



## CURRICULUM VITAE

T. Peter Rakitzis

Born in Chicago, Illinois, U.S.A.

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### EDUCATION AND PROFESSIONAL EXPERIENCE

1988-1992	B.A., Physics (cum Laude), Cornell University
	B.A. Chemistry (Magna cum Laude), Cornell University
1992-1997	Ph.D. (major: Chemistry; minor: Physics), Stanford University, Thesis advisor: Richard N. Zare
1997-1999	Post-doctoral Research Associate (RA), Stanford University
1999-2000	Post-doctoral Research Associate, IESL-FORTH
2001-present	Associated Researcher and Group leader, IESL-FORTH
2001-2006	Lecturer, Department of Physics, University of Crete (UOC)
2006-2011	Assistant Professor, Dept. of Physics, UOC
2011-2016	Associate Professor, Dept. of Physics, UOC
2016-present	Professor, Dept. of Physics, UOC

### RESEARCH HIGHLIGHTS

I have led research efforts, using polarized light, to develop new spectroscopic methods to control and probe matter on the microscopic level, and open the way for novel ultrasensitive measurements. Highlights include:

- Record densities (by factor of  $\sim 10^6$ ) of spin-polarized H and D atoms, *Phys. Rev. Lett.* **121**, 083001 (2018), and proposals for high-signal polarized nuclear fusion experiments at NIF, *Phys. Rev. Lett.* **118**, 233401 (2017).
- Proposals for high-signal Parity Non-Conservation experiments: *Phys. Rev. Lett.* **108**, 210801 (2012) Editors' Suggestion, *J. Phys. B* **52**, 213501 (2019).
- "Evanescent-wave and ambient chiral sensing by signal-reversing cavity-ringdown polarimetry" *Nature* **514**, 76 (2014), demonstrating new applications and limits for optical rotation measurements (Refs. 66, 85, 86).
- Demonstration of cavity-based ellipsometry, for microsecond-resolved interfacial measurements, Ref. 57, 60-1, 67, US patent 8941831].
- First measurement of the complete three-dimensional steric effect in a bimolecular chemical reaction (dependence of reactivity on approach geometry) [F. Wang, *Nature Chemistry* **4**, 636 (2012)]. See Ref. 59.
- Photofragment angular momentum description for polyatomic photodissociation [*JCP* **132**, 224310 (2010)]. [http://jcp.aip.org/editors\\_choices\\_2010](http://jcp.aip.org/editors_choices_2010) and [http://scitation.aip.org/upload/AIP/JCP/JCP\\_80th\\_Anniversary.pdf](http://scitation.aip.org/upload/AIP/JCP/JCP_80th_Anniversary.pdf)
- Proposal and demonstration for the production of spin-polarized atoms and molecules by the time-dependent transfer of polarization from molecular rotational polarization via the hyperfine interaction [T.P. Rakitzis, *Phys. Rev. Lett.* **94**, 83005 (2005)]. See Refs. 37, 43-45, 49, 67, 92,93.
- First observation of the photofragment recoil deflection angle, from the photodissociation of OCS molecules three-dimensionally "fixed-in-space" [Rakitzis et al., *Science* **303**, 1852 (2004)]. See Refs. 29, 31, and 35.
- Production of spin-polarized hydrogen atoms from pulsed molecular photodissociation at high density [Rakitzis et al., *Science* **300**, 1936 (2003)], and pulsed laser-detection (see Refs. 30, 33, 34, 46, 47, and 53).
- First observation of interference in the photofragment orientation from molecular photodissociation [Rakitzis et al., *Science* **281**, 1346 (1998)], showing how the energy dependence gives the most detailed measurement of dissociative states (much better than current ab initio calculations). See Refs. 11-14, 38.

## TEACHING EXPERIENCE

2016-18	Lecturer for Physics 303-4 (Quantum Mechanics I and II)
2010-21	Lecturer for Physics 467 (Atomic & Molecular Physics) U. of Crete (UOC).
2008-21	Lecturer for Physics Laboratories III (Optics), UOC
2006-7	Lecturer for Physics I (Fall semester; Classical mechanics and E&M), UOC. Lecturer for General Chemistry (Spring semester), UOC.
2004-5	Lecturer for Physics Laboratories II (Fall semester; Electromagnetism) and Laboratories III (Spring semester; Optics) UOC
2001-3	Lecturer for Physics I (Fall semester; Class. mechanics and E&M), UOC. Lecturer for Physics II (Spring semester; Modern Physics), UOC.
1992-7	Head Teaching Assistant, Stanford University, Chem. 273 & 31; T.A., Stanford University, Chem. 33 & 31, Cornell University, Chem. 208.

## STUDENTS AND POSTDOCS

Konstantinos Tazes (2022)  
Michalis Koutrakis M.S. (2022)  
Eirini Toutoudaki M.S. (2021)  
Michalis Xygkis PhD (2020-), M.S. (2020)  
Mr. Chrysovalantis Kannis Ph.D. (2017-), M.S. (2016-7)  
Katerina Stamataki Ph.D. (2011-)  
Dr. Alexandros Spiliotis Ph.D. (2014-2020), M.A. (2012-4)  
Dr. Dimitris Sofikitis, Ph.D. (2006-2010), M.S. (2004-6), postdoc (2011-9).  
Lykourgos Bougas Ph.D. (2007-13). Awarded top PhD award at UOC for 2014.  
Dr. Anna Karaiskou Ph.D. (2002-2007)  
Co-supervised PhDs: Vassiliki Bolpasi (2014), Grigoris Konstantinidis (2012), Melina Papa (2011).  
Dr. Giorgios Katsoprinakis, postdoc (2010-)  
Dr. Jann Kruse, postdoc (2011-2)  
Dr. Luis Rubio-Lago, postdoc (2004-2006)  
Dr. Antonis Koubenakis, postdoc (2005-2007)

## RESEARCH GRANTS (principal investigator), Total funding ~ 3.5 MEu

- Greek Ministry of Education, Program P.EN.E.D. (2004-2007), 90 kEu., funding two Ph.D. students for three years, for applications of Polarization-Dependent Cavity Ring-down Spectroscopy.
- General Secretariat of Research and Technology (G.S.R.T.) of Greece, Program PYTHAGORAS (2004-2005), 70 kEu., for the development of the laser-detection of spin-polarized hydrogen, and applications.
- General Secretariat of Research and Technology of Greece, Program for Scientific collaboration between Greece and Russia (2005-2006), 12 kEu., between the groups of T.P. Raktizis and O.S. Vasyutinskii at the Ioffe Institute in St. Petersburg.
- G.S.R.T. of Greece, Program for Scientific collaboration between Greece and the USA (2006-2008), 60 kEu., between groups of T.P. Raktizis and R.N. Zare at Stanford University.
- European Research Council (ERC) Grant, (2009-2014), 910 kEu., “Time-resolved Ring-Cavity-Enhanced Polarization Spectroscopy (TRICEPS)”.
- Marie Curie Training Network Grant, (2009-2013), 200 kEu., “Imaging and Control in Chemistry (ICONIC)”.
- Marie Curie Industry-Academia Partnership and Pathways (IAPP), Grant, (2010-2014), 500 kEu., “SOPRALAB-FORTH Partnership (SOFORT)”.
- Greek Ministry of Education, Program Herakleitos, (2011-2014), 90 kEu., for Cavity-enhanced Polarimetry.
- European Research Council, Proof-of-Concept (PoC) Grant (BIOCARDE), (2012-2013), 150 kEu., for the construction of a precommercial, microsecond-resolved evanescent-wave cavity ring-down ellipsometer.
- European Research Council, Proof-of-Concept (PoC) Grant (CHIRALSENSE), (2015-2016), 150 kEu., for the construction of a precommercial, cavity-ring-down chiral polarimeter.

- ERA-NET, “Portable cavity-enhanced polarimeter for chiral sensing of gases and liquids” (EPOCHSE), (2016-2019), 100 kEu.
- EU H2020 FET-Open, “Ultrasensitive chiral detection by signal-reversing cavity polarimetry: applications to in-situ proteomics, single molecule chirality, HPLC analysis, medical diagnostics, and atmospheric studies” (ULTRACHIRAL), (2017-2021), 722 kEu.
- General Secretariat of Research and Technology of Greece, EL.ID.E.K., “Chirality Amplification and Detection using Cavity Optical Rotation Enhancement” (HANDCORE), (2018-2021), 200 kEu.
- General Secretariat of Research and Technology of Greece, EL.ID.E.K., “Nuclear-spin polarization through molecular laser excitation: from nuclear fusion to NMR enhancement” (NUPOL), (2020-2023), 200 kEu.

## INVITED TALKS

- “Reagent and product polarization in the reactions of atomic chlorine with methane and ethane”, Stereodynamics of Chemical Reactions, December 1996, Bielefeld, Germany.
- “Reagent and product alignment in the reactions of atomic chlorine with methane and ethane”, ACS, April 1997, San Francisco, CA, USA.
- “Multiple-surface wavepacket interference effects in the orientation and alignment of the  $\text{Cl}(^2\text{P}_{3/2})$  polarization from the photolysis of  $\text{ICl}$ ”, XXIII Informal Conference on Photochemistry, May 1998, Pasadena, CA, USA.
- “Photodissociation, interference, and spin-polarized hydrogen atoms”, Stereodynamics of Chemical Reactions, December 2002, Schoorl, the Netherlands.
- “Spin Polarized Hydrogen Atoms from Molecular Photodissociation”, Physical Chemistry Seminar, January 27<sup>th</sup> 2003, Stanford University, CA, USA.
- “Spin Polarized Hydrogen Atoms from Hydrogen Halide Photodissociation”, International Conference on the Dynamics of Molecular Systems (MOLEC04), September 5-10 2004, Nunspeet, the Netherlands.
- “Pulsed-Laser preparation of highly polarized atoms”, XXth Conference on the Dynamics of Molecular Collisions (DMC2005), July 10-15 2005, Asilomar, CA, USA.
- “Pulsed-Laser preparation of polarized atoms”, CCP6 Workshop on Vector Correlation and Alignment in Chemistry, July 24-27 2005, Bristol, UK.
- “Pulsed-Laser production of spin-polarized atoms and molecules”, Workshop on Two colour experiments at synchrotron radiation sources: present and future, November 10-11 2005, ELLETRA Trieste, Italy.
- “New methods in the production and detection of spin-polarized hydrogen”, May 6-11 2007, (9<sup>th</sup> European Conference on Atoms, Molecules, and Photons (ECAMP IX), Hersonissos, Greece.
- “New directions opened by cavity-enhanced ellipsometry”, June 16-18 2008, (1<sup>st</sup> International conference from Nanoparticles and Nanomaterials to Nanodevices and Nanosystems (IC4N), Halkidiki, Greece.
- “Laser-detection of spin-polarized hydrogen: The effect of parent molecule rotation”, October 13-18 2008, Stereodynamics of Chemical Reactions, Dalian, China.
- “New Frontiers of Polarization Spectroscopy: from Coherent Dynamics to Microsecond-Resolved Ellipsometry”, Physical Chemistry Seminar, July 6<sup>th</sup> 2009, Cambridge University, UK.
- “Coherent effects in Polyatomic photodissociation”, October 28<sup>th</sup> - November 3<sup>rd</sup> 2010, Stereodynamics of Chemical Reactions, Santa Cruz CA, USA.
- “Ultra-high-density spin-polarized hydrogen atoms from molecular photodissociation”, Feb. 14 2011, Max Planck Institute for Biophysical Chemistry, Göttingen, Germany.
- “Chiral Cavity Ring-Down”, Sep. 9-14 2012, European Conference on the Dynamics of Molecular Collisions (MOLEC), Oxford, UK.
- “Cavity-Enhanced Optical Rotation with Signal Reversals: Ultrasensitive Measurement of Chirality”, June 20<sup>th</sup> 2013, Atomic Physics Seminar, Department of Physics, University of Notre Dame.
- “Applications of chiral cavity ring down, and production of long-lived nuclear singlet states”, August 16-23 2014, Stereodynamics of Chemical Reactions, St. Petersburg, Russia.
- “Chiral Cavity-Enhanced Polarimetry”, November 6-11 2016, Stereodynamics of Chemical Reactions, Taipei, Taiwan.

- “Cavity-based chiral polarimetry: Towards atomic parity nonconservation measurements”, March 6-10 2017, AMOP-DPG (Spring Meeting), Mainz, Germany.
- “Cavity Ring-Down polarimetry”, June 12-15 2017, 12th International User Meeting on Cavity Enhanced Spectroscopy (CES2017), Egmond aan Zee, Netherlands.
- “Spin-polarized hydrogen isotopes from UV molecular photodissociation, and nuclear-spin-polarized molecules from IR rovibrational excitation followed by hyperfine beating”, October 2-3 2017, Polarized Fuel for Fusion at INFN and Unife Of Ferrara, Ferrara, Italy. <http://www.fe.infn.it/polfusion/2017/>
- “Nuclear-spin-polarized hydrogen isotopes from UV molecular photodissociation, for polarized laser fusion experiments”, International Conference on Extreme Light (ICEL-2017), November 5-9 2017, Szeged, Hungary.
- “High-density spin-polarized H and D from UV photodissociation, and spin-polarized molecules from IR rovibration excitation”, International Conference on Nuclear Hyperpolarization (HYP18), September 2-5 2018, Southampton, UK. <https://generic.wordpress.soton.ac.uk/hyp18/>
- “Optical excitation of molecules for Spin-Polarized Nuclear Fusion”, September 10-14 2018, 23rd International Spin Symposium, Ferrara, Italy. <http://spin2018.unife.it/>
- “Measurement of Chirality Using Optical Cavities”, February 14th 2019, Science Forum, Chapman University, Orange CA, USA. <https://events.chapman.edu/61815>
- “From chiral cavity polarimetry, to ultrahigh-density spin-polarized hydrogen”, August 25-29 2019, American Chemical Society (ACS) National Meeting (Fall), San Diego, USA. <https://acsanalytical.org/wp-content/uploads/2019/07/258-ANYL-Final-Program.pdf>
- “A Nanosecond-resolved Ultrahigh-density Spin-polarized Hydrogen Magnetometer” June 21-25 2021, [International Symposium on Molecular Spectroscopy \(online\)](#).
- “Applications of Cavity-based Polarimetry”, 12th International Workshop on Quantum Effects in Biological Systems, June 6-10, 2022, Heraklion, Crete. <https://www.quebs.gr/>
- “Applications of Cavity-based Polarimetry”, June 14-17 2022, 14th International User Meeting on Cavity Enhanced Spectroscopy (CES2022), Lecco, Italy. <https://www.ces2022.lecco.polimi.it/>

## **PATENTS**

- 1) US Patent number: 8,941,831, for a cavity-enhanced time-dependent ellipsometer: “Intra-cavity ellipsometer system and method”.
- 2) US Patent number: 9,702,812, titled “Cavity enhanced polarimeter and related methods”, for cavity-based chirality measurements.
- 3) US Patent number: 9,903,805, titled “Cavity enhanced polarimeter and related methods”, for cavity-based chirality measurements.

## **INTERNATIONAL COLLABORATIONS**

- 1) Prof. Maurice Janssen, Vrije Universiteit, Amsterdam, (8 papers).
- 2) Dr Andrew Alexander, University of Edinburgh, (8 papers).
- 3) Prof. Richard N. Zare, Stanford University, (6 papers, since appointment at UOC).
- 4) Prof. Michael Everest, Westmont College (4 papers).
- 5) Prof. David Parker, University of Nijmegen, (3 papers).
- 6) Prof. Victor Flambaum, and Dr. Vladimir Dzuba, University of New South Wales (3 papers).
- 7) Prof. Jonathan Sapirstein, Notre Dame (2 paper).
- 8) Prof. Dmitry Budker, Berkeley and Mainz (1 paper).
- 9) Prof. Claire Vallance, University of Oxford, paper (1 paper).
- 10) Prof. Gabriel Balint-Kurti, Bristol University, Prof. Al Brown, University of Alberta, Prof. J. Alberto Beswick, Toulouse, Dr Oleg Vasyutinskii, Ioffe Institute, St. Petersburg (1 paper).
- 11) Dr Kopin Liu, Academia Sinica (1 papers).
- 12) Dr Greg Hall, Brookhaven National Laboratory, (1 paper).
- 13) Jean-Louis Stehle, Sopralab Paris (1 paper).
- 14) Dr Andreas Osterwalder, EPFL (1 paper).