform sensitive tests of the Standard Model of weak interactions. In parallel I also worked on a project to laser cool ions in a superconducting Penning trap. The relevant work appears in publications [14] and [15].

Independent PI Research at the University of Crete The Laboratory for Quantum Science and Technology (<http://www.quantum-technology.gr>) is the first laboratory in Greece dealing with experiments in the field of quantum optics and atomic physics. I have made several studies, experimental and theoretical, related to the quantum physics of atomic magnetometers. In particular my work has shed light on one of the main limitations to the sensitivity of these quantum sensors, namely spin noise and its various manifestations.

In recent years I embarked on a new research direction in the emerging field of quantum biology. I have been the first to analyze the dynamics of the chemical (avian) compass mechanism from the perspective of quantum information science and quantum measurement theory, demonstrating that this biochemical sensor exhibits all quantum effects known from fundamental quantum science, and thus introducing a paradigm shift in understanding the basic physics of spin-dependent chemical reactions studied by the field of spin chemistry.



TEACHING AND STUDENT SUPERVISION

Undergraduate Courses taught at the Physics Department, University of Crete

(with representative syllabus and textbooks)

General Physics I

One- and two-dimensional motion, Newton's laws, energy and work, momentum, collisions, rotational motion, angular momentum, gravitation, oscillations and waves, resonance, thermodynamics (Serway, *Physics for Scientists & Engineers*).

General Physics II

Electric field and potential, Gauss law, conductors, capacitors, current, resistance, Kirchoff's law, circuits, magnetic field, charge motion in magnetic field, laws of Biot-Savart, Faraday and Ampere, geometric optics, laws of Snell, Young's experiment (Serway, *Physics for Scientists & Engineers*).

Optics Laboratory

Geometric optics, index of refraction, cavities, polarization, gratings, diffraction, optical activity, microwaves, optical spectroscopy (Hecht, *Optics*)

Advanced Physics Laboratory

Vacuum technology, ferromagnetic hysteresis, Hall effect, Franck-Hertz experiment, photoelectric effect, Zeeman effect, molecular spectroscopy, radiation detectors (A. Melissinos, *Experiments in Modern Physics*)

Quantum Mechanics II

Quantum physics of spin, time-independent perturbation theory, atomic and molecular structure, time-dependent perturbation theory, atom-radiation interaction.

Advanced Electromagnetism

I designed this course with new syllabus, including electromagnetic wave propagation, antennas, radar systems, waveguides, cavities, and introduction to accelerators.

Ph.D. Students

- 1) G. Katsoprinakis, Ph.D. 2010, University of Crete
Spin Noise, Decoherence and Magnetic Effects in Alkali Atoms and Biomolecules
- 2) A. Dellis, Ph.D. Candidate, University of Crete
Spin Quantum Measurements in Alkali Atoms and Biomolecules

RESEARCH GRANTS – PATENTS

- Greek Secretariat for Research and Technology Funding Program 2010, € 45k.
- John Latsis Public Foundation Award 2010, € 12k.
- Marie Curie International Reintegration Grant, € 80k, awarded in January 2004.
- U.S. Patent 7,038,450, with M. V. Romalis, T. W. Kornack, J. C. Allred and R. Lyman, “*High sensitivity atomic magnetometer and methods for using same*”.

PROFESSIONAL SERVICE

- Referee for Physical Review Letters and Physical Review A, ERC, DFG, SNSF.
- Member of Organizing Committee, European Conference on Atoms Molecules & Photons IX (ECAMP 9), May 2007, Heraklion, Greece
- Organization of the 18th Advanced Physics Summer School on Quantum Optics and Quantum Information, July 2006, Heraklion, Greece. Lectured on Laser Cooling and Trapping.

PUBLICATIONS (The journal references are active links)

Number of citations as of 25 April 2012 = 994

h-index=13

QUANTUM BIOLOGY

- [27] Magnetic Sensitivity and Entanglement Dynamics of the Chemical Compass
I. K. Kominis, submitted.
- [26] Photon statistics as an experimental test discriminating between theories of spin-selective radical-ion-pair reactions
A. T. Dellis and I. K. Kominis, submitted.
- [25] The Quantum Zeno Effect Immunizes the Avian Compass Against the Deleterious Effects of Exchange and Dipolar Interactions
A. T. Dellis and I. K. Kominis, [Biosystems 107, 153 \(2012\)](#).
- [24] Radical-ion-pair reactions are the biochemical equivalent of the optical double slit experiment
I. K. Kominis, [Phys. Rev. E 83, 056118 \(2011\)](#).
- [23] Comment on "Spin-selective reactions of radical pairs act as quantum measurements"
I. K. Kominis, [Chem. Phys. Lett. 508, 182 \(2011\)](#).
- [22] Coherent trilet excitation suppresses the heading error of the avian compass
G. Katsoprinakis, A. T. Dellis and I. K. Kominis, [New J. Phys. 12, 085016 \(2010\)](#).
- [21] Quantum Zeno effect explains magnetic-sensitive radical-ion-pair reactions
I. K. Kominis, [Phys. Rev. E 80, 056115 \(2009\)](#).

ATOMIC PHYSICS - QUANTUM PHYSICS

- [20] Quantum Zeno effect in atomic spin-exchange collisions
I. K. Kominis, [Phys. Lett. A 372, 4877 \(2008\)](#).
- [19] 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 \(2008\)](#).
- [18] Sub-shot-noise Magnetometry with a Correlated Spin-Relaxation Dominated Alkali-Metal Vapor
I. K. Kominis, [Phys. Rev. Lett. 100, 073002 \(2008\)](#).

- [17] 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).
- [16] High Frequency Atomic Magnetometer by Use of Electromagnetically Induced Transparency
G. Katsoprinakis, D. Petrosyan and I. K. Kominis, *Phys. Rev. Lett.* 97, 230801 (2006).
- [15] Detecting shake-off electron-ion coincidences to measure beta-decay correlations in laser trapped Na-21
N. D. Scielzo et al., *Nucl. Phys. A* 746, 677c (2004).
- [14] RETrap – a cryogenic Penning ion trap system
S. Toleikis et al., *Nucl. Instrum. Meth. In Phys. Res. B* 235, 479 (2005).
- [13] Sub-femtotesla Multi-channel Atomic Magnetometer
I. K. Kominis, T. W. Kornack, J. C. Allred and M. V. Romalis, *Nature* 422, 596 (2003).

NUCLEAR PHYSICS

- [12] ^3He Spin-Dependent Cross Sections and Sum Rules
K. Slifer et al., *Phys. Rev. Lett.* 101, 022303 (2008).
- [11] Extraction of the neutron magnetic form factor from quasielastic $^3\text{He} \rightarrow (e, e')$ at $Q^2=0.1-0.6$ $(\text{GeV}/c)^2$
B. Anderson et al., *Phys. Rev. C* 75, 034003 (2007).
- [10] Measurement of the Generalized Forward Spin Polarizabilities of the Neutron
M. Amarian et al., *Phys. Rev. Lett.* 93, 152301 (2004).
- [9] Parity-violating electroweak asymmetry in p scattering
K. A. Aniol et al., *Phys. Rev. C* 69, 065501 (2004).
- [8] Basic Instrumentation for Hall A at Jefferson Lab
J. Alcorn et al., *Nucl. Instr. Meth. In Phys. Res. A*, 522, 294 (2004).
- [7] Q^2 evolution of the Neutron Spin Structure Moments using a ^3He target
M. Amarian et al., *Phys. Rev. Lett.* 92, 022301 (2004).
- [6] Plane-wave impulse approximation extraction of the neutron magnetic form factor from quasielastic $^3\text{He}(e, e')$ at $Q^2=0.3$ to 0.6 $(\text{GeV}/c)^2$
W. Xu et al., *Phys. Rev. C* 67, 012201 (2003).
- [5] The Q^2 evolution of the generalized Gerasimov-Drell-Hearn integral for the neutron using a ^3He target
M. Amarian et al., *Phys. Rev. Lett.* 89, 242301 (2002).
- [4] Precision Measurement of the Spin-dependent Asymmetry in the Threshold Region of $^3\text{He}(e, e')$
F. Xiong et al., *Phys. Rev. Lett.* 87, 242501 (2001).

- [3] New Measurement for Parity Violation in Elastic Electron-Proton Scattering and Implications for Strange Form Factors
K. A. Aniol *et al.*, [Phys. Lett. B 509, 211 \(2001\)](#).
- [2] The Transverse Asymmetry A_T from Quasi-elastic ${}^3\text{He}(e,e')$ Process and the Neutron Magnetic Form Factor
W. Xu *et al.*, [Phys. Rev. Lett. 85, 2900 \(2000\)](#).
- [1] Sol-gel coated glass cells for spin-exchange polarized ${}^3\text{He}$
M. F. Hsu *et al.*, [Appl. Phys. Lett. 77, 2069 \(2000\)](#).

PRESENTATIONS

- [32] I. K. Kominis, Stevens Symposium on Quantum Open System and Quantum Information, Department of Physics, Stevens Institute of Technology, May 2012. [oral](#)
- [31] I. K. Kominis, Beckman Institute, University of Illinois at Urbana-Champaign, April 2012. [oral](#)
- [30] I. K. Kominis, Department of Physics, University of Massachusetts Boston, March 2012. [oral](#)
- [29] I. K. Kominis, Department of Physics, Stevens Institute of Technology, March 2012. [oral](#)
- [28] I. K. Kominis, Department of Chemistry, Columbia University, February 2012. [oral](#)
- [27] I. K. Kominis, Department of Physics, Princeton University, February 2012. [oral](#)
- [26] I. K. Kominis, Spin Chemistry Meeting, May 2011, Noordwijk, Netherlands. [oral](#)
- [25] A. T. Dellis and I. K. Kominis, Spin Chemistry Meeting, May 2011, Noordwijk, Netherlands. [poster](#)
- [24] I. K. Kominis, APS March Meeting, March 2011, Dallas USA. [oral](#)
- [23] I. K. Kominis, Workshop on "Quantum Measurement and Spin Dynamics", March 2010, Lorentz Center, Leiden, Netherlands. [oral](#)
- [22] I. K. Kominis, Physics Department Colloquium, University of Crete, October 2009, Heraklion, Greece. [oral](#)
- [21] I. K. Kominis, Spin Chemistry Meeting, August 2009, St. Catharines, Canada. [oral](#)
- [20] A. T. Dellis and I. K. Kominis, Spin Chemistry Meeting, August 2009, St. Catharines, Canada. [poster](#)
- [19] I. K. Kominis, International Conference on Quantum Foundation and Technology, July 2009, Shanghai, China. [oral](#)
- [18] I. K. Kominis, Workshop on Quantum Effects in Biological Systems, July 2009, Lisbon, Portugal. [oral](#)
- [17] I. K. Kominis, Vienna Symposium on the Foundations of Modern Physics, June 2009, Vienna, Austria. [poster](#)
- [16] I. K. Kominis, Max Planck Institute for Quantum Optics Colloquium, June 2009, Garching, Germany. [oral](#)
- [15] I. K. Kominis, Chemistry Department Seminar, University of Fribourg, October 2008, Fribourg, Switzerland. [oral](#)
- [14] I. K. Kominis, Physics Department Seminar, University of Fribourg, October 2008, Fribourg, Switzerland. [oral](#)
- [13] I. K. Kominis, Physics Department Colloquium, University of Crete, April 2008, Heraklion, Greece. [oral](#)
- [12] I. K. Kominis, Seminar at the Department of Photonics, Institute of Physics, Jagiellonian University, June 2007, Cracow, Poland. [oral](#)
- [11] I. K. Kominis, Seminar at the Research Center for Astronomy and Applied Mathematics at the Academy of Athens, May 2007, Athens, Greece. [oral](#)

- [10] G. E. Katsoprinakis, A. T. Dellis, M. Polis and I. K. Kominis, ECAMP 9 Conference, May 2007, Heraklion, Greece. [poster](#)
- [9] I. K. Kominis, Cold Matter Group Seminar, April 2007, Imperial College, London, UK. [oral](#)
- [8] I. K. Kominis, Seminar at the Institut Laue-Langevin, November 2003, Grenoble, France. [oral](#)
- [7] I. K. Kominis, S. J. Freedman, N. D. Scielzo and P. A. Vetter, DAMOP Conference, May 2003, Boulder, USA. [poster](#)
- [6] I. K. Kominis, T. W. Kornack, J. C. Allred and M. V. Romalis, DAMOP Conference, May 2003, Boulder, USA. [oral](#)
- [5] I. K. Kominis, Physics Dept. Colloquium, University of Crete, October 2002, Heraklion, Greece. [oral](#)
- [4] T. Kornack, I. K. Kominis and M. Romalis, International Conference on Atomic Physics, July 2002, Boston, USA. [poster](#)
- [3] I. K. Kominis, GDH-Workshop, June 2000, Mainz, Germany. [oral](#)
- [2] A. Deur and I. K. Kominis, GDH-Workshop, June 2000, Mainz, Germany. [oral](#)
- [1] M. Romalis, I. K. Kominis, W. Happer and B. Saam, DAMOP Conference, May 1998, New Mexico, USA. [poster](#)