

Andreas D. Lyras
Associate Professor
Dept. of Physics & Astronomy
King Saud University, Riyadh, KSA
Tel.: X-76373 ; 0558297930
e-mail: alyras@ksu.edu.sa

PERSONAL INFORMATION:

Place/ Date of birth: Athens, Greece; 2/4/1958
Nationality: Greek
Marital Status: Married; 2 children

EDUCATION / SCIENTIFIC CAREER:

6/1987: Master's Degree in Physics, Dept. of Physics, Univ. of Crete, Heraklion, Crete, Greece
7/1988: Ph. D. in Theoretical Atomic Physics, Dept. of Physics, Univ. of Crete, Heraklion, Crete, Greece
Dissertation title : 'Rydberg Series of Autoionizing States in Strong Laser Fields'
Supervisor: Prof. P. Lambropoulos

9/1988 – 9/1989: Postdoctoral Fellow, Dept. of Physics, Univ. of Southern California, California, USA.
9/1991 – 8/1992: Research Associate, Max-Planck Institute for Quantum Optics, Garching, Germany
1/1993 – 12/1993: Research Scientist, Institute of Theoretical and Physical Chemistry, Hellenic Research Foundation, Athens, Greece
1/1994 – 5/1998: Tenure-track Assistant Professor, Physics Dept., Univ. of Ioannina, Ioannina, Greece
5/1998 – 9/2006: Tenured Assistant Professor, Physics Dept., Univ. of Ioannina, Ioannina, Greece
9/2006 – 9/2016: Associate Professor, Physics Dept., Univ. of Ioannina, Ioannina, Greece
9/2012 – today: Associate Professor, Dept. of Physics & Astronomy, College of Science, King Saud University, Riyadh, KSA

RESEARCH INTERESTS:

- spectroscopy of autoionizing states of alkaline earth atoms
- multiphoton excitation/ionisation processes (perturbative & non-perturbative) in one- and two-active-electron atoms
- non-linear optical processes in one- and two-active-electron atoms (e.g. four-wave mixing, harmonic generation)
- coherent quantum control of ionization and autoionization.
- Multiphoton processes in spatially confined atomic systems (endohedrals)
- Intense, short pulse interaction with polyatomic molecules
- Negative-refractive-index properties of few level systems induced by laser fields.
- Interaction of ultrashort XUV pulses with atoms – XUV non-linear optics
- Interaction of few-level atoms with surface Plasmon fields.
- SPASER in hybrid nanostructured systems

- Optical lattices ; quantum gates on optical lattices of particular geometry
- Interaction of OAM-carrying beams with one- and multi-electron atoms

PUBLICATIONS (in refereed journals)

1. **A. D. Lyras**, J. Roumeliotis, J. Kanellopoulos, and J. Fikioris, " Analysis of the hybrid modes for an eccentrically cladded fiber", IEEE Tran. On Microwave Theory and Techniques, MTT-31, 945 (1983).
2. A. Dohdy, J. A. D. Stockdale, R. N. Compton, X. Tang, P. Lambropoulos, and **A. Lyras**, "Two-photon resonant three-photon ionization of the nd 2D_J states of cesium, rubidium and sodium: Photoelectron angular distributions", Phys. Rev. A 35, 2878 (1987).
3. **A. Lyras**, B. Dai, X. Tang, and P. Lambropoulos, A. Dohdy, J. A. D. Stockdale, D. Zei, and R. N. Compton, " Multiphoton ionization of cesium via quadrupole transitions: Photoelectron angular distributions and polarization effects on total ionization rates", Phys. Rev. A 37, 403 (1988).
4. P. Lambropoulos and **A. Lyras**, "Theory of resonant ionization by broadband radiation in the determination of isotopic abundances", Phys. Rev. A 40, 2199 (1989).
5. X. Tang, **A. Lyras**, and P. Lambropoulos, "Dynamics of resonances rapidly shifting under strong laser pulses", Phys. Rev. Lett. 63, 972 (1989).
6. **A. Lyras**, X. Tang, P. Lambropoulos, and J. Zhang, " Radiation amplification through autoionizing resonances without population inversion", Phys. Rev. A 40, 4131 (1989) ; *ibid.* 44, 796 (1991) (Erratum).
7. **A. Lyras**, " Rydberg series of autoionizing resonances in strong laser fields", Zeit. f Physik D 15, 3 (1990).
8. D. Charalambidis, **A. Lyras**, P. Lambropoulos, X. Tang, S. J. Bajic, and R. N. Compton, "Collisional relaxation of the $6s[3/2]_1^0$ and $6s'[3/2]_1^0$ m_j levels of xenon using resonantly enhanced multiphoton ionization", Phys. Rev. A 41, 1457 (1990).
9. X. Tang, **A. Lyras**, and P. Lambropoulos, "The many faces of resonances in multiphoton ionization", J. Opt. Soc. Am. B 7, 456 (1990).
10. **A. Lyras**, B. Zorman, And P. Lambropoulos, " Theory of doubly resonant ionization by broad-band radiation applied to the determination of isotopic abundances" Phys. Rev. A 42, 543 (1990).
11. H. Bachau, **A. Lyras**, and P. Lambropoulos, "On the possibility of radiation amplification through multiphoton pumping of autoionizing states", Opt. Comm. 83, 331 (1991).
12. **A. Lyras**, X. Tang, and P. Lambropoulos, "Radiation amplification in free-bound transitions through incoherent multiphoton pumping and stimulated recombination", Opt. Comm. 92, 355 (1992).
13. S. Dionissopoulou, Th. Mercouris, **A. Lyras**, Y. Komninos, and C. A. Nikolaides, " High-order harmonic generation and ATI in H : Calculations using expansions over field-free state-specific wavefunctions", Phys. Rev. A 51, 3104 (1995).
14. S. Dionissopoulou, **A. Lyras**, Th. Mercouris, and C. A. Nikolaides," High-order Above threshold Ionization Spectrum of Hydrogen and Photoelectron Angular Distributions", J. Phys. B 28, L109 (1995) ; *corrigendum J. Phys. B* 28, 4005 (1995).
15. A. Bolovinos, E. Luc-Koenig, S. Assimopoulos, **A. Lyras**, N. E. Karapanagioti, D. Charalambidis, and M. Aymar, " $4pnp$ $J=0^e-2^e$ autoionizing series in calcium: experimental and theoretical analysis", Z. Phys.D 38, 265-277 (1996).

16. A. Bolovinos, S. Cohen, **A. Lyras**, C. Skordoulis, T. Mikropoulos and S. Assimopoulos, "Non-linear Optical Phase Conjugation by Degenerate Four-Wave Mixing in Ca vapour", *Appl. Phys. B* **64**, 451-458 (1997).
17. S. Dionissopoulou, Th. Mercouris, **A. Lyras**, and C. A. Nikolaides, "Strong laser field effects in Hydrogen : High-order above-threshold ionization and photoelectron angular distributions", *Phys. Rev. A* **55**, 4397-4406 (1997).
18. E. Luc-Koenig, **A. Lyras**, J. -M. Lecomte, and M. Aymar, "Eigenchannel R-matrix study of two-photon processes including above threshold ionization in magnesium" *J. Phys. B: At. Mol. Opt. Phys.* **30**, 5213-5232 (1997).
19. S. Cohen and **A. Lyras**, "Phase Conjugation by Degenerate Four Wave Mixing via Autoionizing States" *J. Opt. Soc. Am. B* **15**, 1069 (1998).
20. E. Luc-Koenig, M. Aymar, J. -M. Lecomte, and **A. Lyras**, "Eigenchannel R-matrix study of two-photon excitation of low-lying autoionizing states in strontium: dielectronic core-polarization effects", *J. Phys. B: At. Mol. Opt. Phys.* **31**, 727 (1998).
21. S. Assimopoulos, A. Bolovinos, E. Luc-Koenig, S. Cohen, **A. Lyras**, P. Tsekeris and M. Aymar, "3dnd J=4,5 autoionizing levels in Ca: laser optogalvanic spectroscopy and theoretical analysis", *Eur. Phys. J. D* **1**, 243 (1998).
22. E. Luc-Koenig, M. Aymar, J.-M. Lecomte, and **A. Lyras**, "R-matrix calculations of Raman couplings and dynamical Stark shifts in heavy alkaline earth atoms", *Eur. Phys. J. D* **7**, 487 (1999).
23. **A. Lyras** and H. Bachau, "Multiple phase control in Mg through the continuum", *Phys. Rev. A* **60**, 4781(1999).
24. E. Luc-Koenig, M. Aymar, M. Millet, J.-M. Lecomte, and **A. Lyras**, "Ionization of barium through a coherent excitation of two bound intermediate states", *Eur. Phys. J. D* **10**, 205 (2000).
25. S. Cohen and **A. Lyras**, "Phase conjugation through autoionizing states: a density matrix approach", *J. Phys. B: At. Mol. Opt. Phys.* **37**, 1025 (2004).
26. I. Lontos, A. Bolovinos, S. Cohen and **A. Lyras**, "Single and double ionization of magnesium via four-photon excitation of the $3p^2\ ^1S_0$ autoionizing state: Experimental and theoretical analysis", *Phys. Rev. A* **70**, 033403 (2004).
27. **A. Lyras** and H. Bachau, "Electronic Correlation Effects in a model of endohedral Mg ($Mg@C_{60}$)" *J. Phys. B: At. Mol. Opt. Phys.* **38**, 1119 (2005).
28. P. Siozos, S. Kaziannis, C. Kosmidis, **A. Lyras**, "Ionization/dissociation processes in some alkyl iodides induced by strong picosecond laser beam" *Int. J. Mass Spectrometry* **243**, 189 (2005).
29. C. Kosmidis, S. Kaziannis, P. Siozos, **A. Lyras**, L. Robson, K. W .D. Ledingham, D. A. Jaroszynski, "Molecular hydrogen ion elimination from alkyl iodides under strong laser beam irradiation" *Int. J. Mass. Spectrometry* **248**, 1 (2006).
30. N. Merlemis, **A. Lyras**, M. Katharakis, and T. Efthimiopoulos, "Amplified spontaneous emission without population inversion in potassium vapour by internally generated fields", *J. Phys. B: At. Mol. Opt. Phys.* **39** No 8 (28 April 2006) 1913-1927
31. I. Lontos, A. Bolovinos, S. Cohen, **A. Lyras**, S. Benec'h and H. Bachau, "Two-photon ionization of Calcium above the $4S_{1/2}$ threshold ", *J. Phys. B: At. Mol. Opt. Phys.* **39** No 12 (28 June 2006) 2693-2708.
32. C. Kosmidis, S. Kaziannis and **A. Lyras**, "Alignment of ethyl Halide Molecules ($C_2H_5X, X=I, Br, Cl$) induced by strong picosecond laser irradiation", *J. Phys. Chem. A* **112**, 4754 – 4764 (2008).
33. I. Lontos, S. Cohen, **A. Lyras**, "Multiphoton Ca^{2+} production occurring before the onset of Ca^+ saturation: is it a fingerprint of direct double ionization?", *J. Phys. B: At. Mol. Opt. Phys.* **43** (2010) 095602.

34. A. Dimitriou, S. Cohen and **A. Lyras**, “Energy dependence of photoelectron angular distributions from two- and four-photon ionization of Mg in the vicinity of the $3p^2\ ^1S_0$ doubly excited state”, *J. Phys. B: At. Mol. Opt. Phys.* **44** (2011) 135001.
35. A. Armyras, D. Pentaris, T. Efthimiopoulos, N. Merlemis and **A. Lyras**, “Saturation and population transfer of a two-photon excited four-level potassium atom”, *J. Phys. B: At. Mol. Opt. Phys.* **44** (2011) 165401.
36. D. Pentaris, T. Efthimiopoulos, N. Merlemis and **A. Lyras** “Temporal dynamics of the internally generated radiations in a two-photon excited four-level potassium atom” *J. Mod. Opt.* **56** (2012) 179.
37. D. Pentaris, T. Efthimiopoulos, N. Merlemis, V. Vaičaitis and **A. Lyras**, “Emissions from high density potassium atoms excited by either nanosecond or femtosecond laser pulses”, *App. Phys. B* **107** (2012) 71.
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39. A. Dimitriou, S. Cohen, **A. Lyras** and I. Lontos, “Strong laser-induced coupling between autoionizing states: the case of the four-photon-excited $3p^2\ ^1S_0$ state of magnesium” *J. Phys. B: At. Mol. Opt. Phys.* **45** (2012) 205003
40. D. Pentaris, G. Papademetriou, T. Efthimiopoulos, N. Merlemis and **A. Lyras**, “Emissions enhancement in a pump-coupling V-type coherently controlled four-level atomic system” *J. Mod. Optics* **60** (2013) pp. 1855 - 1868
41. V. E. Lembessis, A. Lyras, A. A. Rashed, O. M. Aldossary, and Z. Ficek, “Radiation pattern of two identical emitters driven by a Laguerre-Gaussian beam: An atom nanoantenna” *Phys. Rev. A* **92** (2015) 023850
42. Mateusz Łacki, Hannes Pichler, Antoine Sterdyniak, **Andreas Lyras**, Vassilis E. Lembessis, Omar Al-Dossary, Jan Carl Budich, and Peter Zoller, “Quantum Hall physics with cold atoms in cylindrical optical lattices” *Phys. Rev. A* **93** (2016) 013604
43. D. Pentaris, D. Damianos, G. Papademetriou, **A. Lyras**, K. Steponkevičius, V. Vaičaitis, and T. Efthimiopoulos, “Coherently controlled emissions $|4P_{3/2,1/2}\rangle \leftrightarrow |4S_{1/2}\rangle$ from a femtosecond Λ -type excitation scheme in potassium atom” *J. Mod. Optics* **63** (2016) pp. 1301 – 1312
44. Anwar Al Rashed, **Andreas Lyras**, Vassilis E. Lembessis and Omar M. Aldossary, “Guiding of atoms in helical optical potential structures” *J. Phys. B: At. Mol. Opt. Phys.* **49** (2016) 125002
45. Anwar Al Rashed, **Andreas Lyras**, Omar M. Aldossary, Vassilis E. Lembessis, “Rotating optical tubes for vertical transport of atoms” *Phys. Rev. A* **94** (2016) 063423
46. G. Papademetriou, D. Pentaris, T. Efthimiopoulos and **A. Lyras**, “Dynamic emission and population control in a Λ -type excitation scheme of atomic potassium” *J. Phys. B: At. Mol. Opt. Phys.* **50** (2017) 125401
47. M. Tohari, **A. Lyras**, and M. Alsalihi, “Giant self-Kerr nonlinearity in the metal nanoparticles-graphene nanodisks-quantum dots hybrid systems under low-intensity light irradiance” *Nanomaterials (Basel, Switzerland)* **8**, no. 7, 521 (2018)
48. M. Tohari, **A. Lyras**, and M. Alsalihi, “Ultrafast energy transfer in the metal nanoparticles-graphene nanodisks-quantum dots hybrid systems” *Plasmonics*, **14**, 17-24 (2019)
49. Vassilis E. Lembessis, Anwar Al Rashed, **Andreas Lyras**, and Omar M. Aldossary, “Dark state atom mirrors based on artificial gauge fields

- created by surface optical vortices*" *J. Opt. Soc. Am. B* **36** (no. 4), 971 (2019)
50. Jakub Bělin, V. E. Lembessis, **A. Lyras**, O. Aldossary, and Johanness Courtial, "**Arrays of dark optical traps on a toroidal surface**" *Phys. Rev. A* **99**, 013841 (2019)
 51. M. M. Tohari, M. M. Alqahtani and **A. Lyras**, "**Optical Multistability in the Metal nanoparticle-Graphene nanodisk-Quantum dot Hybrid Systems**", *Nanomaterials* **10**, 1687 (2020)
 52. H. G. Ghaitan, Z. A. Alhamed, **A. Lyras**, S. H. M. Qaid, A. S. Aldwayyan, "**Computational Investigation of the Folded and Unfolded Band Structure and Optical Properties of $\text{CsPb}(\text{I}_{1-x}\text{Br}_x)_3$ Perovskites**" , *Crystals* **10**, 342 (2020).
 53. M. Tohari, **A. Lyras**, and M. Alsalhi, "**A Novel Metal nanoparticle-Graphene nanodisk-Quantum dot Hybrid-System-based spaser**", *Nanomaterials* **10**, 416 (2020).
 54. Vassilis E. Lembessis, **Andreas Lyras**, and Omar M. Aldossary, "Optical Ferris wheels as a platform for collisional quantum gates", , *J. Opt. Soc. Am. B* **38** (no. 1), 233 - 240 (2021).
 55. Vassilis E. Lembessis, **Andreas Lyras**, and Omar M. Aldossary, "Lamb-Dicke localization of cold atoms in Ferris wheel optical dipole potential", *J. Opt. Soc. Am. B* **38** (no. 12), 3794 - 3801 (2021).
 56. H. G. Ghaitam, S. M. H. Qaid, Z. A. Alahmed, M. Hezam, **Andreas Lyras**, M. Amer, A. S. Aldwayyan, "Anion Substitution Effects on the Structural, Electronic, and Optical Properties of Inorganic $\text{CsRb}(\text{I}_{1-x}\text{Br}_x)_3$ and $\text{CsRb}(\text{Br}_{1-x}\text{Cl}_x)_3$ Perovskites: Theoretical and Experimental Approaches" *J. Phys. Chem. C* **125** (no. 1), 886 – 897 (2021).
 57. N Merlemis, **A Lyras**, G Papademetriou, D Pentaris, T Efthimiopoulos, "Numerical Calculations on Multi-Photon Processes in Alkali Metal Vapors" *Approximation and Computation in Science and Engineering*, 627-642 (2022) (Springer-Verlag)
 58. Vassilis E. Lembessis, **Andreas Lyras**, and Omar M. Aldossary, "Quantum states of a two-electron atom trapped in a helical optical tube" *J. Opt. Soc. Am. B* **39** (no. 9), 2319 - 2328 (2022).
 59. A. Al-Khateeb, **A. Lyras**, V. E. Lembessis, O. M. Aldossary, "Two-photon bound-bound atomic transitions induced by LG beams" *Results in Physics* **43**, 106107 (2022).
 60. A. F. Alharbi, **A. Lyras**, V. E. Lembessis, O. M. Aldossary, "Photoexcitation of atoms near the center of vortex light", *Results in Physics* **46**, 106311 (2023).
 61. V. E. Lembessis, **A. Lyras**, O. M. Aldossary, "Two-level atom dynamics induced by spin-orbit coupled optical vortex: dressed states formulation", *Optics Continuum* **2**, 1256 – 1266 (2023).
 62. A. F. Alharbi, **A. Lyras**, V. E. Lembessis, "Significance of the longitudinal component of paraxial light in position-dependent selection rules for quadrupole atomic transitions", *Optics Express* **31** (26), 43690 – 43697 (2023)
 63. M. Alquraishi, V. E. Lembessis, **A. Lyras**, O. M. Aldossary, "Optical dipole potential energy of a two-level atom interacting with a tightly focused truncated optical Bessel beam", *Laser Physics* **33** (12), 125501 (2023)
 64. N. Alsaawi, V. E. Lembessis, **A. Lyras**, M. Babiker, J. Yuan, "Helicity of magnetic fields associated with non-relativistic electron vortex beams", *J. Phys. A: Mathematical and Theoretical* **57** (32), 325303 (2024)

65. A. F. Alharbi, **A. Lyras**, "Role of higher-order electric field corrections in the quadrupole interaction of twisted light with matter", *Optics Express* **33** (3), 6070 – 6079 (2025)
66. A. Jaouadi, **A. Lyras**, V. E. Lembessis, "Towards a Twisted Atom Laser: Cold Atoms Released from Helical Optical Tube Potentials", *Photonics* **12** (10), 999 (2025).

PUBLICATIONS (in books)

1. P. Lambropoulos and **A. Lyras**, "Resonant multiphoton ionization under broadband excitation: application to the determination of isotopic composition", *Resonance Ionization Spectroscopy 1988*, Eds. T.B. Lucatorto & J. E. Parks, Institute of Physics Conference Series Number 94, Institute of Physics (1988, Bristol).
2. P. Lambropoulos, **A. Lyras**, and X. Tang, "Resonance Multiphoton Ionization under strong fields" *Fundamentals of Laser Interactions II*, Ed. F. Ehlotzky, Springer Verlag (1990)

PUBLICATION in CONFERENCE PROCEEDINGS (after refereeing):

1. D. Pentaris, N. Merlemis, **A. Lyras**, and T. Efthimiopoulos, "*Parametric Four-Wave Mixing in Low Atomic Densities of Potassium Vapor*" AIP Conf. Proc. **963**, 788 – 791 (Dec. 26, 2007).
2. M. Eleftheriou, M. Bakarezos, A. Lyras, C. Kosmidis, M. Tatarakis, N. Papadogiannis, "*High Frequency Ultrasonic Waves in Metals and Dielectrics*" The Journal of the Acoustical Society of America **123**(5), 3551 (2008).
3. E. Tzianaki, M. Tatarakis, M. Bakarezos, M. Eleftheriou, N. Papadogiannis, S. Kazianis, C. Kosmidis and A. Lyras, "*Experimental Studies of Generation and Propagation of High Frequency Acoustic Waves in various Solid Materials using Ultraviolet Picosecond Laser Pulses*", The Journal of the Acoustical Society of America **123**(5), 3155 (2008).

CITATIONS : ~ 1018 , h-index: 16 , i10-index: 29

RESEARCH FUNDING / COLLABORATIONS:

1/1995 – 12/1996: Joint research program with the Lab. Aimé Cotton, Orsay, France, funded through the Greek-French Research and Technology Cooperation Agreement (PLATON program). TITLE : 'Spectroscopy and multiphoton processes in doubly excited autoionizing states of alkaline earths'

6/1997: Visiting Assistant Professor (1 month) at the Univ. de Paris Süd & Lab. Aimé Cotton, Orsay, France (funded by Univ. de Paris Süd)

6/1998: Visiting Assistant Professor (1 month) at the Univ. de Bordeaux I, Talence, France (funded by Univ. de Bordeaux I)

9/2002 - 2/2003: Marie Curie Fellowship (Category: Experienced Researcher). Host Institution: CELIA, Univ. de Bordeaux I, Talence, France (funded by the EC)

6/2006: Visiting Assistant Professor (1 month) at CELIA, Univ. de Bordeaux I, Talence, France (funded by Univ. de Bordeaux I)

10/2010: Visiting Associate Professor (1 month) at CELIA, Univ. de Bordeaux I-CNRS-CEA, Talence, France (funded by Univ. de Bordeaux I)

1/2011 – 5/2011: Visiting Associate Professor (1 semester) at the Dept. of Physics, University of Cyprus, Nicosia, Cyprus.

REFeree for scientific journals: I have refereed submitted manuscripts for the following journals: The Journal of Physical Chemistry A, The Journal of Chemical Physics, Chemical Physics Letters, European Physical Journal D, Journal of Physics B: Atomic, Molecular and Optical Physics, New Journal of Physics.

ACTIVITY SINCE JOINING KSU, DEPT. OF PHYSICS & ASTRONOMY (1/9/ 2012)

1. PUBLICATIONS in ISI journals

1. D. Pentaris, T. Efthimiopoulos, N. Merlemis and **A. Lyras** "**Temporal dynamics of the internally generated radiations in a two-photon excited four-level potassium atom**" *J. Mod. Opt.* **56** (2012) 179.
2. D. Pentaris, T. Efthimiopoulos, N. Merlemis, V. Vaičaitis and **A. Lyras**, "**Emissions from high density potassium atoms excited by either nanosecond or femtosecond laser pulses**", *App. Phys. B* **107** (2012) 71.
3. D. Pentaris, T. Efthimiopoulos, N. Merlemis and **A. Lyras**, "**Control of the emission channels energy flow in a nonlinear laser-potassium atom interaction**" *J. Phys. B: At. Mol. Opt. Phys.* **45** (2012) 205505.
4. A. Dimitriou, S. Cohen, **A. Lyras** and I. Lontos, "**Strong laser-induced coupling between autoionizing states: the case of the four-photon-excited $3p^2\ ^1S_0$ state of magnesium**" *J. Phys. B: At. Mol. Opt. Phys.* **45** (2012) 205003
5. D. Pentaris, G. Papademetriou, T. Efthimiopoulos, N. Merlemis and **A. Lyras**, "**Emissions enhancement in a pump-coupling V-type coherently controlled four-level atomic system**" *J. Mod. Optics* **60** (2013) pp. 1855 - 1868
6. V. E. Lembessis, **A. Lyras**, A. A. Rsheed, O. M. Aldossary, and Z. Ficek, "**Radiation pattern of two identical emitters driven by a Laguerre-Gaussian beam: An atom nanoantenna**" *Phys. Rev. A* **92** (2015) 023850
7. Mateusz Łacki, Hannes Pichler, Antoine Sterdyniak, **Andreas Lyras**, Vassilis E. Lembessis, Omar Al-Dossary, Jan Carl Budich, and Peter Zoller, "**Quantum Hall physics with cold atoms in cylindrical optical lattices**" *Phys. Rev. A* **93** (2016) 013604
8. D. Pentaris, D. Damianos, G. Papademetriou, **A. Lyras**, K. Steponkevičius, V. Vaičaitis, and T. Efthimiopoulos, "**Coherently controlled emissions $|4P_{3/2,1/2}\rangle \leftrightarrow |4S_{1/2}\rangle$ from a femtosecond Λ -type excitation scheme in potassium atom**" *J. Mod. Optics* **63** (2016) pp. 1301 – 1312
9. Anwar Al Rsheed, **A. Lyras**, Vassilis E. Lembessis and Omar M. Aldossary, "**Guiding of atoms in helical optical potential structures**" *J. Phys. B: At. Mol. Opt. Phys.* **49** (2016) 125002
10. G. Papademetriou, D. Pentaris, T. Efthimiopoulos and **A. Lyras**, "**Dynamic emission and population control in a Λ -type excitation scheme of atomic potassium**" *J. Phys. B: At. Mol. Opt. Phys.* **50** (2017) 125401

11. M. Tohari, **A. Lyras**, and M. Alsalhi, "Ultrafast energy transfer in the metal nanoparticles-graphene nanodisks-quantum dots hybrid systems" *Plasmonics*, **10**, 1-8 (2018)
12. M. Tohari, **A. Lyras**, and M. Alsalhi, "Giant self-Kerr nonlinearity in the metal nanoparticles-graphene nanodisks-quantum dots hybrid systems under low-intensity light irradiance" *Nanomaterials (Basel, Switzerland)* **8**, no. 7, 521 (2018)
13. Vassilis E. Lembessis, Anwar Al Rsheed, **Andreas Lyras**, and Omar M. Aldossary, "**Dark state atom mirrors based on artificial gauge fields created by surface optical vortices**" *J. Opt. Soc. Am. B* **36** (no. 4), 971 (2019)
14. Jakub Bělin, V. E. Lembessis, **A. Lyras**, O. Aldossary, and Johaness Courtial, "**Arrays of dark optical traps on a toroidal surface**" *Phys. Rev. A* **99**, 013841 (2019)
15. M. M. Tohari, M. M. Alqahtani and **A. Lyras**, "**Optical Multistability in the Metal nanoparticle-Graphene nanodisk-Quantum dot Hybrid Systems**", *Nanomaterials* **10**, 1687 (2020)
16. H. G. Ghaitan, Z. A. Alhamed, **A. Lyras**, S. H. M. Qaid, A. S. Aldwayyan, "**Computational Investigation of the Folded and Unfolded Band Structure and Optical Properties of $\text{CsPb}(\text{I}_{1-x}\text{Br}_x)_3$ Perovskites**", *Crystals* **10**, 342 (2020).
17. M. Tohari, **A. Lyras**, and M. Alsalhi, "**A Novel Metal nanoparticle-Graphene nanodisk-Quantum dot Hybrid-System-based spaser**", *Nanomaterials* **10**, 416 (2020).
18. Vassilis E. Lembessis, **Andreas Lyras**, and Omar M. Aldossary, "Lamb-Dicke localization of cold atoms in Ferris wheel optical dipole potential", *J. Opt. Soc. Am. B* **38** (no. 12), 3794 - 3801 (2021).
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29. M. Alquraishi, V. E. Lembessis, **A. Lyras**, O. M. Aldossary, "Optical dipole potential energy of a two-level atom interacting with a tightly focused truncated optical Bessel beam", *Laser Physics* **33** (12), 125501 (2023)
30. N. Alsaawi, V. E. Lembessis, **A. Lyras**, M. Babiker, J. Yuan, "Helicity of magnetic fields associated with non-relativistic electron vortex beams", *J. Phys. A: Mathematical and Theoretical* **57** (32), 325303 (2024)
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32. A. Jaouadi, **A. Lyras**, V. E. Lembessis, "Towards a Twisted Atom Laser: Cold Atoms Released from Helical Optical Tube Potentials", *Photonics* **12** (10), 999 (2025).

PUBLICATIONS (in books)

- 1 . N. Merlemis, **Andreas Lyras**, G. Papademetriou, D. Pentaris, T. Efthimiopoulos, "Numerical calculations on multi-photon processes in alkali metal vapors", Ch. **34**, 1 – 16, *Approximation and Computation in Science and Engineering*, N. J. Daras and T. M. Rassias (ed.), *Springer Optimization and its Applications Series*, vol. 180, Springer (2022)

PUBLICATION in CONFERENCE PROCEEDINGS (after refereeing):

- 1 . Vassilis E. Lembessis, Anwar Al Rsheed, **Andreas Lyras**, and Omar M. Aldossary, "Towards spiral-like cold atom states" META21 (The 11th Conference on Metamaterials, Photonic Crystals and Plasmonics) Conference Proceedings, S. Zoudhi, D. Pawlak, A. Kudelski (eds.) pp. 404 (2021), ISSN:2429 – 1390
- 2 . Vassilis E. Lembessis, **Andreas Lyras**, and Omar M. Aldossary, "Lamb-Dicke confinement of cold atoms in Ferris Wheels" META21 (The 11th Conference on Metamaterials, Photonic Crystals and Plasmonics) Conference Proceedings, S. Zoudhi, D. Pawlak, A. Kudelski (eds.) pp. 896 (2021), ISSN:2429 – 1390

2. PhD student currently under my supervision

NAME: Afaf AlSulaimi

Expected Graduation date: 31/5/2026

TITLE: “Nonlinear Optical Processes by Structured Light in Three- and Four-Level Atomic Systems”

3. MSc / PhD students supervised in the past

1 . MSc student:

Mrs. **Saja Mohammed Algessair** completed her MSc thesis under my supervision in May 2015. Thesis title: “Mechanical effects of femtosecond Gaussian pulses on Lambda-type three-level systems”

2 . PhD students:

Mr. **Anwar Al Rsheed** completed his PhD thesis under my co-supervision in May 2016. Thesis title: “The Atomic Motion inside Static and Rotating Helical Optical Tubes”

Mrs. **Mariam Mohammed Nasser Tohari** completed her PhD thesis under my supervision in December 2018. Thesis title: “Nonlinear and Ultrafast phenomena in Noble metal-graphene-quantum dot hybrid systems and the properties of their spacers”

Mr. **Ayman Alkhateeb** completed his PhD thesis under my co-supervision in December 2023. Thesis title: “**Interaction of Orbital-Angular-Momentum (OAM) carrying beams with bound states of atoms**”

4 . Research Projects

I am currently working (in collaboration with colleagues and a PhD student) on the following research projects:

a) The quantum theory of the motion of cold atoms in the helical optical potential generated by the interference of Laguerre-Gauss beams. Based on the results of the classical theory of the system (already completed and published) we anticipate that the system will provide a novel set-up for an atom ‘laser’ whose output atomic beam will possess not only linear momentum but also angular momentum.

b) The study of nonlinear and ultrafast phenomena in a hybrid semiconductor system comprising noble metal quantum dots, graphene nanodisks and metal nanoparticles. The final goal is to assess the potential of such a system as a novel spaser, i.e. as a source of a nanoscale source of coherent light relying on surface plasmons for the generation and amplification of the light.

c) The interaction of Orbital Angular Momentum carrying light beams (e.g. Bessel or Laguerre-Gauss beams) with atomic systems. In particular, the study of bound-bound multiphoton processes, resonant multiphoton ionization and the excitation of autoionizing resonances in atoms. These novel light sources, available both in the optical and the UV range, offer new opportunities for the spectroscopy of materials and various applications.

d) In collaboration with colleagues from Austria and Scotland, we are working on schemes for generating optical trapping potentials with toroidal symmetry that could be used for quantum simulations with cold trapped atoms of solid state phenomena and in particular the Quantum Hall Effect and variants of it.

5. Grants & Funds

a) I participated as a consultant researcher in the NSTIP project entitled “Laser-Atom Interactions and Applications” (11-MAT-1898-02) that lasted from November 2013 till November 2015.

b) I was co-Principal Investigator to a NSTIP project entitled “The study of mechanical and coherence effects of OV beams on two- and three-level atoms” (15-MAT5110-02-4) that after external refereeing has been approved for funding and started in October 2020. It was successfully completed in 2024.

c) A research grant as part of the program **Supporting High-Quality and Impact in Scientific Publishing** (June 2019 – April 2020) under title “*Optical Ferris Wheels and internal state dependent optical lattices*” (in collaboration with Prof. V. Lembessis and Omar Aldossary)

d) I was the Principal Investigator to a NSTIP project entitled “Interaction of structured light beams with the autoionizing states of multielectron atoms” (2-17-01-001-0057) that after external refereeing has been approved for funding and started in September 2020. It was successfully concluded in early 2025.