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**Curriculum Vitae (detailed)**  
including  
**List of Publications**  
and  
**Research & Teaching Statements**

1. Personal information: page 1
  2. Education & academic qualifications: p. 1
  3. Career overview: p. 2
  4. Research overview: p. 5
  5. National and international recognition – awards, honours: p. 7
  6. Funding – support grants and contracts: p. 8
  7. Teaching overview: p. 9
  8. Academic service and teaching related administration: p. 11
  9. Research supervision: p. 12
  10. Recognition – Impact, wide audience texts in the press: p. 15
  11. Academic References: p. 16
- Appendix A: Synopsis of research interests & areas of expertise: p. 17
- Appendix B: List of Publications: p. 18
- Appendix C: Conference attendance / Talks / Seminars: p. 36
- Account of Research Activity: p. 43
- Account of Teaching Activity: p. 48

Data as of: 24 November 2017



# CURRICULUM VITAE

Dr Ioannis (*Yannis*) KOURAKIS

## 1. PERSONAL INFORMATION

Citizenship: Hellenic (Greek) and Belgian (dual citizenship).

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Live research metrics at [www.researcherid.com/rid/B-7885-2010](http://www.researcherid.com/rid/B-7885-2010);

ResearcherID: B-7885-2010; ORCID: 0000-0002-4027-0166.

## 2. EDUCATION, ACADEMIC QUALIFICATIONS & AWARDS

- **Doctor of Science** (*Doctorat en Sciences*), Theoretical Physics, Université Libre de Bruxelles (ULB), Brussels, Belgium, 16 Oct. 2002.  
Thesis title: “*Kinetic theory for a test-particle weakly coupled to a heat-bath – Application in magnetized plasmas*”. Thesis supervisors: Alkis Grecos & Léon Brenig.
- **Postgraduate Certificate in Higher Education Teaching (PGCHET)**.  
Queen's University Belfast (QUB), School of Education, Belfast, UK; awarded 4 July 2013.
- **DEA en Sciences (Belgian equiv. MPhil.)**, Université Libre de Bruxelles (ULB), Brussels, Belgium; 13 September 2001. Field: “*Statistical Mechanics and Nonlinear Phenomena*”.  
Thesis: “*Kinetic theory for a test-particle weakly-coupled to a large heat-bath in equilibrium*”; Supervisor: Léon Brenig.
- **DEA de Physique (French equiv. MSc. in Physics)**.  
Université de Bourgogne, Dijon, France; 1 July 1991.  
Field: “*Molecular Spectroscopy and Materials for Optical and Electronic Applications*”.  
Thesis title: “*Modulational Instability in Hydrogen-Bonded Systems*”.  
Thesis supervisors: R. Boesch & M. Peyrard.
- “**Ptychio**” (Greek 4-year equiv. BSc degree) in Physics; University of Crete, Heraklion, Greece; Awarded 16 November 1989. Grade: 7.46/10.

## FURTHER TRAINING / SKILLS / PERSONAL DEVELOPMENT

### — *Language Skills:*

- *Greek*: fluent (mother tongue).
- *English*: fluent (read/spoken/written); “*Certificate of Proficiency in English*”, issued by the University of Cambridge, Athens Examination Board; awarded in June 1982.
- *French*: fluent (read/spoken/written); “*Diplôme d’Etudes Supérieures en Langue Française*”, issued by the “Institut Français d’Athènes”; awarded in 30 Nov. 1987.

- *Spanish*: excellent working level (read/spoken/written).
- *German*: good level (read), fair (spoken, written).
- *Portuguese*: basic level (read, mainly).

— ***IT/Computing Skills***:

- Operating environments: Windows XX, Unix/Linux, Mac OS.
- Expertise in symbolic/numerical computation software (Wolfram Mathematica);
- Data processing tools (Origin ,...).
- Word-/text-processing software: LaTeX, MS Office tools.
- Electronic communication software: standard web (WWW, email), FTP protocol, ...

— **PROFESSIONAL DEVELOPMENT**

- **UK Higher Education Academy (HEA) Fellow**, since 4 July 2013.
- *Academic Staff Training*: I have attended and completed a series of training sessions, courses and seminars offered by Queen’s University’s Staff Training and Development Unit (STDU), since 2007. These included: Academic Leadership Skills; Developing for Success: Emotional Intelligence and Leading Others; Management of Difficult Communication; Research supervision; Coaching as Management Skill; Plagiarism; ...
- *Teaching Quality Review*: participation to teaching assessment scheme, as part of standard university policy, both actively (as peer reviewer) and passively (as reviewed lecturer).
- *Academic Appraisal*: Participation to Queen’s University staff appraisal scheme.
- Commitment to observing the University’s Equal Opportunities policy at all times.

**3. CAREER OVERVIEW**

**3.1 EMPLOYMENT HISTORY**

- Current occupation: *Associate Professor* (UK equiv. *Lecturer/AC3*–Grade 8; highest spine point), Queen’s University Belfast, School of Mathematics and Physics; since 10/2007 (tenured since 02/2009).

— **Visiting appointments, secondments:**

- *Visiting Researcher*, Institute of Theoretical Physics, UNESP – State University of Sao Paulo, Brazil; supported by the State of Sao Paulo Research Fund (FAPESP) via the *UK Academies/CONFAP - Fellowship and Research Mobility* program; Aug.-Dec. 2017.
- *Special Visiting Researcher (Pesquisador Visitante Especial - PVE)* status, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil; supported by the Brazilian Research Fund (CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil); Aug. 2013 - Jan. 2017.
- *Visiting Researcher*, School of Physics, Department of Complex Systems, University of Sydney; Dec. 2010 - Jan. 2011; also, Feb.-Mar. 2009.

— **Postdoctoral appointments:**

- 2006-2007: Research Associate (*Wissenschaftlicher Mitarbeiter*); Ruhr Universität Bochum, Germany; German Research Society (*Deutsche Forschungsgemeinschaft*), *Emmy Noether Programme* (grant SH 93/3-1): *Cosmic Ray Diffusion*; PI: Dr. A. Shalchi.
- 2006: Research Associate, Universiteit Gent, Sterrenkundig Observatorium, Ghent, Belgium; FWO (Flemish Research Fund); coll. w/ Prof. F. Verheest on Space plasmas.
- 2004 - 2005: Research Associate (*Wissenschaftlicher Mitarbeiter*); Ruhr Universität Bochum, Germany; *Sonderforschungsbereich 591 – Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung*, *Deutsche Forschungsgemeinschaft (DFG)*; coll. with Prof. P. K. Shukla & Prof. R. Schlickeiser.
- Sept. 2005 & Aug. 2006: Guest Lecturer (in the context of Plasma Physics related activities), Abdus Salam International Center for Theoretical Physics, Trieste, Italy.
- 2005: Research Fellow of the Max-Planck-Institut für extraterrestrische Physik (Max Planck Institute for Extraterrestrial Physics), Garching, Germany; Project: “*Komplexe Plasmen*”; collaboration with Prof. G. E. Morfill.
- 2003 - 2004: Post-doctorate Research Fellow (E.U. funding), Ruhr-Universität Bochum, School of Physics and Astronomy, Theoretical Physics IV, Bochum, Germany (address above). Research work on theoretical Plasma Physics: nonlinear wave propagation in dusty plasmas; collaboration with Prof. P. K. Shukla.

— **Pre-PhD appointments & secondments:**

- 2002: Research visit (Euratom mobility grant), Euratom - Hellenic Republic Association, at: University of Thessaly, Laboratory of Fluid Dynamics & Turbomachinery, Volos, Greece; collaboration with Prof. A. Grecos.
- 1999 - 2005: Teaching and Research Assistant, Université Libre de Bruxelles (ULB), Faculté des Sciences Appliquées (Engineering School), Brussels, Belgium; formally on leave from Feb. 2003 on; Physics & Mathematics: tutoring classes and laboratory courses.
- 1995 - 2002: Doctoral Researcher (EU Euratom fellowship), Université Libre de Bruxelles & Euratom-Belgian State Association, CP 231 Physique Statistique et Plasmas, Brussels, Belgium. Research in Non-Equilibrium Statistical Physics and Plasma Kinetic Theory, Fusion Theory; collaboration with Prof. A. Grecos & L. Brenig.
- 1992: Laboratory Instructor (*Agent Temporaire Vacataire*), Biophysics (DEUG degree, 2nd year), Université de Bourgogne, School of Pharmacy, Dijon, France.
- 1991 - 1992: Research Fellow, Université de Bourgogne, Dijon, France, Laboratoire Ondes et Structures Cohérentes (Waves & Coherent Structures). Research in Nonlinear Physics as applied in Solid State Physics; collaboration with Prof. M. Peyrard & Dr. R. Boesch.
- 1990 - 1992: Teaching Assistant, Université de Bourgogne, Faculté des Sciences (School of Sciences), Dijon, France; Physics (laboratory courses), mainly Optics & Electromagnetism.
- 1987 - 1990: Teaching Assistant, University of Crete, Heraklion, Greece; Physics (laboratory courses), mainly Optics, Mechanics, Electromagnetism and Radioactivity.

### 3.2 CONSULTANCY, COMMITTEES, PROFESSIONAL BODIES

#### — *Committee Membership:*

- UK EPSRC (Engineering and Physical Sciences Research Council): Associate Peer Review College membership, since 10/2016.
- **Evaluation Committee membership**, upon nomination: Natural Sciences and Engineering Research Council of Canada (NSERC), Discovery Grants Program, Physics Evaluation Group; three-year term, July 1, 2014 to June 30, 2017.

#### — *Editorial Activity:*

- **Editorial Board Member (EBM):** *Scientific Reports* (Nature Publishing; EBM for Fluids and Plasma Physics), Impact Factor: ?4.259 (2016); EBM since 05/2014.
- EBM: *Plasma* (MDPI AG; Switzerland), EBM since 03/2017.
- EBM: *Nucleus* (PINSTECH, Nilore Islamabad, Pakistan), since 04/2017.
- EBM: *Open Plasma Physics Journal*, 2009 to 2016.

#### — *Reviewer for Funding Agencies:*

- Engineering and Physical Sciences Research Council (EPSRC), UK: 2011 - today;
- Royal Society (UK): 2012 - ;
- Flemish Research Fund (FWO), Belgium, 2015 - today;
- National Center of Science and Technology Evaluation, Kazakhstan; 2014 - today;
- Rustaveli Foundation, Georgia, 2013;

#### — *Institutional/professional assessment - Academic reviewer:*

- National Research Foundation (NRF), South Africa (2014 & 2015);
- *Technical Review Panel* member for academic staff promotion (2017), Institute for Space Technology (IST), Islamabad, Pakistan.
- *External Panel member for academic staff promotion at professorial level* (open-ended appointment, 2012 -), Quaid-i-Azam University, Islamabad, Pakistan.

#### — **External Examiner:**

- PhD thesis examination (panel membership); *17 (seventeen) PhD assignments to date; + 1 MSc* (details in page 11): two in UK (Nottingham University 2009, Strathclyde University 2016), Sweden 1 (KTH - Royal Institute of Technology, Stockholm 2014), Australia 1 (University of Sydney 2013), S. Africa 2 (University of Kwazulu Natal, Durban 2015), Pakistan 11 (Gomal University 2014, COMSATS 2010 & 2013, QAU Quaid-i-Azam University 2013 & 2017, Peshawar 2013, Lahore 2015 & 2017, PIEAS 2015, 2016, 2017, Kohat 2017); + 1 MSc (Australia).

#### — *Academic Accreditation:*

- 2007-2010: *Qualification au Concours de Maîtres de Conférences*: French Higher Education professional accreditation, awarded in 3 sections: 28-Dense Media & Materials (no.

07228137659, 9 Feb. 2007), 30-Dilute media & Optics (no. 07230137659, 31 Jan. 2007), 34-Astronomy & Astrophysics (no. 07234137659, 2 Feb. 2007).

— *Peer-Reviewer (referee)*:

- Regular assignments for scientific journals, including: Physical Review journals (PR Letters, PRA and & PRE; APS, USA), Physics of Plasmas (AIP, USA), IEEE Transactions in Plasma Science (IEEE, USA), Journal of Plasma Physics (Cambridge University Press, UK), Plasma Physics and Controlled Fusion (IoP, UK), Journal of Geophysical Research (AGU USA), Plasma Sources Science and Technology (IoP, UK), Physics Letters A (Elsevier, Holland), New Journal of Physics (IOP, UK), Nonlinear Processes in Geophysics (EGU, Germany), Chaos (AIP, USA), Journal of Ocean Engineering and Science (Elsevier), PTRSA - Philosophical Transactions of the Royal Society A, MNRAS - Monthly Notices of the Royal Astronomical Society (RAS, UK), Physica Scripta (IoP, Swedish Academy), Optics Express (OSA, USA), Journal of Optical Society of America (JOSA & JOSB, USA), Royal Society/Philosophical Transactions A (UK), Journal of Ocean Engineering and Science (Elsevier), J. of Fusion Energy (JOFE; Springer), Canadian Journal of Physics, Astrophysics and Space Science (Elsevier), Indian Journal of Physics, Brazilian Journal of Physics (Springer), Open Plasma Physics Journal (OPPJ, Bentham), Fizika B (Croatia).

— *Professional Bodies – Membership, Affiliation*:

- **UK Higher Education Academy (HEA) Fellowship**, status awarded 4 July 2013.
- APS - American Physical Society (Regular Member since 2000).
- AGU - American Geophysical Union, USA (Ordinary Member since 2013).

#### 4. RESEARCH OVERVIEW

— *In a nutshell*:

- My principal research interests lie in the field of **Applied Mathematics (Theoretical Physics)**, with applications in *Plasma Physics*, in **Soft Condensed Matter** and in *Nonlinear Science*. Nonlinear plasma physics is relevant in *technological applications* (microcircuits based on semiconductor plasmas), in *energy production* (fusion) and in *plasmonic materials* (optical metamaterials for electromagnetic waveguide design).
- I am currently investigating *extreme events (freak waves, rogue waves)* and *modulated structures (envelope solitons)*, in particular, focusing on how their properties arise from fluid models for *beam-plasma interactions*. Electrostatic waves in ultra-high density (quantum) plasmas, in Space plasmas and in non-Maxwellian plasmas, in particular, are the principal axes of my current research. Relying on multiple-scale techniques, applied to fluid models, I model the formation of nonlinear waves (solitary waves, shocks) in multi-component plasmas and investigate their structural and dynamical properties.
- I have sustained tight links with international communities active in *laser-plasma interactions*, in *dusty plasmas*, in *Space plasmas* and in *Applied Mathematics*.
- Earlier research of mine has focused on **solid state physics** (molecular crystals, colloidal plasmas) and *Many-body Systems*, and in particular on: modulational instability criteria for coupled optical systems, kinetic theory (based on a Liouville/Fokker-Planck

formulation) for long-range interacting systems, nonlinear waves in lattices (crystals) in condensed matter and in complex (dusty) plasmas, and finally on astrophysical turbulence (anomalous diffusion).

Some indicative information and indices of quality and impact (metrics) of my activity are provided in the following.

A detailed Publication List and a list of Conference Presentations is provided in the Appendix.

— ***Team leadership:***

- Five (5) PhD students supervised to date, including three (3) graduates (details in p. 12).
- Four (4) postdocs (7.5 person-years, UK EPSRC funded) supervised to date (see in p. 11).

— ***Publication record:***

- **150+ original articles published in refereed journals;**
- 60+ papers in Conference Proceedings.
- 10+ papers in Collective Volumes and peer-reviewed Conference Proceedings;
- A detailed List of Publications is appended to this CV; my publication list (+ preprints) is also available online at: [www.kourakis.eu](http://www.kourakis.eu) (under link publications);

— ***Impact/citations:***

- **Citation H-index: 33;** 3,328 (2,871\*) citations to-date in 1,929 (1,795\*) citing articles (\* within parenthesis, excluding self-citations); data from *Web of Science*, accessed on 23 November 2017; alternatively: **Citation H-index: 37** and **Citation i10-index = 108;** 4266 citations; data from *Google Scholar* (as of 23 November 2017).
- Citation metrics: [www.researcherid.com/rid/B-7885-2010](http://www.researcherid.com/rid/B-7885-2010); ORCID: 0000-0002-4027-0166.

— ***Conference participation & dissemination of results:***

- 40+ Invited Talks in International Conferences and Advanced Schools;
- 45+ Contributed Talks and Poster presentations, at international conferences and scientific events/workshops;
- A detailed List of Conferences attended and of papers presented is appended to this CV.

— ***Conference Administration***

- Member of Organizing Committee: *45th IoP Plasma Physics Group Conference*, Belfast, April 9-12th 2018.
- Member of Scientific Program Committee for Special Session D3.3 (Role of nonthermal distributions in wave generation, particle heating and acceleration in space plasmas) in *42nd COSPAR Scientific Assembly (COSPAR2018)*, Pasadena, California, USA, 14-22 July 2018.
- Member of the International Advisory Committee: *International Scientific Spring (ISS-2018)*, 12-16 March 2018, Islamabad, Pakistan.
- Member of the Advisory Committee: *SigmaPhi2017 - International Conference on Statis-*



*tical Physics*, 10-14 July 2017, Corfu, Greece.

- Member of the International Scientific Committee: *10th Chaotic Modeling and Simulation International Conference (CHAOS2017)*, Barcelona, Spain (30 May - 2 June, 2017).
- Member of the International Scientific Committee: *9th Chaotic Modeling and Simulation International Conference (CHAOS2016)*, London, UK (23-26 May 2016).
- Member of the International Scientific Committee: *8th Chaotic Modeling and Simulation International Conference (CHAOS2015)*, Institut Henri Poincar'e, Paris, France (26-29 May 2015).
- Member of the International Scientific Committee: *7th Chaotic Modeling and Simulation International Conference (CHAOS2014)*, Madrid, Spain (7-10 June 2014).
- Member of the International Advisory Committee: *International Scientific Spring (ISS-2014)*, Islamabad, Pakistan (10-14 March 2014).
- Member of the International Scientific Committee: *6th Chaotic Modeling and Simulation International Conference (CHAOS2013)*, Istanbul, Turkey (11-14 June 2013).
- Member of the International Advisory Committee: *International Scientific Spring (ISS-2013)*, Islamabad, Pakistan (11-15 March 2013).
- Member of the International Scientific Committee: *5th Chaotic Modeling and Simulation International Conference (CHAOS2012)*, Athens, Greece (12-15 June 2012).
- Member of the International Advisory Committee: *International Scientific Spring (ISS-2012)*, Islamabad, Pakistan (5-9 March 2012).
- Member of the Local Organizing Committee: *30th International Conference on Phenomena in Ionized Gases (ICPIG2011)*, Belfast, Northern Ireland, UK (28 Aug.-2 Sept. 2011).
- Member of the International Advisory Committee: *XII Latin-American Workshop on Plasma Physics (XII LAWPP)*, Caracas, Venezuela (September 17-21, 2007).

— *Conferences - Session Convener*

- AGU (American Geophysical Union) Fall Meeting 2014 (<http://fallmeeting.agu.org/2014/>), held in San Francisco USA, 15-19 December 2014 (special sessions "*SH43C: Implications and Applications of Kappa Distributions in Space Plasma Physics*" I & II, org. George Livadiotis, I. Kourakis & Jacob Heerikhuisen).

## 5. NATIONAL & INTERNATIONAL RECOGNITION / AWARDS / HONOURS

- 2017: I was one of only eleven (11) referees chosen from over 1,400 worldwide, for special recognition as **distinguished reviewer**(s) from *Physics of Plasmas* journal (AIP, USA); Editor (M.E. Mauel), in their 03/2017 edition [Phys. Plasmas **24**, 039801 (2017)] cited us "*(for offering) extraordinary service to the authors and readers of Physics of Plasmas*".
- 2016: EPSRC Associate Peer Review College membership status awarded.
- 2014-2017: Invitation to join the (top ranking) Physics Evaluation Group of the Natural Sciences and Engineering Research Council of Canada (NSERC), Discovery Grants Program; four-year term.
- 2014: Invitation to join the Editorial Board of prestigious journal *Scientific Reports* (Nature Publishing; EBM for Fluids and Plasma Physics).

- 2013: *Special Visiting Researcher (Pesquisador Visitante Especial - PVE)* status, awarded by the Brazilian Research Fund (CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil); three-year term.
- 2007: *Professor Harry Messel Fellowship*, University of Sydney, School of Physics, Australia (awarded, then declined, due to overlapping professional appointments).
- 2005: *Fellowship* of the Max-Planck-Institut für extraterrestrische Physik (Max Planck Institute for Extraterrestrial Physics), Garching, Germany; Project: “*Complex Plasmas*”; collaboration with G E Morfill and P K Shukla.
- 2003-2005: EU *Post-doctoral fellowship*; Human Potential Research and Training Network (Contract No. HPRN-CT-2000-00140): “*Complex Plasmas: The Science of Laboratory Colloidal Plasmas & Mesospheric Charged Aerosols*” Ruhr-Universität Bochum, Germany.
- 2000-01: *Doctoral Prize* of the David & Alice Van Buuren Foundation, Brussels, Belgium.
- 1995 - 1997: *Training & Research Fellowship*, Commission of the European Communities (Direction General RDT - Fusion Programme); Euratom - Belgian State Association & Université Libre de Bruxelles, C.P. 231 Physique Statistique et Plasmas, Brussels, Belgium; Project: *Kinetic Theory of Magnetically Confined Plasmas*.
- 1990 - 1991: *Erasmus Scholarship* of the E.U.; Université de Bourgogne, Dijon, France.
- 1989 - 1990: *Postgraduate Fellowship* of the Research Center of Crete and the University of Crete, for postgraduate studies at the University of Crete (Greece).
- 1984 - 1986: *Training Fellowship* of the Greek scholarship Foundation (IKY).

## 6. FUNDING – SUPPORT GRANTS and CONTRACTS

- FAPESP (Sao Paulo State Research Fund) & The UK Academies **Research Fellowship**; Visiting Researcher status awarded at UNESP (State University of Sao Paulo), Aug.-Dec. 2017.
- I have created and currently lead, as principal coordinator, an EU-funded international mobility network, combining 5 universities from 4 countries (UK, Sweden, Portugal, Brazil): “*Complex ideal and non-ideal quantum plasmas*” (612506 QUANTUM PLASMAS FP7-PEOPLE-2013-IRSES), EU-FP7 IRSES Programme; PI & Project Coordinator: IK; Jan. 2014 - Dec. 2017.
- “*Waves and Instabilities in Quantum Plasmas*”, Brazilian Research Council (CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil; *Science without Borders* Programme, processo: 400624/2013-3), R\$ 233K (approx. 73K euros, or GBP 60K); awarded (2014); duration: 36 months, starting 01 October 2013.
- NITheP - National Institute of Theoretical Physics (South Africa), travel grant (10K ZAR).
- 2013-2014: HIPOLIN - European Erasmus IP on “*An Introduction to high power light-matter interactions (HIPOLIN)*” (an intense training course funded by the Erasmus IP action): <http://hipolin.chania.teicrete.gr/>; IK: partner and local (node) coordinator.
- 11/2011-06/2012: EPSRC research grant EP/I031766/1; *Fluid theory for laser plasma interactions*; GBP 125 K; PI: I Kourakis.
- 2009-2012: APPEPLA - 3rd European Erasmus IP on “*Applications of Electronics in Plasma Physics (APPEPLA)*” (training course funded by the Erasmus IP action); IK: partner and local (node) coordinator.

- 10/2007-05/2012: Support from EPSRC Science and Innovation grant (EP/D06337X/1) awarded to CPP, QUB, UK; *Queen's University Belfast Plasma Physics*; PI Prof WG Graham, participation as researcher (own salary covered 10/2007-05/2012), group leader (3 PDRAs & 1 PhD covered) and supported via equipment funding.
- 10/2010-09/2012: EU LLP Curriculum Development grant (EU 51 0587-LLP-1-2010-1-GR-ERASMUS-ECDSP: PLAPA - Plasma Physics and Applications): Participating node; IK: local coordinator & PI (13 K allocated to QUB);
- 01/2010: International Travel Grant 2010/R2, Royal Society, UK; *Nonlinear Wave Dynamics and Modulational Interactions in Plasmas*; PI: IK.
- 02/2008: International Outgoing Short Visit 2008/R2, Royal Society, UK; *Nonlinear Processes and Structures in Multi-component and Dusty Plasmas*; PI: IK.
- German government program: *SFB 591 - Sonderforschungsbereich 591: Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung, Deutsche Forschungsgemeinschaft*; participation as Research Associate (Wissenschaftlicher Mitarbeiter).
- Project: "*Komplexe Plasmen*" (Complex Plasmas); *MPIeP: Max-Planck-Institut für extraterrestrische Physik* (Max Planck Institute for Extraterrestrial Physics), Garching, Germany; Individual post-doctoral fellowship; collaboration with Prof. Gregor Morfill; 1 Jan.-31 Mar. 2005.
- *Complex Plasmas: The Science of Laboratory Colloidal Plasmas and Mesospheric Charged Aerosols*, Commission of the European Community, Human Potential Research and Training Network; Contract No. HPRN-CT-2000-00140 (Ruhr-Universität Bochum, Germany; 2003 - 2004); participation as Researcher (PI: PK Shukla).
- *Kinetic Theory of Magnetically Confined Plasmas*, Commission of the European Community, Fusion Programme (Euratom - Belgian State Association, Université Libre de Bruxelles, Belgium, 1/2/1995 - 31/1/1997); Individual Research and Training Fellowship.

## 7. TEACHING OVERVIEW: pedagogical activity, supervision, mentoring

I have long experience in academic teaching and supervision.

Academic courses (undergraduate & postgraduate) that I have taught are listed below.

**A more detailed Teaching Statement (including teaching evaluation statistics) is appended at the end of this Vitae.**

— *Courses taught, as principal coordinator/lecturer:*

- Undergraduate (UG):
  - *Computer Algebra*, Pure Mathematics (PMA 3008, QUB - Queen's University Belfast); taught in 2016/17 - SEM2 (Spring Semester).
  - *Synoptic Physics* (PHY4029, QUB) Part 4 - Introduction to Nonlinear Physics; years 2015-16-17 (SEM2, Spring Semester course).
  - *Mathematical Modelling in Biology and Medicine*, Applied Mathematics (AMA3014, QUB); 2014/15 & 2015/16 (SEM - Spring Semester course).
  - *Calculus of Variations and Hamiltonian Dynamics*, Applied Mathematics (AMA3013, QUB); year(s) 2009-10 through 2012-13 (SEM2, Spring Semester course).

- Postgraduate (PG):

- *Introductory Plasma Modelling* (PHY9013, QUB); course coordinator (75 %), 2008-2013 (SEM1, Fall Semester).
- *Laser Produced Plasmas* (Module PHY9016, QUB); 25%, 2009-2013 (Spring Semester course).

— ***Courses/tutorials taught, as secondary lecturer/tutor:***

- AMA1021 *Mathematical Modelling* (Applied Mathematics), 2016/17 (SEM2, QUB);
- PMA1021 *Mathematical Reasoning* (level 1 tutorials, Pure Mathematics), 2016/17 (SEM1, QUB);
- PHY1004 *Foundation Physics* (tutoring classes); 2010 – 2013, both semesters; QUB.
- Level 2 *Physics laboratory*; 2010-11-2012 & 2014-15, both semesters; QUB.

— **Project supervision**

I have supervised a total of 15 long projects (= 7 PGT/MSc long research projects + 8 UG/MSci Level 4 projects) and 30 short pedagogical projects (12 PGT/MSc + 18 UG/MSci Level 3) to date (05/2017). Breakdown as follows:

- *PGT/MSc Dissertation-Projects* (QUB MSc Module PHY9019; MSc in Plasma Physics, Queen’s U. Belfast): seven (7) research projects supervised in total, 2007-2011;
- *PGT/MSc Short Projects* (QUB MSc Module PHY9014; MSc in Plasma Physics, Queen’s U. Belfast): supervision of 12 short pedagogical/training projects; 2007-08 through 2012-13 (Spring Semester);
- *UG/MSci Projects*: eight (8) 4th year MSci projects supervised at Queen’s U. Belfast (MSci in Physics, Physics PHY4030 and Applied Mathematics Module AMA4005; 2012-today;
- *UG/MSci 3rd year short projects* (QUB Module Long Investigations): thirty (30) short training projects supervised; 2011-today;
- +: *PGR/research projects (PhD level)*: currently **supervising two (2) PhD students** at QUB (Belfast); 3 PhD students have successfully graduated in the past. (See page 12.)

— **International teaching activity:**

Lectures delivered at international Summer Schools (for details, see: Appendix - *Invited Talks*):

- *Guest Lecturer* at the (UNESCO) International Centre for Theoretical Physics, Trieste, Italy (2004, -05, -07);
- Lecturer at *Int. Summer School on Nuclear Fusion and Technology*, EURATOM-Hellenic State Association (2002 & 2004);
- Guest Lecturer at APPLEPLA & HIPOLIN summer schools (2010, -11, -12, -13 and -14).

— **Course & Curriculum development**

- *MSc in Plasma Physics* (QUB); Web-based Postgraduate Curriculum: participation in the Curriculum design, setup, organization and operation, 2007-13.

- *PLAPA - Physics of Lasers and Plasmas*; Intra-EU Web-based Postgraduate Master's, currently under development: Curriculum design, setup, organization, local coordination, web-based course development, 2018-13 (EU-funded Erasmus Lifelong-Programme).
- *Introductory Plasma Modelling* (Module PHY9013, QUB); course coordinator, year(s) 2007-08 through 2012-13 (Autumn Semester course).
- *Laser Produced Plasmas* (Module PHY9016, QUB); 25%, year(s) 2007-08 through 2012-13 (Spring Semester course).

— **Student mentoring/advising activity**

- **Adviser of Studies (AoS)**: student enrolment, supervision, advising, guidance to local administration:
  - Undergraduate AoS: 60 UG students approx. each year, 2010-13 (3 years);
  - Postgraduate AoS: 10 UG students approx. each year, 2007-13 (6 years);
- **Personal Tutor**, undergraduate students (advising/coaching, guidance); approx. 6 students each year; 2010-13 & 2014-today.

**8. ACADEMIC SERVICE & TEACHING-RELATED ADMINISTRATION**

- **Examinations Liaison Officer (ELO)**, Queen's University Belfast, School of Mathematics and Physics, Department of Physics: 2014-15.
- **Postgraduate Admissions Officer**, *MSc in Plasma Physics* at Queen's University Belfast: student recruitment & entry selection, entirely in charge of streamlining and short-listing applications from prospective stage through final admission; also, funding matters (selection, shortlisting and interviews for studentship award); 2007-13 (6 years).
- **Vice-Coordinator**, *MSc in Plasma Physics* at Queen's University Belfast; local organisation tasks, MSc publicity/outreach, internationalisation activities; 2007-13 (6 years).
- **Student Progress Support Committee (SSPC)** membership: 2010-13 (3 years) as UG AoS, 2014-15 as ELO.
- Member of PhD examination committees as Chair (*Independent Convener*): 4 (four) appointments to date (Queen's University Belfast, UK): Mr Peter Keys (May 2013), Mr Jonathan Whyte (Oct. 2014), Mr Andrew Gibson (Feb. 2015), Mr Yifan Li (Feb. 2017).
- **Postgraduate Taught (PGT) student assessment panel** membership: PGT Progress Committee, Queen's University Belfast, UK (2011-2014).
- Postgraduate Research (PGR) PhD differentiation/**Progress Review Committee** membership, Queen's University Belfast, UK; approx. 3-4 assignments per year (2013-2017).
- Academic promotion reviewer for (international) academic institutions: see page 4 above.
- **Postgraduate examination committee** membership as *external examiner*:
  - (name withheld \*), Lahore University, Pakistan (2017);
  - (name withheld \*), Kohat University of Science & Technology, Pakistan (2017);
  - Mr Muhammad Naeem, Quaid-e-Azam University (QAU), Pakistan (2017);
  - Mr Hafeez ur Rehman, PIAES - Pakistan Institute of Engineering and Physical Sciences, Nilore, Islamabad, Pakistan (2017);
  - Mr Sijia Chen, Strathclyde University, Department of Physics, Glasgow, UK (2016);

- Mr Sajjad Hussain, PIAES - Pakistan Institute of Engineering and Physical Sciences, Nilore, Islamabad, Pakistan (2016);
- Mr Aaron Mugemana, UKZN - Univ. Kwazulu-Natal, Durban, S. Africa (2015, 2016);
- Mr Shaukat Ali, PIAES - Pakistan Institute of Engineering and Physical Sciences, Nilore, Islamabad, Pakistan (2015);
- Ms Sabeen Arshad, GCU - Government College University, Lahore, Pakistan (2015);
- Ms Farran Henning, UKZN - Univ. Kwazulu-Natal, Durban, S. Africa (2015);
- Mr Etienne Koen, KTH - Royal Institute of Technology, Department of Space and Plasma Physics, Stockholm, Sweden (2014);
- Mr Adnan Saeem, University of Gomal, Pakistan (2014);
- Mr Ali Ahmad, COMSATS Inst. of Information Technology (CIIT), Pakistan (2013);
- Mr Shahid Naseer, University of Peshawar, Pakistan (2013);
- Mr Jan Faiq, Quaid-e-Azam University (QAU), Pakistan (2013);
- Mr. Shabbir Khan, COMSATS Inst. of Information Tech. (CIIT), Pakistan (2010);
- Mr Zhengwei Wu, University of Sydney, Australia (2009);
- Mr Xiang Yi, Nottingham University, UK (2010);
- +: Mr Modjtaba Moaied, MSc examination, University of Sydney, Australia (2013).

## 9. RESEARCH SUPERVISION

### 9.1 Team leadership - Collaborations - Supervision

– *Overview:* My team at CPP/QUB currently consists of two (2) PhD students and two (2) MSci students, working on topics from nonlinear dynamics (soliton theory) and plasma theory/laser-plasma interactions. Past collaborators include: four (4) Postdoctoral Research Associates (PDRAs) @QUB (7.5 person-years in total: 2008-11, 2008-10, 2010-11 and 2012-13, respectively), 3 PhD students (2008-2012, 2011-2014 & 2011-17) and 10+ self/funded research visitors; details below.

– I have hosted a number of research visits by external collaborators to CPP/QUB, including: Dr Shimul Maharaj and Dr Olivier Carel (S. African National Space Agency), Dr Mark Erik Dieckmann (Linkoping University, Sweden), Prof Manfred A. Hellberg (Durban, S. Africa), Prof Frank Verheest (Gent, Belgium), D Samsonov (Liverpool, UK), Prof Myoung-Jae Lee (Taiwan).

– I have collaborated and co-authored joint publications with a number of scientists abroad; 45+ co-authors in 13+ countries worldwide.

— *Postdoctoral Research Associate(s)* at Queen’s University Belfast: supervision & collaboration (supported by EPSRC UK) at Queen’s University Belfast:

- Dr Naresh Pal Singh Saini, nonlinear plasma dynamics (03/2008-02/2010); EPSRC funding (S & I grant to CPP/QUB);
- Dr Ashutosh Sharma, laser beam profile dynamics (04/2008-03/2010); ; EPSRC funding (S & I grant to CPP/QUB);
- Dr Gianluca Sarri, dynamics of laser-plasmas (10/2010-09/2011); ; EPSRC funding (S & I grant to CPP/QUB);

- Dr Vikrant Saxena, fluid plasma simulations (11/2011 - 06/2013); EPSRC funding.

— *PhD supervision at QUB:*

- Ms Sharmin Sultana, Solitary waves in multicomponent plasmas (UK EPSRC funded, 10/2008-07/2012);
- Ms Gina Williams, Solitary Wave and Shock Dynamics in Non-Maxwellian Plasma Environments (DEL-NI/UK funded, 08/2011 - 12/2014);
- Mr Michael McKerr, Nonlinear Waves in Quantum Plasmas (DEL-NI/UK funded, 10/2011 - 11/2016; graduation 07/2017);
- Mr Spiros Thanasoulas, Computer simulations of shock dynamics in laser-plasma interactions (p/time, self/funded, 10/2011 - today).
- Mr Ibrahim Sayed Ibrahim El Kamash, Energy and Charge Transport by Localized Pulses in Renewable Energy Production Schemes: the Case of Inertial Confinement Fusion (funded by the Egyptian Cultural Bureau, 2/2015 - today).

— *Visitors hosted (in chronological order) - long term visits ( $\geq 1$  month):*

- Jafar Borhanian, honorary research visitor, Tabriz University, Iran (May - September 2008); numerical studies of laser-plasma solitons; self-funded (government fellowship);
- Mehdi Seyed Hosseini Jenab, honorary research visitor, Tehran University, Iran (October 2010 - May 2011); kinetic simulations of dusty-plasma dynamics; self-funded (government fellowship);
- Sebastien Guisset, research visit/internship, Universit'e de Bordeaux, France (June - September 2012); fluid simulations of electrostatic pulses; self-funded (Erasmus EU fellowship);
- Ata Ur-Rahman, Quaid-i-Azam University, Pakistan: 6-month visit (June 2013 - November 2013), funded by the Pakistani HEC (Higher Education Commission).
- Muhammad Adnan, University of Peshawar, Pakistan: 6-month visit (July 2013 - November 2013), funded by the Pakistani HEC (Higher Education Commission).
- Gaji Majarul Anowar, Begum Rokeya University, Rangpur, Bangladesh: 3-month visit (September 2013 - November 2013), funded by a UK Commonwealth Fellowship.
- Omar Bouzit, Faculty of Physics, University of Science and Technology Houari Boumediene (USTHB): two 1-month visits (December 2014 and November 2015), funded by an Algerian government academic fellowship.
- Dr Ebraheem Ebraheem Behery, Lecturer, Department of Physics, Damietta University, Egypt: 6-month visit (Feb.-July 2015), funded by the Egyptian Cultural Office.
- Dr Fernando Haas, UFRGS University, Porto Alegre, Brazil: 1-month visit (14/1-14/2/2015), funded by an EU IRSES grant.

— *Visitors hosted - short visits ( $< 1$  month):*

Various short incoming visits, including (in alphabetical order): Mark E. Dieckmann (Linkoping University, Sweden), Fernando Haas (Universidade Federal Rio Grande do Sul, Porto Alegre, Brazil), Manfred A. Hellberg (UKZN University, Durban, S. Africa), Myoung-Jae Lee (Hanyang University, Seoul, Korea), Shimul Maharaj and Carel Olivier (SANSa, Hermanus, S. Africa), Frank Verheest (Universiteit Gent, Belgium).

— Partial supervision of the postdoctoral research of Dr. Waleed Moslem, Von Humboldt Fellow (*“Nonlinear Structures in Active Galactic Nuclei”*), at Ruhr-Universität Bochum (2006-2007).

— Partial (co-)supervision, remote (PhD): Tom Cattaert (Universiteit Gent, Belgium) (visits in 2005 & 2006); large-amplitude solitary waves in space plasmas; partial supervision of PhD research work (principal supervisor: Prof. Frank Verheest; PhD defended in 2006 (Universiteit Gent, Belgium)).

— Partial supervision of the PhD research of Shahid Ali, DAAD (German Government) Fellow, at Ruhr-Universität Bochum (2006-2007); PhD thesis defended in 2008 (Umea U., Sweden).

## 9.2 Research visits (in reverse chronological order)

- 2007-today: Several short research visits to: Ruhr Univesität Bochum, Germany (Prof R Schlickeiser & P K Shukla†); Universiteit Gent, Belgium (Prof F Verheest); National Kapodistrian University of Athens (Department of Physics), Greece, hosted by Professor D.J. Frantzeskakis; University of Crete, Greece (Prof G Tsironis, Dr N Lazaridis).

- Universidade Federal do Rio Grande do Sul - UFRGS, Porto Alegre, Brazil; 2 monthly visits in 2014; 1 visit in 2015; 2 visits in 2016 (Special Visiting Researcher status awarded); hosted by Dr Fernando Haas.

- Nov. 2013: One month visit to University of Kwazulu-Natal, Durban, South Africa, hosted by NITheP (S.A. National Institute of Theoretical Physics) and Professor Manfred A. Hellberg.

- Dec. 2013: 1 week visit to SANSa - S. African National Space Science Agency, Hermanus, S. Africa, hosted by Dr Shimul Maharaj.

- 2010-2013: Several short visits to Max Planck Institute for Physics of Complex Systems (MPIPKS), hosted by Dr Evangelos Siminos and Dr Stefan Skupin.

- 5 week visit to Uni. Sydney (Australia) in 2010-11; host: Prof S Vladimirov (UK Royal Society travel grant).

- 6 week visit to Uni. Sydney in 2009; hosts: Prof D Melrose and Prof S Vladimirov (UK Royal Society travel grant).

- Visiting Research Associate, Universiteit Gent, Sterrenkundig Observatorium, Gent, Belgium; FWO (Flemish Research Fund) funding; collaboration with Prof. F. Verheest on Space plasmas (1 June - 30 Sept. 2006).

– Research visit (1 week) and oral presentation at: MPIPKS - Max Planck Institut für Physik komplexer Systeme, Dresden, Germany, upon invitation by Dr. S. Flach (22 - 27 Nov. 2004).

– Research visit (1 month, Euratom mobility grant) and oral talk at: Euratom - Hellenic Republic Association, University of Thessaly, Laboratory of Fluid Dynamics and Turbomachinery, Volos, Greece); invitation by (and collaboration with) Prof. A. Grecos (May 2002).



## 10. RECOGNITION: IMPACT, WIDE AUDIENCE TEXTS in the PRESS

### — Citations of published work

**Citation H-index: 33**; 3,328 (2,871\*) citations to-date in 1,929 (1,795\*) citing articles (\* within parenthesis, excluding self-citations); data from *Web of Science*, accessed on 23 November 2017; alternatively: **Citation H-index: 37** and **Citation i10-index = 108**; 4266 citations; data from *Google Scholar* (as of 23 November 2017).

### — Highlights from my research

— Pioneering article on *Freak Waves (Rogue Waves) in electromagnetic beam interactions with a plasma*: I have led, from original concept through finish, the research described in the article [2013/A03] (ref. Publication List below) by G.P. Veldes *et al* (*Journal of Optics*, 2013) was selected by the Editors to be included in the “*Highlights of 2013*” collection (Editorial certificate awarded).

— First prediction of the occurrence of *Discrete Breathers* (Intrinsic Localized Modes) in dusty plasma crystals (see paper [2005/A03] by Kourakis *et al*, in Publication List below).

— First experimental observation of electron-holes via proton imaging diagnostics (see paper [2010/A02] by Sarri *et al*, in Publication List below); my contribution was in the theoretical interpretation.

### — Publicity / Press Excerpts

A number of published press articles with reference to our research are available online at: [www.tp4.rub.de/~ioannis/misc/](http://www.tp4.rub.de/~ioannis/misc/) (original www links and .pdf reprints). Examples include:

— IoP (UK) LabTalk webpage “*Monster waves in a laser beam: myth or reality?*”: <http://iopscience.iop.org/2040-8986/labtalk-article/53714> (2013).

— Research Media Innovation article (Special Issue on Complexity Science): “*Riding the Soliton ‘Wave’*”, July 2013; accessible via <http://www.research-europe.com/magazine/ICT/EX13>.

— IoP (UK) LabTalk webpage “*Life off the Maxwellian border: nonthermal effects on plasma waves*”: [iopscience.iop.org/0741-3335/labtalk-article/54105](http://iopscience.iop.org/0741-3335/labtalk-article/54105) (2013).

— APS Physical Review Focus Story, 1 Sept. 2006: *Waves of Destruction*; online at: <http://focus.aps.org/story/v18/st7>.

— PhysOrg Sci. Site, 13 Sept. 2006: *New theory (and old equations) may explain causes of ship-sinking freak waves*; online at: <http://www.physorg.com/news77381892.html>.

— Springer, Geowissenschaften (in German): *Wie entsteht eine “Monsterwelle”*; online at: <http://www.springer.com/dal/home/geosciences?SGWID=1-10006-12-302901-0>.

— Rheinische Post (German daily), 20 Sept. 2006: *Ansage für Monsterwellen*; online at: <http://www.rp-online.de/public/article/aktuelles/wissen/erde/362683>.

— forskning.se (Swedish Uni. Network) article, 14 Aug. 2006: *Små vågsvall ger oväntade monster vågor*; online at: [http://www.forskning.se/GetDoc?meta\\_id=89716](http://www.forskning.se/GetDoc?meta_id=89716).

## 11. ACADEMIC REFERENCES

### 1. **William G. (Bill) GRAHAM**, Professor

Centre for Plasma Physics, Department of Physics and Astronomy, Queen's University Belfast, BT7 1NN Northern Ireland, UK; Tel. +44 771 3323364 ; Email b.graham@qub.ac.uk.

Note: ex-Director of Research, Centre for Plasma Physics (Queen's U. Belfast); Elected Member of the Royal Irish Academy; Fellow of the Institute of Physics; Fellow of the American Physical Society; Honorary Professorship, University of Bucharest; ICPIG Franklin - Von Engel Prize (2013); Editor Plasma Sources Science and Technology (2014- present); Member of the Council of Institute of Physics (1991-1994); Chair of the IOP Plasma Physics Group Committee (1993-1996), among other honours. Professor Graham was my line manager at Queen's University, and has actually collaborated with me in setting up our MSc in Plasma Physics in 2008.

### 2. **Manfred A. HELLBERG**, Professor Emeritus

School of Physics, University of KwaZulu-Natal, Durban 4000, South Africa; Tel: +27 31 260 2860 (office); +27 83 6608902 (mobile). Fax: +27 31 260 7795; Email: hellberg@ukzn.ac.za.

Note: Professor Hellberg is a distinguished member of the Academy of Science of South Africa; a member of St John's College (Cambridge, UK); a Fellow of the UK Institute of Physics; a Fellow of the Royal Society of South Africa; Fellow and Honorary Member (for outstanding contributions) of the South African Institute of Physics (SAIP) and recipient of the highest award conferred by SAIP, the SAIP de Beers Gold Medal, in 2014.

Professor Hellberg and I have collaborated in the last 10 years on topics from Space Plasmas, in particular on solitons in plasmas with electrons obeying non-Maxwellian ( $\kappa$ ) distributions.

### 3. **Frank VERHEEST**, Professor Emeritus

Universiteit Gent, Sterrenkundig Observatorium, Krijgslaan 281, B-9000 Gent, Belgium; Office Phone: +32 9 26 44 799 ; Fax: +32 9 26 44 989; Email: Frank.Verheest@UGent.be.

Note: Formerly Professor at Ghent University, Belgium; Honorary Professor in the School of Physics, UKZN University Durban, S. Africa; Fellow of the Institute of Physics (UK) and of the Royal Astronomical Society (UK). First laureate in 1990 of the H.L. Vanderlinden Prize for Astronomy, bestowed by the Royal Academy of Sciences of Belgium.

Professor Verheest and I have collaborated on various projects; our most recent collaboration focuses on the KdV-Burgers description of shocks in dusty plasmas.

### 4. **Panayotis (Panos) KEVREKIDIS**, Professor

University of Massachusetts Amherst, USA

<http://www.math.umass.edu/~kevrekid> , kevrekid@math.umass.edu, kevrekid@gmail.com ; Mobile tel. / US cell. +1 413 5881882.

Note: Panos Kevrekidis has received numerous awards and distinctions, including a CAREER award in Applied Mathematics from the U.S. National Science Foundation (in 2003), a Humboldt Research Fellowship from the Humboldt Foundation, the 2008 International Stephanos Pnevmatikos Award for research in nonlinear phenomena, the 2013 J.D. Crawford Prize of the Society for Industrial and Applied Mathematics for outstanding research in nonlinear science, the 2013 A.F. Pallas award from the Academy of Athens. In 2014 he was elected a Fellow of the American Physical Society. In 2017 he was elected Fellow of the Society for Industrial and Applied Mathematics, "for fundamental contributions to the existence, stability, and dynamics of nonlinear waves with applications to atomic, optical, and materials physics".

Panos Kevrekidis and I have been collaborating recently on topic from nonlinear science, including extreme-amplitude events (freak waves, rogue waves) in plasmas.

**Ioannis Kourakis**  
www.kourakis.eu

## **Appendix A. SYNOPSIS OF RESEARCH INTERESTS & AREAS OF EXPERTISE**

My research focuses on *Nonlinear Dynamics*, *Theoretical Physics* and *Mathematical Physics*, with emphasis on applications in *Plasma Modelling*, *Laser-Plasma Interactions* and *Materials Science*. The topics below are all represented in the attached Publication List.

### **Mathematical Modeling, Nonlinear Dynamics & Applications**

- Modeling of nonlinear wave propagation in dispersive media, tracing the microscopic origin of nonlinearity & dispersion mechanisms; forcing (gain) & dissipative (loss) effects; modulational instability and wave coupling.
- Nonlinear PDEs - Soliton Theory (formal): stability, conservation properties, interactions, collective coordinate formalism, effect of perturbations. Generic paradigms include: Korteweg de Vries (KdV), nonlinear Schrödinger (NLS), Boussinesq (Bq) equations; in higher dimensionality: Kadomtsev-Petviashvili (KP), Zakharov-Kuznetsov (ZK) equation(s).
- My most recent research focuses on: i) *rogue waves (freak waves)*, i.e. extreme amplitude excitations, typically modeled by *nonlinear Schrodinger* type equations, ii) solitary waves in non-Maxwellian plasmas, and iii) nonlinear fluid models for ultradense quantum plasmas.

### **Nonlinear Waves and Instabilities in Plasmas**

- Nonlinear excitations, solitons and associated nonlinear instabilities, modulated envelope wave packets, modulational instability, ponderomotive coupling effects.
- Electrostatic and electromagnetic waves in Space and laboratory plasmas: pair plasmas, e-p-i plasmas, beam-plasma systems, two-electron temperature plasmas; laser-plasma interactions.

### **Beam Dynamics in Laser Plasmas**

- Theory and simulation of beam profile dynamics in laser plasmas; beam self-focusing and filamentation instabilities; extensive recent work on quantum effects and on non-Gaussian beam profile effects in laser beam propagation.

### **Dusty Plasmas (Complex plasmas)**

- Weakly coupled plasmas, in the presence of charge mesoscopic defects (dust particulates): wave propagation, dispersion properties, instabilities, electrostatic interaction laws.

### **Soft Condensed Matter – Colloidal Plasmas**

- Strongly coupled dusty plasmas; Debye (Yukawa) crystals: sheath dynamics, wake potentials, crystal formation and stability, nonlinear wave propagation; structural and dynamical properties.

### **Transport phenomena and EM pulse propagation in Materials Science**

- Nonlinear excitations in Soft Condensed Matter: Solitons, Intrinsic Localized Modes.
- Nonlinear effects in *Left-handed Materials (LHM)* (negative refraction index media).

## Appendix B: LIST of PUBLICATIONS

(Listed in reverse chronological order)

### B.1 Research articles: published in refereed scientific journals

154. [2017/A05] *On the Effects of Suprathermal Populations in Dusty Plasmas: the case of Dust-Ion-Acoustic Waves*, M. Lazar, I. Kourakis, S. Poedts and H. Fichtner, *Planetary and Space Science* (Elsevier), accepted, in press.
153. [2017/A04] *Ion-beam/plasma interaction effects on electrostatic solitary wave propagation in ultradense relativistic quantum plasmas*, I. S. Elkamash, I. Kourakis and F. Haas, *Physical Review E* **96**, 043206 (2017). DOI: 10.1103/PhysRevE.96.043206
152. [2017/A03] *Ion-beam/plasma modes in ultradense relativistic quantum plasmas: dispersion characteristics and beam-driven instability*, by I.S. Elkamash, F. Haas and I. Kourakis, *Physics of Plasmas*, **24**, 092119 (2017); DOI: 10.1063/1.4989777.
151. [2017/A02] *New insight in the dispersion characteristics of electrostatic waves in ultra-dense plasmas: electron degeneracy and relativistic effects*, I. Kourakis, M. McKerr, I.S. Elkamash and F. Haas, *Plasma Physics and Controlled Fusion*, **59** (10), 1050132017 (2017).
150. [2017/A01] *On the characteristics of obliquely propagating electrostatic structures in non-Maxwellian plasmas in the presence of ion pressure anisotropy*, M. Adnan, A. Qamar, S. Mahmood and I. Kourakis, *Physics of Plasmas*, **24**, 032114 (2017); DOI: <http://dx.doi.org/10.1063/1.4978613>.
149. [2016/A05] Comment on *Weakly dissipative dust-ion acoustic wave modulation* [J. Plasma Phys. **82**, 905820104 (2016)], I. Kourakis and I.S. Elkamash, *Journal of Plasma Physics*, **82** (5) 905820508, (2016); DOI: 10.1017/S0022377816000891; also, *Corrigendum, ibid*, **82** (6), 945820601 (2016); DOI: <https://doi.org/10.1017/S0022377816001033>.
148. [2016/A04] *Multi-species plasma expansion into vacuum: the role of secondary ions and suprathermal electrons*, I. S. Elkamash and I. Kourakis, *Physical Review E*, **94**, 053202 (2016); DOI: 10.1103/PhysRevE.94.053202.
147. [2016/A03] *Ion-Acoustic Envelope Modes in a Degenerate Relativistic Electron-Ion Plasma*, Michael Mc Kerr, Fernando Haas, Ioannis Kourakis, *Physics of Plasmas*, **23**, 052120 (2016); DOI <http://dx.doi.org/10.1063/1.4952774>.
146. [2016/A02] *Localized structures in complex plasmas in the presence of a magnetic field*, P. Dongmo Tsopgue, A. Mohamadou, I. Kourakis, Timoleon C. Kofane and J.P. Tanga, *Astrophys. Space Sci.* **361**, 130 (2016); DOI 10.1007/s10509-016-2712-5.
145. [2016/A01] *Weakly nonlinear ion acoustic excitations in a relativistic model for dense quantum plasma*, E. E. Behery, F. Haas and I. Kourakis, *Physical Review E* **93**, 023206 (2016); <http://dx.doi.org/10.1103/PhysRevE.93.023206>.
144. [2015/A06] *Electron-scale dissipative electrostatic solitons in multi-species plasmas*, S. Sultana and I. Kourakis, *Phys. Plasmas*, **22**, 102302/1-7 (2015); <http://dx.doi.org/10.1063/1.4932071>.
143. [2015/A05] *Laser-driven generation of electron-positron beams: a review*, G. Sarri, M. E. Dieckmann, I. Kourakis, A. Di Piazza, B. Reville, C. H. Keitel, and M. Zepf, *J. Plasma Phys.* **81** (4), 455810401/1-23 (2015); doi:10.1017/S002237781500046X.

142. [2015/A04] *Relativistic breather-like solitary waves with linear polarization in cold plasmas*, G. Sánchez-Arriaga, E. Siminos, V. Saxena and I. Kourakis, *Phys. Rev. E* **91**, 033102 (2015); DOI: <http://dx.doi.org/10.1103/PhysRevE.91.033102>; accessed on ArXiv as: arXiv:1410.1741 (<http://arxiv.org/abs/1410.1741>).
141. [2015/A03] *Electrostatic solitary waves in relativistic degenerate electron-positron-ion plasma*, Ata-ur-Rahman, Ioannis Kourakis and Anisa Qamar, *IEEE Transactions in Plasma Science* **43** (4), 974 (2015); doi: 10.1109/TPS.2015.2404298.
140. [2015/A02] *Amplitude modulation of quantum-ion-acoustic wavepackets in electron-positron-ion plasmas: modulational instability, envelope modes, extreme waves*, Ata-ur-Rahman, Michael Mc Kerr, Wael El-Taibany, Ioannis Kourakis and Anisa Qamar, *Physics of Plasmas* **22**, 022305 (2015); DOI: <http://dx.doi.org/10.1063/1.4907247>.
139. [2015/A01] *Nonlinear hydrodynamic Langmuir waves in fully degenerate relativistic plasma*, F. Haas and I. Kourakis, *Plasma Phys. Cont. Fusion* **57**, 044006 (2015); doi: 10.1088/0741-3335/57/4/044006.
138. [2014/A08] *Modelling relativistic solitary wave interactions in over-dense plasmas: a perturbed nonlinear Schrödinger equation framework*, E. Siminos, G. Sánchez-Arriaga, V. Saxena and I. Kourakis, *Phys. Rev. E*, **90** (6) 063104 (2014); DOI: 10.1103/PhysRevE.90.063104; also as: <http://arxiv.org/abs/1410.0662>.
137. [2014/A07] *Relativistic theory for localized electrostatic excitations in degenerate electron-ion plasmas*, Michael Mc Kerr, Fernando Haas, Ioannis Kourakis, *Physical Review E*, **90**, 033112 (2014); DOI: 10.1103/PhysRevE.90.033112.
136. [2014/A06] *A Schamel equation for ion acoustic waves in superthermal plasmas*, G. Williams, F. Verheest, M.A. Hellberg, G. Anowar and I. Kourakis, *Phys. Plasmas*, **21**, 092103 (2014); doi: 10.1063/1.4894115.
135. [2014/A05] *Pressure anisotropy effects on nonlinear electrostatic excitations in magnetized electron-positron-ion plasmas*, M. Adnan, G. Williams, A. Qamar, I. Kourakis, *Eur. Phys. J. D*, **68**, 247 (2014); DOI: 10.1140/epjd/e2014-50384-y.
134. [2014/A04] *Vlasov-kinetic computer simulations of electrostatic waves in dusty plasmas: an overview of recent results*, S. M. Hosseini Jenab and I. Kourakis, *European Physical Journal D* **68**, 219 (2014); DOI: 10.1140/epjd/e2014-50177-4.
133. [2014/A03] *Multicomponent kinetic simulation of BGK modes associated with ion acoustic and dust-ion acoustic excitations in electron-ion and dusty plasmas*, S. M. Hosseini Jenab and I. Kourakis, *Phys. Plasmas*, **21**, 043701 (2014); <http://dx.doi.org/10.1063/1.4869730> .
132. [2014/A02] *Dust-acoustic shocks in strongly coupled dusty plasmas*, S. E. Cousens, S. Sultana, I. Kourakis, V. V. Yaroshenko, F. Verheest and M. A. Hellberg, *Phys. Rev. E* **89**, 043103 (2014); <http://dx.doi.org/10.1103/PhysRevE.89.043103>.
131. [2014/A01] *Freak waves and electrostatic wavepacket modulation in a quantum electron-positron-ion plasma*, M. McKerr, I. Kourakis and F. Haas, *Plasma Phys. Cont. Fusion* **56**, 035007 (17pp) (2014).
130. [2013/A13] *On the existence and stability of electrostatic structures in non-Maxwellian electron-positron-ion plasmas*, G. Williams and I. Kourakis, *Physics of Plasmas*, **20**, 122311 (2013); <http://dx.doi.org/10.1063/1.4849415>.
129. [2013/A12] *Semiclassical relativistic fluid theory for electrostatic envelope modes in dense*

- electron-positron-ion plasmas: modulational instability & rogue waves*, Ioannis Kourakis, Michael McKerr and Ata Ur-Rahman, *J. Plasma Phys.*, **79** (6), 10891094 (2013) (<http://dx.doi.org/10.1017/S0022377813001323>); also: *Corrigendum, ibid.*, **80** (04), 653 (1 p.); DOI: <https://doi.org/10.1017/S0022377814000178>.
128. [2013/A11] *Dust-acoustic supersolitons in a three-species dusty plasma with kappa distributions*, M.A. Hellberg, T.K. Baluku, F. Verheest and I. Kourakis, *J. Plasma Phys.*, **79** (6), 10391043 (2013).
127. [2013/A10] *Ion-acoustic supersolitons in plasmas with two-temperature electrons: Boltzmann and kappa distributions*, Frank Verheest, Manfred A. Hellberg and Ioannis Kourakis, *Phys. Plasmas* **20**, 082309/1-12 (2013); doi: 10.1063/1.4818888.
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2. [2017/A06R] *Dissipative electrostatic shock waves in multi-ion dusty plasmas*, I. S. Elkamash and I. Kourakis, submitted to *Physical Review E* (USA), under review.
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4. [2017/A08R] *Electrostatic solitary waves in ultradense relativistic quantum plasmas in the presence of a negative-ion beam: propagation characteristics and polarity reversal*, I. S. Elkamash and I. Kourakis, *Physical Review E* (APS, USA), submitted, under review (2017).

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17. [2006/C01] *“Charge polarization (dressed electrostatic interaction) effects in dusty (complex) crystals”*, I. Kourakis, P. K. Shukla and B. Farokhi, *Proc. 13th International Congress on Plasma Physics – ICPP06* (Kiev, Ukraine, May 22-26, 2006); E036p.
16. [2004/C11] *“Nonlinear Whistlerons”*, B. Eliasson, I. Kourakis and P. K. Shukla, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics* (Nice, France), (Nice, France, 2004); e-Proceedings: <http://hal.ccsd.cnrs.fr/ccsd-00001894/en/>.
15. [2004/C10] *“Nonlinear theory of dust lattice mode coupling in dust crystals”*, I. Kourakis and P. K. Shukla, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics*

- (Nice, France, 2004); e-Proceedings: <http://hal.ccsd.cnrs.fr/ccsd-00001893/en/>.
14. [2004/C9] “*Intrinsic localized modes in dust lattices*”, I. Kourakis, P. K. Shukla and V. Basios, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics* (Nice, France, 2004); e-Proceedings: <http://hal.ccsd.cnrs.fr/ccsd-00001892/en/>.
  13. [2004/C8] “*Modulated envelope localized wavepackets associated with electrostatic plasma waves*”, I. Kourakis and P. K. Shukla, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics* (Nice, France, 2004); <http://hal.ccsd.cnrs.fr/ccsd-00001889/en/>.
  12. [2004/C7] “*Lagrangian formulation of ion- and dust-ion-acoustic waves*”, I. Kourakis and P. K. Shukla, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics* (Nice, France, 2004); e-Proceedings: <http://hal.ccsd.cnrs.fr/ccsd-00001891/en/>.
  11. [2004/C6] “*Theory of solitary waves in complex plasma lattices*”, I. Kourakis, P. K. Shukla and B. Eliasson, *Proceedings of the 2004 ICPP: International Congress on Plasma Physics* (Nice, France, 2004); e-Proceedings: <http://hal.ccsd.cnrs.fr/ccsd-00001890/en/>.
  10. [2004/C5] “*Discrete breather modes in complex plasma crystals*”, I. Kourakis, P. K. Shukla and V. Basios, *Proceedings of the 31st EPS Conference on Plasma Physics* (London, UK), *European Conference Abstracts (ECA)* (Petit Lancy, Switzerland), Vol. **28B**, P1.011 (2004).
  9. [2004/C4] “*Modulational instability and envelope excitations of dust-acoustic waves in a non-thermal background*”, I. Kourakis and P. K. Shukla, *Proceedings of the 31st EPS Conference on Plasma Physics* (London, UK), *European Conference Abstracts (ECA)* (Petit Lancy, Switzerland), Vol. **28B**, P4.081 (2004).
  8. [2004/C3] “*Envelope localized modes in electrostatic plasma waves*”, I. Kourakis and P. K. Shukla, *Proceedings of the 31st EPS Conference on Plasma Physics* (London, UK), *European Conference Abstracts (ECA)* (Petit Lancy, Switzerland), Vol. **28B**, P5.058 (2004).
  7. [2004/C2] “*Lagrangian formulation of electrostatic plasma waves: Application to dust-acoustic waves*”, I. Kourakis and P. K. Shukla, *Proceedings of the 31st EPS Conference on Plasma Physics* (London, UK), *European Conference Abstracts (ECA)* (Petit Lancy, Switzerland), Vol. **28B**, P-2.067 (2004).
  6. [2004/C1] “*Theory of nonlinear excitations in dusty plasma crystals*”, I. Kourakis, P. K. Shukla and B. Eliasson, *Proceedings of the 31st EPS Conference on Plasma Physics* (London, UK), *European Conference Abstracts (ECA)* (Petit Lancy, Switzerland), Vol. **28B**, O-5.07 (2004).
  5. [2002/C2] “*Modulational instability and localized excitations in dusty plasma crystals*”, I. Kourakis, *Proceedings of the 29th EPS meeting on Controlled Fusion and Plasma Physics, European Conference Abstracts (ECA)* Vol. **26B** (2002) P-4.221.
  4. [2002/C1] “*Relaxation times for magnetized plasma*”, I. Kourakis, *Proceedings of the 29th EPS meeting on Controlled Fusion and Plasma Physics, European Conference Abstracts (ECA)* Vol. **26B**, P-4.008 (2002).
  3. [2001/C1] “*Kinetic Theory and diffusion coefficients for plasma in a uniform magnetic field (Debye potential)*”, I. Kourakis, D. Carati & B. Weyssow, *Proceedings of the 2000 International Conference on Plasma Physics / APS-DPP meeting in Québec*, Vol. **1**, 49 - 53 (2001).
  2. [2000/C1] “*Kinetic Theory and diffusion coefficients for plasma in a uniform magnetic field (Coulomb potential)*”, I. Kourakis & D. Carati, *Proceedings of the 27th EPS meeting on Con-*

*trolled Fusion and Plasma Physics, Eur. Conf. Abstracts (ECA) Vol. 24B*, 872 - 875 (2000).

1. [1998/C1] “Fokker-Planck equation for a test-particle in magnetized plasma”, I. Kourakis, *Proceedings of the 1998 ICPP & 25th EPS meeting on Controlled Fusion and Plasma Physics, ECA (Europhysics Conference Abstracts) 22C*, 264 - 267 (1998).

## B.5 Dissertations

2002/DISS. “Kinetic theory for a test-particle weakly coupled to a heat-bath. Application to magnetized plasmas”, PhD thesis, ULB - Université Libre de Bruxelles, Belgium (2002).

2001/DISS. “Kinetic theory for a test-particle weakly-coupled to a large heat-bath in equilibrium - application to magnetized plasma”, mémoire de D.E.A. (Belgian MPhil. thesis), ULB - Université Libre de Bruxelles, Belgium (2001).

1991/DISS. *Modulational instability in hydrogen-bonded systems (“Instabilité Modulationnelle dans les Systèmes à Liaisons Hydrogènes”)*, mémoire de D.E.A. (French MSc. thesis), Université de Bourgogne, Dijon, France (1991).

## B.6 Lecture Notes & Tutorials

2008/T1. *Introduction to Plasma Modelling*, Lecture Notes by I. Kourakis (75 %, + coordinator), Marco Borghesi and Matt Zepf (25 %), MSc course PHY9013, Queen’s University Belfast (2008).

2008/T2. *Laser-produced Plasmas*, Lecture Notes by D. Riley, I. Kourakis, C. Lewis and M. Zepf, MSc module PHY9016, Queen’s University Belfast (2008+).

2007/T1. *Nonlinear field line random walk and generalized compound diffusion of charged particles*, I. Kourakis, *2007 Summer College on Plasma Physics* (Abdus Salam ICTP, Trieste, Italy, 2007); published online at the ICTP server.

2007/T2. *Localized envelope excitations in pair plasmas*, I. Kourakis, *2007 Summer College on Plasma Physics* (Abdus Salam ICTP, Trieste, Italy, 2007); published online at the ICTP server.

2006/T1. *Nonlinear Modulated Envelope Electromagnetic Excitations in Multi-Component Plasmas: Focus on Oblique Electromagnetic Wavepackets in Magnetized e-p-i Plasmas or Doped Pair Plasmas*, I. Kourakis, *International Workshop on Frontiers of Plasma Science* (Abdus Salam ICTP, Trieste, Italy, 2006); online on the ICTP server, at: <http://cdsagenda5.ictp.trieste.it>.

2005/T1. *Collective processes in dusty plasma crystals*, I. Kourakis, *Autumn College on Plasma Physics* (Abdus Salam ICTP, Trieste, Italy, 2005); available online as ICTP/SMR1673/19, at the ICTP server.

2004/T1. “Electrostatic wave propagation in dusty plasmas - occurrence of dust in fusion plasmas”, I. Kourakis & P. K. Shukla, ‘3rd School on Fusion Physics and Technology’, Volos (Greece), 1 April 2004 (proceedings in greek, Association Euratom-Hellenic Republic, 2005).

2003/T1. “Fokker-Planck kinetic equation for a test-particle in plasma inside a magnetic field”, I. Kourakis & A. Grecos, ‘1st School on Fusion Physics and Technology’, Volos (Greece), may 2002, pp. 147 – 163 (proceedings in greek, 2003).

## Appendix C: CONFERENCE ATTENDANCE / TALKS / SEMINARS

### C.1 Invited Presentations (Invited Talks)

43. Invited Speaker, *International Scientific Spring (ISS-2018)*, 12-16 March 2018, Islamabad, Pakistan.
42. Invited Lecture, Special Session on Kappa Distributions, in *SigmaPhi2017 - International Conference on Statistical Physics*, 10-14 July 2017, Corfu, Greece.
41. *5th SOLARNET workshop*, invited lecture, Belfast, 1 September, 2016.
40. Invitation to the VI International Conference on *Frontiers in Nonlinear Physics - FNP2016*, Mini-Symposium on “*Rogue Waves in Nature*”, invited lecture, Nizhny Novgorod & St. Petersburg, July 17-23, 2016 (cancelled).
39. UK National Astronomy Meeting - NAM2016, Session “*Solar and Experimental Plasma Physics Synergy*”, invited lecture, 27 June - 1 July 2016.
38. *International Scientific Spring*, National Centre for Physics, Islamabad, Pakistan (9 March 2016); invited video-lecture.
37. *QuAMP-2015 - International Conference on Quantum, Atomic, Molecular and Plasma Physics*, University of Sussex, Brighton, UK, 1-4 September 2015; invited lecture.
36. Joint *BUKS-2015 - MHD waves and Instabilities in the Solar Atmosphere and Celebrating the Scientific Career of Michael Ruderman – Honorary Meeting*, Budapest, 25-29 May 2015; invited lecture.
35. *International Scientific Spring*, National Centre for Physics, Islamabad, Pakistan (20 March 2015); invited video-lecture.
34. *SIAM Conference on Nonlinear Waves and Coherent Structures (SIAM NW14)*, August 11-14, 2014, Churchill College, University of Cambridge, UK, <http://www.siam.org/meetings/nw14/>; invited lecture (special session on “*Nonlinear Waves in Metamaterials*”) (attendance canceled due to overlapping commitments).
33. Invited Lecture, *SigmaPhi2014 - International Conference on Statistical Physics*, 07-12 July 2014, Rhodes, Greece.
32. *HIPOLIN 2014 - An Introduction to high power light-matter interactions*, Summer School, Rethymnon Crete, Greece; invited lecture (4 July 2014).
31. *International Scientific Spring ISS-2014*, National Center for Physics, Islamabad, Pakistan, 10-14 March 2014; (invited talk; not attended).
30. 7th International Conference on the Physics of Dusty Plasmas (ICPDP2014), held in New Delhi, 3-7 March 2014 (invited talk; not attended); <http://www.icdpd2014.com>.
29. AGU (American Geophysical Union) Fall Meeting 2013 (<http://fallmeeting.agu.org/2013/>), held in San Francisco USA, 9-13 December 2013 (invited talk: special session “*Kappa-distributions in Space Plasmas*”, org. George Livadiotis & Peter Yoon).
28. Invitation to *First ICTP-NCP International College on Plasma Physics (SMR 2565)* (held in Islamabad Pakistan, 11-15 November 2013), jointly organized by the International Centre for Theoretical Physics (ICTP, Trieste, Italy) and the National Center for Physics (NCP, Pakistan); declined, to personal commitment.

27. *HIPOLIN 2013 - An Introduction to high power light-matter interactions*, Summer School, Rethymnon Crete, Greece; lecture delivered 10 July 2013.
26. *International Scientific Spring*, National Centre for Physics, Islamabad, Pakistan (11-15 March 2013).
25. *ITCPS2012 - International Topical Conference on Plasma Science*, Faro, Portugal (24-28 September 2012).
24. *APPEPLA 2012 - Applications of Electronics in Plasma Physics*, Rethymnon Crete, Greece (July 2012).
23. *Joint European Physical Society (EPS) Conference on Plasma Physics and Int. Congress. on Plasma Physics*, Stockholm, Sweden (2-6 July 2012).
22. *International Scientific Spring*, National Centre for Physics, Islamabad, Pakistan (5-9 March 2012).
21. *APPEPLA 2011 - Applications of Electronics in Plasma Physics*, Rethymnon Crete, Greece (September 2011).
20. *ICPDP - 6th International Conference on the Physics of Dusty Plasmas*, Garmisch-Partenkirchen, Germany (May 16-20, 2011).
19. *International Scientific Spring*, National Centre for Physics, Islamabad, Pakistan (March 01-04, 2011) (not attended due to last minute administrative problem).
18. *Workshop on Frontiers in Plasma Physics*, ICTP International Center of Theoretical Physics, Trieste, Italy (July 2010).
17. *APPEPLA - Applications of Electronics in Plasma Physics*, Rethymnon Crete, Greece (June-July 2010).
16. *Summer College in Plasma Physics*, ICTP International Center of Theoretical Physics, Trieste, Italy (August 2009).
15. *SIAM Conf. on Applications of Dynamical Systems (DS09)* in Snowbird Utah, USA.
14. *9th Workshop on Fine Particle Plasmas (NIFS)* in Toki/Gifu, Japan (Dec. 2008; invitation; not attended due to inconvenience).
13. *Greek-Turkish conference on "Statistical Mechanics and Dynamical Systems"*, Rhodos, Greece & Marmaris, Turkey (11-17 September 2008).
12. *International Congress on Plasma Physics (ICPP 2008)*, Fukuoka, Japan (8-12 Sept. 2008).
11. *Int. Workshop on the Frontiers of Modern Plasma Phys.*, Trieste, Italy (14-25 July 2008).
10. *SIAM Conf. on Nonlinear Waves and Coherent Structures (NW08)*, Rome, Italy (21-24 July 2008).
9. *5th International Conference on Dusty Plasma Physics Conference (ICPDP5)*, Ponta Delgada, Azores, Portugal (18-24 May 2008).
8. *2007 Summer College on Plasma Physics*, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy (31 July - 24 August 2007).
7. *3rd FSA (Flemish-South African) Workshop on Space Plasma Physics*, Universiteit Gent, Belgium (27 - 29 Sept. 2006).

6. *International Workshop on Frontiers of Plasma Science*, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy (21 August - 1 September 2006).
5. *Autumn College on Plasma Physics: Collective Processes*, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy (5-30 September 2005).
4. *1st FSA Workshop on Dusty and Space Plasma Physics*, Gent, Belgium (22 - 24/09/2004).
3. *SPIG 2004: 22nd Summer School and International Symposium on the Physics of Ionized Gases*, Tara Park, Serbia and Montenegro (23 - 27 August 2004).
2. *3rd School on Fusion Physics and Technology*, organized by the Euratom - Hellenic Republic Association, held at the University of Thessaly, Volos, Greece (29 March - 2 April 2004).
1. *1st School on Fusion Physics and Technology*, organized by the Euratom - Hellenic Republic Association, held in the University of Thessaly, Volos, Greece (16 - 21 May 2002).

## C.2 Contributed presentations (talks, posters)

52. 44th Eur. Phys. Soc. Conference on Plasma Physics (Belfast, 26-30 June 2017); 1 oral talk, 1 poster presented and 3 posters co-authors: for titles, see items 60-64 in Conf. Proceedings section above.
51. *Extended modulation instability criteria for dissipative dusty plasmas*, 8th Int. Conf. Phys. Dusty Plasmas, Prague (20-25 May 2017) (poster presentation).
50. *Analysis and Applications of Localized Structures in Nonlinear Media*, Lorentz Center, Leiden, Holland, 29 Aug - 2 Sep 2016 (oral talk).
49. *43rd IoP Plasma Physics Group Annual Meeting*, Isle of Skye, UK; 23-26 May 2016 (oral talk and poster (presented by I. Elkamash)).
48. 42nd EPS Conference on Plasma Physics (Lisbon, Portugal, July 2015), Poster and paper (presented by I. Elkamash).
47. 42nd EPS Conference on Plasma Physics (Lisbon, Portugal, July 2015), Poster and paper (presented by I. Elkamash).
46. 41st EPS Conference on Plasma Physics (Berlin, Germany, July 2014), Poster and paper (presented by G. Williams).
45. *11th Conference of the Hellenic Astronomical Society (HelAS)*, Athens, Greece; 8-12 September 2013.
44. *2013 IoP Plasma Physics Group Annual Meeting*, York, UK; 25-29 March 2013 (oral talk).
43. *International endeavor to establish Laser-Based High Energy Physics and Applications Conference (IZEST)*, University of Strathclyde, Glasgow (UK), November 13-15, 2012 (poster).
42. *2nd Conference on Localized Excitations in Nonlinear Complex Systems (LENCOS'12)*, Sevilla (Spain), July 9-12, 2012 (oral talk).
41. Joint *39th European Physical Society (EPS) Conference on Plasma Physics and Int. Congress. on Plasma Physics*, Stockholm, Sweden (2-6 July 2012); poster(s) and paper(s) (presented by G. Williams and M. McKerr).
40. *5th Chaotic Modeling and Simulation International Conference (CHAOS 2012)*, Athens



(Greece), 12-15 June 2012 (oral talk).

39. *ENLITE12 - International Workshop on Laser-Plasma Interaction at Ultra-High Intensity*, Dresden Germany; 16 - 20 April 2012 (oral talk).

38. *2012 IoP Plasma Physics Group Annual Meeting*, Oxford, UK; March 2012.

37. *Rogue Waves – ROGUE11*, International Workshop (Scientific Coordinators: Nail Akhmediev, Alan C. Newell, Efim Pelinovsky), Dresden Germany; 07 - 11 November 2011 (poster).

36. *30th International Conference on Phenomena in Ionized Gases (ICPIG2011)*, Belfast, Northern Ireland, UK; 28 Aug.-2 Sept. 2011 (poster).

35. *2011 IoP Plasma Physics Group Annual Meeting*, North Berwick, Scotland UK; March 2011 (poster); *IoP best student poster prize awarded to PhD student S. Sultana*.

34. *2010 EPS meeting on Plasma Physics*, Dublin, Ireland; June 2010 (poster).

33. *12th Workshop on Phys. Dusty Plasmas*, Boulder Colorado USA, 17-20 May 2009 (talk).

32. *2009 IoP Plasma Physics Group Annual Meeting*, Warwick, UK; 30 March - 2 April, 2009 (poster).

31. *International Conference on Statistical Physics (Sigma-Phi 2008)*, Kolymbari, Crete, Greece (14-18 July 2008) (poster).

30. *35th IEEE International Conference on Plasma Science*, Karlsruhe, Germany (15-19 June, 2008) (talk).

29. *2008 IoP Plasma Physics Group Annual Meeting*, London, UK (1-4 April, 2008) (talk).

28. *Hamiltonian Lattice Dynamical Systems*, Leiden, Netherlands (October 15-19, 2007) (talk).

27. *The Sun, the Heliosphere and the Earth, IHY 2007 conference*, international workshop, Bad Honnef, Germany (May 14-18, 2007); poster contributions (2).

26. *Nonlinear Physics in Periodic Structures and Metamaterials*, international workshop, Max Planck Institut für Physik komplexer Systeme, Dresden, Germany, March 19-30, 2007; contributed talk.

25. *Dynamics Days Europe 2006*, Heraklion-Crete, Greece (25 - 29 September 2006).

24. *Nonlinear Physics and Mathematics (NLPM 2006)*, International Workshop, Kiev, Ukraine (25-27 May, 2006); poster contribution.

23. *13th International Congress on Plasma Physics*, Kiev, Ukraine (22-26 May, 2006).

22. *NEXT-SigmaPhi: News, Expectations and Trends in Statistical Physics*, Kolymbari (Crete), Greece (13-18 August 2005).

21. *Nonlinear Science and Complexity: 18th Panhellenic Summer School and Conference*, University of Thessaly, Volos, Greece (18-30 July 2005).

20. *ICPP2004: 12th Int. Congress on Plasma Physics*, Nice, France (25 - 29 October 2004).

19. *International Conference and Summer School: Complexity in Science and Society*, Patras and Ancient Olympia, Greece (14 - 26 July 2004).

18. *Workshop on Theoretical Plasma Physics*, ICTP International Center of Theoretical Physics, Trieste, Italy (5 - 16 July 2004).

17. *31st EPS meeting on Plasma Physics*, London, UK (28 June - 2 July 2004).
16. *International Topical Conference on Plasma Physics - ITCPP 2003*, Santorini, Greece (8 - 12 September 2003).
15. Annual meeting of the Belgian Physical Society, UMH - Université de Mons - Hainaut, Mons, Belgium (25 - 26 May 2004).
14. *International Conference on Noise and Fluctuations - ICNF 2003*, Prague, Czech Republic (18 - 22 August 2003).
13. *16th Summer School / Panhellenic Congress on Nonlinear Dynamics: Chaos and Complexity*, Halkida, Greece (14 - 24 July 2003).
12. *11th International Workshop on the Physics of Non-Ideal Plasmas - PNP11*, Valencia, Spain (20 - 25 March 2003).
11. *29th EPS meeting on Plasma Physics and Controlled Fusion* (17 - 21 June 2002), Montreux, Switzerland (17 - 21 June 2002).
10. *International Workshop on Chaotic Transport and Complexity in Classical and Quantum Dynamics*, Carry-le-Rouet (Marseille), France (24 - 28 June 2002).
9. *'III Congreso Venezolano de Física'*, Meeting of the Physical Society of Venezuela, Universidad Simon Bolívar, Caracas, Venezuela (10 - 14 December 2001).
8. *Collisions in the Universe*, Conference, FUNDP - Facultés Universitaires Notre-Dame de Namur, Namur, Belgium (21 - 22 November 2001).
7. Workshop: *Kinetic Theory and Asymptotic Expansions in Classical and Quantum Systems*, Granada, Spain (17 - 21 September 2001).
6. *2000 ICPP - International Conference on Plasma Physics / APS-DPP (American Physical Society - Division of Plasma Physics) joint meeting*, Québec, Canada (23 - 27 October 2000).
5. *27th EPS (European Physical Society) meeting on Plasma Physics and Controlled Fusion*, held at Budapest, Hungary (12 - 16 June 2000).
4. *8th European Fusion Theory Conference*, Como, Italy (27 - 29 October 1999).
3. *International Topical Conference on Plasma Physics: New Frontiers of Nonlinear Sciences*, University of Algarve, Faro, Portugal (6 - 10 September 1999).
2. *1998 ICPP (International Congress on Plasma Physics) and 25th EPS (European Physical Society) meeting on Plasma Physics and Controlled Fusion*, Prague, Czech Republic (28 June - 3 July 1998).
1. Annual meeting of the Belgian Physical Society, Limburgs Universitair Centrum, Belgium (29 - 30 May 1997).

### **C.3 Research visits & presentations upon invitation / seminars**

15. Research Visit & seminar talk (on 26 November 2014), Ruhr University Bochum (RUB), Bochum Germany, 24-28 November 2014; hosted by Professor R Schlickeiser.
14. Research Visit & seminar talk (on 18 June 2014), Ruhr University Bochum (RUB), Bochum Germany, 16-21 June 2014; hosted by Professor R Schlickeiser.

13. Research Visit & seminar talk (on 12 June 2014), Crete Center for Quantum Complexity and Nanotechnology (CCQCN), Heraklion - Crete, 9-12 June 2013; hosted by Professor G Tsironis.
12. *Special Visiting Researcher (Pesquisador Visitante Especial - PVE)* status, held at Universidade Federal do Rio Grande do Sul - UFRGS, Porto Alegre, Brazil, supported by the Brazilian Research Fund (CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico - Brasil); two visits, in March and in May 2014; Colloquium talk at UFRGS (27 May 2014).
11. Research Visit & seminar talk, invited and funded by SANSA (South-African National Space Agency), Hermanus South Africa, 5-8 October 2013; hosted by Dr Shimul Maharaj.
10. Research Visit & seminar talk, invited and supported by NITheP (National Institute of Theoretical Physics), University of Kwazulu - Natal, Durban, South Africa, 24 October - 24 November 2013; hosted by Professor Manfred A. Hellberg.
9. December 2010 - January 2011: Research visit to University of Sydney, funded by a UK Royal Society travel grant: hosted by Professor Sergey Vladimirov.
8. March 2009: Research visit to ANU - Australian National University, Canberra: hosted by Professor Yuri Kivshar.
7. February - March 2009: Research visit to University of Sydney, funded by a UK Royal Society travel grant: hosted by Professor Sergey Vladimirov.
6. Atomistic Simulation Centre, Queen's University Belfast, UK; 2008, invited seminar.
5. Hellenic Open University, Patras, Greece, April 28, 2007.
4. Ruhr Universitaet Bochum, Lehrstuhl Theoretische Physik IV – Theoretische Weltraum und Astrophysik, Bochum, Germany, 16 Nov. 2005.
3. Aristotle University of Thessaloniki, Engineering (Polytechnic) School, General Department, Thessaloniki, Greece, 3 Nov. 2005.
2. National Technical University of Athens, School of Applied Mathematics and Physical Sciences, Mathematics Department, Athens Greece, 25 Feb. 2005.
1. MPIPks - Max Planck Inst. Phys. of Complex Systems, Dresden, Germany, 24 Nov. 2004.

#### **C.4 Scientific training / Schools attended**

8. *8th Panhellenic Congress / 13th Summer School on Complexity and Nonlinear Dynamics*, Hania (Crete), Greece (17 - 28 July 2000).
7. Summer School on *Solitons: concepts and recent developments*, Dijon, France; organized by *Centre de Dynamique des Systèmes Complexes* and Université de Bourgogne (16-20 June 1997).
6. Workshop on *Fluctuations, Nonlinearity and Disorder*, Heraklion (Crete), Greece; organized by the University of Crete and the FORTH: Foundation of Research and Technology Hellas (30 September 1997 - 4 October 1997).
5. *2nd Carolus Magnus Summer School on Plasma Physics*, Aachen, Germany; organized by the institutes: KFA-Forschungszentrum, Jülich, FOM-Instituut voor Plasmafysica, Nieuwegein and ERM/KMS Laboratory for Plasma Physics, Brussels (11 - 22 September 1995).
4. *3rd Panhellenic Congress / 8th Summer School on Complexity and Chaotic Dynamics of Nonlinear Systems*, Democritus University of Thrace, Xanthi, Greece (17 - 28 July 1995).

3. *2nd Panhellenic Congress / 7th Summer School on Complexity and Nonlinear Dynamics*, Democritus University of Thrace, Xanthi, Greece (25 July - 5 August 1994).
2. *International Summer School on Chaos and Nonlinear Dynamics*, University of the Aegean, Samos, Greece (July 1990).
1. *2nd Summer School on Chaos and Nonlinear Dynamics*, University of the Aegean, Samos, Greece (July 1989).

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## ACCOUNT of RESEARCH ACTIVITY

### *Current research, achievements, future plans*

My principal research interests lie in the field(s) of **Theoretical Physics and Applied Mathematics**, with applications in *Plasma Physics*, in *Soft Condensed Matter* and in *Nonlinear Science*. Nonlinear plasma physics is relevant in *technological applications* (microcircuits based on semiconductor plasmas), in *energy production* (fusion) and in *plasmonic materials* (optical metamaterials for electromagnetic waveguide design).

***Nature is intrinsically nonlinear!*** In various physical contexts, ranging from Plasma Physics to Nonlinear Optics and from Materials Science to Biophysics, the delicate balance between nonlinearity and Fourier dispersion gives rise to stable structures (*solitary waves*). At a first approach, these are modelled as *solitons*, i.e. exact solutions on ***Nonlinear Partial differential Equations*** (PDEs). A more sophisticated description requires taking into account gain (forcing) and loss (dissipative) terms, in addition to effects like noise, random interactions/collisions etc.

My research focuses in particular on *Nonlinear Waves* and their propagation characteristics in the aforementioned physical media. My research consists of extensive investigations, both theoretical and computational, of the dynamics of *solitary waves* and *shocks* (localized modes) propagating in dispersive media, modelled by nonlinear (nonlinear Schrödinger and Korteweg de Vries and variants, e.g.) theories, and of associated nonlinear effects, i.e. instabilities, localized modes, etc. Thematic areas are identified below.

***Team leadership:*** I have been leading my own group, since my academic appointment at Queen's University (post offered in 2007; tenured in 2009). In the last years, I have supervised or/and collaborated with: four (4) postdocs (7.5 person-years in total); five (5) PhD students (as principal supervisor);  $\geq 15$  research visitors, at postgraduate level; various long-term academic visitors. (Details upon request).

#### ***International leadership – network of collaborators:***

— Extensive network of external collaborators: 66+ co-authors from 47 different institutions, in 23+ countries (from all five continents). Ongoing collaboration has been maintained with 20+ of these collaborators (data from Web of Science, as of 2 Nov. 2017).

— I am currently leading an international cluster of research groups on *Quantum Plasmas*, funded by the European Union (IRSES scheme, 2014-2017), which combines 5 universities/groups in 4 countries (UK, Portugal, Sweden and Brazil).

— I have created, and till now sustain, active collaborations with groups worldwide. These include (but are not limited to) the following:

- In high-density (quantum) plasmas: F. Haas, University of Porto Alegre (Brazil); T. Mendonça, Instituto Superior Tecnico, Lisbon, Portugal; ...
- In Space Plasmas: S. Maharaj, South-Africa National Space Agency (SANSA); M. Hellberg, University of Durban (S. Africa); R. Schlickeiser, Ruhr Universität Bochum (Germany); M. Lazar, Katholic University of Leuven (Belgium); ...

- In plasma simulations and modelling: B. Eliasson, Strathclyde University (Glasgow, UK); M. Jenab, Univ. Umea (Sweden); ...
- In nonlinear dynamics (Applied Mathematics): R. Kraenkel and group, Institute of Theoretical Physics, State University of Sao Paulo (Brazil); P. Kevrekidis, Amherst University (USA); DJ Frantzeskakis, U. Athens (Greece); ...
- In Complex Plasmas: Prof Hubertus Thomas, Deutsches Zentrum für Luft- und Raumfahrt, DLR; Forschungsgruppe Komplexe Plasmen, Wessling (Germany).

These collaborations form the core of my near-future research plan(s).

**Metrics** in a nutshell: **150+ published articles in refereed journals**; 10+ papers in Collective Volumes and peer-reviewed Conference Proceedings; ~60+ papers in Conference Proceedings; **Citation H-index: 33**; 3,328 (2,871\*) citations to-date in 1,929 (1,795\*) citing articles (\* within parenthesis, excluding self-citations); data from *Web of Science*, accessed on 23 November 2017; alternatively: **Citation H-index: 37** and **Citation i10-index = 108**; 4266 citations; data from *Google Scholar* (as of 23 November 2017).

**Breadth of research interest:** Topics of interest cover areas of *Laser-plasma Interactions* and *Nonlinear Plasma Physics*, and also selected topics from *Statistical Physics* (and its applications in other areas; e.g., article in Econophysics in 2009), in *Materials Science* (metamaterials; BEC condensates) and in ocean dynamics (PRL article on freak waves).

My main research areas (nos. 1-3 below) are outlined in the following, along with a summary of *current research focus points*, associated *achievements* and future plans. Areas 4 and 5 refer to earlier work and are here provided for completeness.

[The numbering of sample articles cited below follows the numbering in my Publication List.]

1. [**Plasma Physics, Mathematical Physics**] ***Nonlinear dynamics, theories for solitary waves and shocks***; + **multiscale mathematical techniques for rogue waves (freak waves) in charged matter (quantum plasmas, laser-plasma interactions, materials)**

Nonlinear excitations occur in various physical contexts, thanks to a delicate balance between nonlinearity and dispersion (or, in some cases, dissipation). Their remarkable stability and dynamical properties make them good candidates for the modeling of excitations in various fields (ranging from tsunami waves in the sea, and charge carriers in biomolecules, to information carriers in telecommunication and to DNA bubbles). Generic paradigms include *solitons* (as models for *solitary waves*, or for *shocks*), *breathers*, and *rogue waves (freak waves)*, to mention but a few. These are based on nonlinear PDEs, include integrable theories (the Korteweg - de Vries or KdV theory; the nonlinear Schrödinger, or NLS theory), but also non-integrable variants thereof (e.g. the Gardner or modified KdV theory), and also multidimensional generalisations (the Zakharov-Kuznetsov equation; the Kadomtsev Pethviashvili equation; the Davey-Stewartson problem). Further extensions include *discrete breathers* (for discrete systems, i.e. lattices), and also the quasi-soliton pseudopotential (Sagdeev) theory in plasmas.

The majority of my research, as outlined below, relies on applications of nonlinear analytical theories (above) in various physical systems. My recent activity has focused on charged matter (*plasmas*), but also spans other areas (articles in materials science, nonlinear optics and theory of Bose-Einstein condensates). Combined with a solid mathematical modelling background, this rich experience provides a strong toolbox for modeling various physical frameworks.

General theoretical work on nonlinear PDEs includes, among others, a recent investigation of

analytical solutions of the hybrid KdV-Burgers equation [2016/C02 and followup work, now in progress; 2012/A02]; solitons and shock fronts in nonlinear dispersive media [2017/A01, 2016/A05, 2016/A04, 2015/A06]; modulation instability in NLS [2015/A04, 2013/A12] and coupled NLS [2006/A04] systems.

***Related achievements.***

- Our article in *Journal of Optics* (see item 120.[2013/A03] in the attached Publication List), published upon invitation by Nail Akhmediev (Guest Editor of a Special Issue in the journal) was recently selected as one of the *Highlights of 2013* by the Editors. This research has also attracted a dedicated public understanding article on the IoP “*LabTalk*” website (data in §10 of my CV: “*Monster waves in a laser beam: myth or reality?*”).
- We have been the first (with two collaborators from S. Africa and Belgium) to investigate the concept of a super-soliton in three-species plasmas (earlier believed to exist in many-species plasmas); ref. article [2013/A02]. Ours was the second paper (ever!) where supersolitons are discussed in plasmas!

***Current focus & Future plans:***

- *Rogue waves/freak waves in plasmas and in materials:* Recently, we have focused on employing multiple scale perturbation techniques in beam-plasma interactions, in order to establish a theoretical framework for rogue waves of electromagnetic nature in plasmas. My group is currently investigating the occurrence of Freak Waves in charged matter (in laboratory plasmas, in Space Plasmas, and also in high density electron configurations in semiconductors).
- *Supersolitons:* The new paradigm of *supersolitons* (see above; e.g. ref. [2013/A02]) can be generalized to other plasma configurations and/or physical frameworks, as e.g. in discrete models for molecular chains (nonlinear Klein-Gordon systems), left-handed media, and elsewhere. I am currently working on developing a generic prototypical mathematical model for such “supersoliton” excitations in physical systems.
- *Dissipative solitons:* Open systems are known to be subject to gain/loss mechanisms. These are often treated as small perturbations to integrable systems, for the sake of analytical tractability. Roughly a decade ago, it has been shown that such systems support robust structures, in the form of *Dissipative Solitons* (DS), which are stabilized by a delicate balance between dispersion and nonlinearity, on one hand, and gain and loss terms, on the other. Such a phenomenon has hardly been investigated in plasmas, to my knowledge – beyond a couple of first attempts in the 1970s (Pereira-Stenflo solitons). I have recently proposed a theory for dissipative solitons in plasmas (obtained via multiscale perturbation methodology, specially adapted to dissipative systems), and we are currently working in this direction. This area forms the focus of a research grant proposal, currently in preparation.

**2. [Electromagnetic theory – Plasmas] *Relativistic laser-plasma & beam-plasma interactions***

The core of my current recent research work is devoted to the modelling of laser-plasma interactions via analytical and numerical techniques. Topics include:

- (a) EM pulse propagation in laser plasmas [2015/A04; 2014/A08; 2013/A01; 2010/A13, A12, A11, A07; 2009/A12; 2008/A03];
- (b) EM beam-plasma interactions [2015/A05; 2009/A08; 2008/A07];

(c) perturbation theory for relativistic laser plasmas [2014/A08; 2009/A09].

*Nonlinear fluid theory for laser plasmas* also formed the object of a UK EPSRC grant proposal, successfully awarded (2011-13).

***Current focus: Non-thermal/non-Maxwellian plasmas.*** We have focused on nonlinear techniques, as applied in many-body systems (e.g. plasmas) characterised by highly energetic (suprathermal) particles, leading to long-tailed distributions. Such particles are tacitly observed in Space and laboratory observations. Typical theories of this kind are based on the so called kappa distribution, and lately, on the Tsallis theory for non-extensive thermodynamics.

#### ***Related achievements.***

- Our article in *Plasma Physics and Controlled Fusion* (115. [2012/A09] in the attached Publication List) is one of the standard references in kappa-distributions in plasmas, in relation with nonlinear waves. It was the subject of an invited lecture given at the European Physical Conference on Plasma Physics (Stockholm, 2012). This research has also attracted a dedicated public understanding article on the IoP “*LabTalk*” website (data in §9.3 of the CV: “*Life off the Maxwellian border: nonthermal effects on plasma waves*”). [?] was part of a team who reported the first (ever) observation of electron phase-space holes in laboratory plasmas; ref. article [2010/A02].
- *Rogue waves/freak waves in plasmas and in materials:* We are currently investigating electrostatic structures in *multidimensional* (2D, 3D) plasma geometries. The analytical framework for these is distinct, and requires a more sophisticated formalism, which is currently being developed.

### **3. [Plasmas/Materials] *Nonlinear wave propagation in Space and laboratory plasmas & focus on Complex (Dusty) Plasmas***

Part of my current activity is devoted to the study of nonlinear phenomena in various plasma contexts, including suprathermal (kappa-Maxwellian) plasmas [2015/A06; 2011/A01; 2010/A09, A08, A04; + others], quantum plasmas [2016/A03, 2016/A01, 2015/A03, 2015/A01; 2008/A03, 2007/A07, ...], pair-ion and e-p-i plasmas [2008/SUB10 & SUB08, 2007/A12, 2007/A02]. Furthermore, my postdoctoral research work at the Ruhr Universität Bochum (Germany), in collaboration with Prof. Padma Kant Shukla and co-workers, has focused on the linear and nonlinear aspects of wave propagation in *Complex (Dusty) Plasmas*. Effects like *energy localization, modulational instability, localized modulated envelope wave packet* and *soliton* formation, as well as *ponderomotive field-waves coupling* effects were investigated, with respect to known electrostatic and electromagnetic modes propagating in dusty and/or ordinary electron-ion plasmas. Plasma modes considered include e.g. dust-acoustic and dust-ion acoustic waves, electron-acoustic waves, ion- and electron-cyclotron waves/whistlers, etc.; ref. earlier articles, e.g. [2003/A04-A05; 2004/A01-A03, A05-A06, A12-A13; 2005/A01-A02, A04-A09].

***Future plan: nonlinear waves in complex plasma crystals (colloidal charged matter, soft condensed matter).*** Recent research has put forward complex plasma as a testbed for strongly-coupled system physics (colloidal charged matter, soft condensed matter). The basic mechanism for such exotic states of matter is now being investigated, and a comprehensive state of understanding and consensus in the dynamical modelling is, in my view, far from established as yet. I have been in contact with Prof Hubertus Thomas (Deutsches Zentrum fr Luft- und Raumfahrt, DLR; Forschungsgruppe Komplexe Plasmen) in view of an intensive collaboration in the near future (2018).



4. [Materials/Plasmas] *Localized modes in Debye crystals: solitons, localized envelope structures, Discrete Breathers, vortices.*

A consistent analytical theory was developed for the modelling of localized structures (solitons) propagating in *complex plasma lattices (dust crystals)*. At first approach, these models rely on standard Nonlinear Schrödinger and Korteweg-deVries theories, in a continuum approximation [2016/A05; 2016/A02; 2004/A07 - A11; 2005/A13; 2006/A02, A06, A13]. Asymmetric longitudinal envelope modes and solitary waves, in addition to transverse envelope modes, have thus been investigated, with respect to 1D and D (hexagonal) lattices. Mode coupling [2004/A11] will be further investigated in the future. I have published the *first* prediction of *Discrete Breather*-type excitations (Intrinsic Localized Modes) in Debye lattices (1D, PRE, [2007/A04; 2005/A03; 2004/C05, C09]). Finally, the intrinsic properties of dusty plasmas were investigated, by studying the fundamental influence of supersonic intra-electrode ion-flow and conducting wall proximity on the interaction between dust grains, in the sheath region (in complex plasma discharge experiments); also, ref. earlier articles, e.g. [2003/A06; 2006/A02, A06].

5. [Materials] *Electromagnetic (EM) Wave Propagation in Left-handed Media.*

*Left-handed media (LHM)* are composite meta-materials which are characterized by a negative value of both the dielectric permittivity  $\epsilon$  and the magnetic susceptibility  $\mu$ , in addition to a negative index of refraction  $n$ , namely  $n = -\sqrt{\epsilon\mu}$ . The propagation of EM waves in LHM was recently shown to be dominated by nonlinear effects, due to the field-amplitude dependence of the refraction index. Inspired by this fact, I have investigated the modulational stability of an electromagnetic wave, propagating in a nonlinear LH medium. Relying on a pair of coupled nonlinear Schrödinger type equations for the E/M fields, the possibility for the occurrence of modulational instability was pointed out. An analytical condition to be satisfied for (in)stability was derived for the first time, in terms of the characteristic LH material frequencies and non-linearity parameters. [2005/A10]. A later study was devoted to the ponderomotive interaction between a high-frequency field and low-frequency potential perturbations, as a mechanism for the generation of magnetic fields in LHM [2006/A10]. I have also studied self-focusing phenomena in arrays of *magnetic metamaterials* (PRE, [2007/A03]). More recently, I have investigated the occurrence of ultra-short soliton pulses, modelled via a higher-order nonlinear Schrödinger equation, in the framework of LHM [2009/A01].

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## ACCOUNT of TEACHING ACTIVITY

I possess *extensive pedagogical experience*, in all areas of: lecturing (both classroom/“whiteboard” teaching and web-based), project supervision, course and curriculum development. My teaching experience is described in the following.

### A) Teaching and Curriculum Development

#### (i) Undergraduate (UG) Teaching – course development & coordination;

I have coordinated, developed original material for and taught the following courses:

- *Computer Algebra*, Pure Mathematics (Module PMA3008), Queen’s University Belfast (UK); 2016-2017 (Spring Semester).
- *Synoptic Physics* (Module PHY4029) – *Part 4: Introduction to Nonlinear Physics*, Queen’s University Belfast (UK); 2015-2016 (Spring Semester).
- *Mathematical Modelling in Biology and Medicine*, Applied Mathematics (Module AMA3014), Queen’s University Belfast (UK); 2014-2016 (Spring Semester).
- *Calculus of Variations and Hamiltonian Dynamics* Applied Mathematics (Module AMA3013); academic years: 2009 through 2013 (Spring semester).

I have developed both course content and assessment material for the above, including: approx. 30 lectures per semester (face-to-face), approx. 10 tutorials per semester, web-based mentoring (via online tools), development and marking of weekly assignments, final examinations.

I have also participated in a series of collective UG modules, e.g.

- AMA1021 *Mathematical Modelling* (Applied Mathematics), 2016/17, SEM2;
- PMA1021 *Mathematical Reasoning* (level 1 tutorials, Pure Mathematics), 2016/17, SEM1;
- PHY1021 *Foundation Physics I* (SEM1) and PHY1022 *Foundation Physics II* (SEM2) (level 1 tutorials, Physics), 2012-2016;
- Experimental Physics (lab supervisor), UG Level 2 , QUB; 2010-13;
- Tutoring classes, PHY1011 + 1022 Foundation Physics, UG Level 1, QUB; years: 2010-13.
- PHY3030 *Short Physics Projects* (Level 3 BSc and MSci, Physics), 2014-16;
- PHY4030 *Physics Projects* (Level 4 MSci, Physics), 2012-today;
- AMA4005 *Applied Mathematics Projects* (Level 4 MSci, Applied Mathematics), 2012-today;
- AMA4020 Applied Mathematics – Long Investigations; final-year (undergraduate) student project work supervision, years 2010-2016.

## (ii) Postgraduate (PG) Teaching

- *Module PHY9013 – Introductory Plasma Modelling* (2007-13); I have developed this course from scratch, and I have coordinated lecture delivery and also taught (75%) myself.
- *Module PHY9016 – Laser-produced plasmas* (2007-13): I have developed and taught part (25 %) of this course.

## (iii) Innovative Postgraduate (PG) Curriculum design

- I have played a *key role* in the developing and setup of the ***Web-based MSc Programme on Plasma Physics*** (from the very beginning, in Feb. 2008) at Queen’s University Belfast (UK).

## (iv) Teaching-related Administration

I have undertaken MSc-related **administrative tasks** at QUB, namely:

- *Student advisor* and *deputy course coordinator*: enrolment, follow-up, local support.
- Administration: student recruitment-selection procedures (as Admissions Officer), streamlining applications from prospective stage through admission and enrolment, in liaison with Academic authorities
- Publicity, information diffusion, press, public relations, outreach events (e.g. information stands at scientific meetings) ...

## (v) International web-based MSc Curriculum development

- PG Curriculum Development: I have participated, with colleagues from 7 EU countries, in the development of a ***EU-funded Web-based MSc Curriculum on Plasma Physics and Applications***.

## (vi) International pedagogical experience & Summer Schools:

I have taught:

- A number of physics lectures, in addition to introductory group meetings (for pedagogical coordination and in view of scientific collaboration), organized at the *Abdus Salam ICTP* (International Center for Theoretical Physics), on various occasions (roughly, on a yearly basis).
- A number of introductory lectures and group work, offered frequently in the context of various Summer Schools, such as the annual *Summer School of Plasma Physics and Fusion Technology* (Euratom-Hellenic Republic Association, Greece), or the *Summer School on Nonlinear Science and Complexity* (Greece).
- Theoretical (tutoring) classes and laboratory courses of Physics (mechanics, electromagnetism, electricity and optics) and Calculus, at the Engineering School of the ULB - Université Libre de Bruxelles, Brussels, Belgium: from January 1999 till January 2003 (later on leave); classes were taught in French language.
- University course of Biophysics (2nd year, Pharmacy) at the Faculté de Pharmacie,

Université de Bourgogne (Dijon, France): 1992; classes taught in French language.

- Laboratory courses (1st and 2nd years, “*DEUG en Sciences*” Curriculum) at the Faculté des Sciences, Université de Bourgogne (Dijon, France); Physics, mainly Optics and Electromagnetism: 1990 - 1992; classes in French language.
- Laboratory courses (1st to 3rd years) at the University of Crete (Optics, Mechanics, Electromagnetism and Radioactivity): 1987 - 1990 (as Teaching Assistant); classes in Greek language.

## B) Project supervision

I have supervised a total of 15 long projects (= 7 PGT/MSc long research projects + 8 UG/MSci Level 4 projects) and 30 short pedagogical projects (12 PGT/MSc + 18 UG/MSci Level 3) to date (05/2017). Thematic breakdown is provided in detail below.

### (i) Project supervision (postgraduate)

- PHY9019 - Long research projects: I have supervised seven (7) MSc dissertations to date; topics included the following:
  - Electrostatic solitons and double layers in plasmas: Michael Tyrrell (2007-08)
  - Propagation of electron-acoustic excitations in the presence of suprathermal background electrons: Ashbiz Danehkar (2008-09);
  - Relativistic self-compression and self-focusing of a laser beam in plasma: classical vs quantum effects: Gareth Hefferon (2008-09);
  - Drifting charged dust effects on electrostatic waves: linear and non-linear effects: Olufemi Adeyemi (2009-10);
  - Two-fluid model for electrostatic solitary waves in presence of an ion-beam: beam versus excess superthermality effects: Divya Sharma (2009-10);
  - Nonlinear waves in strongly-coupled dusty plasmas: Stephen Cousens (2010-11);
  - Magnetic field geometry effects in the strike point region in the MAST-Upgrade tokamak design: David Taylor (2010-11).
- PHY9014 - Short projects: I have supervised twelve (12) short pedagogical MSc students/projects to date. Projects included:
  - Electrostatic solitons and double layers in plasmas – ion-acoustic solitons and ion-temperature effects: Mujahid Zaka and William Nicholas Mullan (2007-08);
  - Electrostatic solitons in two-electron-temperature plasmas: Ashbiz Danehkar (2008-09);
  - Pseudopotential analysis for electrostatic pulses in collisionless e-e-i (two-electron temperature) plasmas: Olufemi Adeyemi, Robin Hughes, Divya Sharma and Conor Wildy (2009-10); Stephen Cousens and David Taylor (2010-11);
  - Relativistic laser-plasma interaction: Sandeep Kaur Litt (2009-10);
  - Analytical modelling of electrostatic solitary waves in plasmas: Darragh Corvan and Oisín Connelly (2012-13).

## (ii) Project supervision (undergraduate)

- PHY4030 Physics Projects (MSci) & AMA4005 Applied Maths projects (MSci): I have supervised eight (8) final-year MSci dissertations, both in Applied Mathematics and in Physics.

Physics projects (PHY4030) included:

- Modelling of electrostatic Solitary waves: Brian McKee (2012-13);
- Computer simulations of solitary waves in plasmas: Guy Hetherington (2015-16);
- Plasma expansion: Rahul Patel (2015-16);
- : Modelling electrostatic waves and solitons in positron-laden plasmas: Vincent McMullan (2016-17).

Applied Maths projects (AMA4005) included:

- Freak waves everywhere? Mathematical modelling of a new paradigm across disciplines: Niall Tyndall (2012-13);
- Freak Waves and Envelope solitons: mathematical modelling of a paradigm and application in SQUID metamaterials: Chris Nimmon (2014-15);
- Rogue Waves - Monsters of the ocean: Zoe Geddis (2015-16);
- Multiscale methodology for modulational dynamics of Electrostatic Wavepackets in plasmas: the role of collisionality and charged dust: Jack Cook (2016-17).

- PHY3030 Short Physics Projects & AMA4020 Long Investigations: I have supervised eighteen (18) short pedagogical projects, both in Applied Mathematics and in Physics

Short physics projects (PHY3030) included:

- Solitary waves: modelling to applications: Simon Ferguson and Chris Cochrane (2014-15);
- Nonlinear plasma dynamics: Arent van Korlaar, Jonah Gardner, Lynsey Ussher, Tomas Clarke and Ben Smyth (in 2015-16/SEM1); Brian Lagan (in 2015-16/SEM2);
- Soliton modelling of blood flow: Jack Kerr (2015-16).

Short *mathematics* projects (AMA4020 Long Investigations) included:

- Water Waves: Natalie Inkpin and Laura Maddison (2011-12); Stephen Oliver and Sharon O'Toole (2012-13);
- How non-linear partial differential equations give rise to soliton solutions: Niall Tyndall (2011-12);
- Solitons: Sheridan McGinn (2012-13); Ciara McGuire (2014-15); Vincent McMullan (2015-16);
- Traffic models: Amy McMullan (2015-16)

### (iii) Postgraduate research (PGR, PhD) student supervision:

- I currently (2017) supervise, as principal supervisor, three (3) PhD students.
- In the past, I have supervised, as principal supervisor: two PhD students as principal supervisor, and two students (both graduated) as co-supervisor.
- Details on the above (names, topics) are provided in Section 9.1 in the main part of the CV.

### (iv) Supervision-related highlights & awards

— 2015: MSci student Ryan Wilson was awarded the John Geddes Physics Prize for his final-year project “*Modelling of Solitary Waves in Plasmas – Application in negative-ion beam - plasma interactions*”, which was carried out under my supervision in 2014/15. This prize is awarded each year to the student scoring the highest mark for the Level 4 (MSci) Physics Project.

— 2011: My PhD student Mrs Sharmin Sultana was awarded the best poster prize in a competition organized during the 38th IoP Annual Conference on Plasma Physics (4 -7 April 2011), held at the Marine Hotel, North Berwick, Scotland. The Prize was offered by Institute of Physics (IoP) UK, for her poster entitled “*Electrostatic shocks in the presence of accelerated (super-thermal) electrons*”, a joint work with Dr Gianluca Sarri, under my supervision.

— 2010: My PhD student Mrs Sharmin Sultana was awarded the best poster prize in a competition organised during the 2010 Workshop on the Frontiers of Plasma Physics (5 - 16 July 2010), held at the UNESCO Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste Italy. The Prize was awarded during the conference dinner on 7 July 2010, and was offered by Emerging Nations Science Foundation, Trieste, Italy, for her poster entitled “*Dissipative Modulated electrostatic Solitary Plasma Structures in the presence of a Superthermal Component*”. The work presented was carried out under my supervision.

— 2010: My co-supervised PhD student Hamad Ahmed won the best poster award at a Poster Competition held at the all-Ireland celebration event “*The Laser at 50*”. The meeting was held at QUB on 13 September 2010 and organized by QUB, supported by the Institute of Physics in Ireland. The winning poster title was: “*Laser excited shock waves in tenuous plasma*”.

## C) Teaching assessment, evaluation, feedback

- I have received *excellent evaluation grades* during the periodic teaching evaluation scheme (by students) provided both at *Queen’s University Belfast* (QUB, Belfast UK) and, earlier, at *Université Libre de Bruxelles* (ULB, Brussels, Belgium).
  - **Teaching evaluation** at QUB (2007 - today): I have always received very good to excellent feedback (provided via anonymous Teaching Evaluation Questionnaires, TEQs); representative scores include:
    - \* *in 2007-08*: 4.79/5 lecturer evaluation in my newly developed MSc course PHY9013 (and 3.66 in module evaluation); *in 2008-09*: 4.63/5 lecturer evaluation in MSc course PHY9013 (and 4.05 in module evaluation); 4.08/5

- in MSc course PHY9016;
- \* *in 2009-10*: 4.85/5 in my newly developed module AMA3013, 4.75/5 in PHY9016; 4.85/5 in PHY9013 (lecturer evaluation), 4.07/5 in PHY9013 (module evaluation);
  - \* *in 2010-11*, 5.00 in PHY9013, 4.92/5 in PHY9016, PHY1011 (SEM1) 4.92/5; PHY1022 (SEM2) 5.00/5 (!);
  - \* *in 2011-12*, 4.50/5 in AMA3013, 4.08 in PHY9016; *in 2012-13*: AMA3013 4.75/5 lecturer evaluation & 4.39 module evaluation, PHY9013 3.75/5 lecturer evaluation; 4.75/5 in PHY9016;
  - \* *in 2013-14*: NA (on sabbatical leave);
  - \* *in 2014-15*: AMA3013 4.56/5 lecturer evaluation & 4.45 module evaluation;
  - \* *in 2015-16*: AMA3013 4.51/5 lecturer evaluation & 4.30 module evaluation; PHY4029 4.28/5 lecturer evaluation.
  - \* *in 2016-17*: PMA3008 (Computer Algebra) 4.72 (delivery), 4.59 (module average); AMA1021 (Mathematical Modelling, tutorials) 4.40 (module average).
- **Textual feedback** from students (provided anonymously) includes (original quotations; original syntax and grammar having been retained):
- \* Most recent feedback (2016-17): *Really nice and responsible lecturer and tutor. Took students advices and made changes immediately. Explained patiently and clearly. Can see the lecturer put effort in his work. Enjoyed the lecture notes. The lecturer has sense of humour and made the module interesting.*  
*A well-coordinated module.*
  - \* *Excellent lecturer. showed genuine concern that everyone should understand the material and the tutorials provided were particularly helpful.* (2010-11 PHY9013)
  - \* *Dr Kourakis provides a very open and friendly environment in class. Moreover he approaches the material very logically and therefore it can be understood.* (2010-11 AMA3013)
  - \* *I really enjoy studying this module* (2010-11 AMA3013)
  - \* *... overall, the module is fun to be learned.* (2010-11 AMA3013);
  - \* *QUB (principally in the form of Yannis) responded flexibly and helpfully throughout, steering me through the boxes that needed to be ticked.* (on PHY9014 - MSc projects, 2011-12);
  - \* *a very enjoyable course delivered by a lecturer who clearly loved the subject and was never too busy to help with any problems or questions.* (On PHY9013, 2008-09);
  - \* *i am great fan of Dr kourakis as he run this module in a planned manner. At every problem he give ue the quick and right path to move further, especially the discussion tasks....and the daily updates made by Yannis. thanks Yannis*
  - \* *The online and tutorial assistance by Ioannis was of a very high standard, with his assignment feedback being both very detailed and helpful. - i really learned a lot . As the online discussssion is quite helpful and the best thing is*

*the motivation and the good and quick response from the guide Dr Kourakis. I enjoyed this module while studying. The material provided is OK and in a very planned manner. - overall it was well constructed.*

\* On PHY9013 (2009-10):

*I am satisfied with the material and the organisation of this module; I am very much satisfied with teaching methods via online discussion, assignments, Quiz.*

*OVER ALL IT WAS NICE EXPERIENCE WITH TEACHER. HE IS VERY COOPERATIVE AND HELPFUL.*

\* On MSc course & PHY9019 long project: ... *I believe that the projects which I conducted at Queens University Belfast were my first step toward achieving my current position.* AD, alumni feedback (2008-09: carried out his project work with Dr I Kourakis)

● **Evaluation by external examiners:**

– (Four-year report on MSc, 12/5/2011):

– “... this is an excellent course. The distinctive web-based features are working well and are exploited appropriately by lecturers and students .”

– “(the programme’s educational aims and learning outcomes, including skills, were achieved) fully. This I infer from the examination scripts, from the record of web-based interactive activity and, this year, from private discussions with past and current students.”

– “The improvement over the past twelve months is impressive: this course is now excellent, and it is a pleasure to be associated with it.”

– (exam report on second semester paper PHY9016, 23/4/2011): “this (exam paper) is very good with a clear marking scheme.”

– (exam report on first semester paper PHY9013, 15/11/2009): “***This (paper) is very impressive congratulations to the author!*** *The structure of the marking scheme is good, and the questions are a comprehensive mix of basic material and more challenging content. And it is good that the exam feels so fresh, three years into the course.*” (original quotation; my underlining & highlighting).

– (UG Level 3, Applied Maths):

- “*This paper is fine as it is. It presents a challenge at a suitable level and covers a suitably broad range of material.*” (exam report 4/4/2011)

- “This is a nice paper.” (exam report 30/3/2010)

● **Peer reviews:** Participation to lecturing peer-review scheme at Applied Mathematics (led by Mathematics Head of Teaching/HoT: Professor Gleb Gribakin, until 2016; currently, Dr Hugo Van der Hart; Physics HoT Dr Jason Greenwood, currently). Original quotations include:

– “*The lecture matched the learning objectives well. ... Overall I enjoyed the lecture as it was well prepared, well delivered and interesting.*” (Dr Francesca Shearer, 26/3/2012)

– “*The lecturer made every effort to get the material across to the students.*” (Prof Ken Taylor, 5/3/2010).



## D) Teaching philosophy

As a personal statement to be made, in the simplest of terms, I do love and immensely enjoy teaching! I really indulge in a good relation with my students and my supervisees.

I am fully committed to contributing to a positive student experience at all levels, ranging from inspiring lecture delivery and proactive course/tutorial design to mentoring of students, coaching of project supervisees, student guidance and contact in general.

I am keen and capable of providing a pedagogical contribution of the highest quality to a progressive, liberal academic curriculum at any level, ranging from fundamental level Mathematics or/and Physics to specialised courses within my areas of specialisation/expertise: Mathematical Physics, Nonlinear Dynamics, Soliton Theory, Plasma Physics. My ability for advanced knowledge transfer and conveying of ideas and information is demonstrated by the positive feedback I have always received to date, encouraging me to adapt and continuously improve my organisational skills through efficiency in teaching and student orientation, in practice.

I enjoy integrating my research background into my teaching, when given the opportunity, by developing postgraduate level teaching material on advanced theoretical plasma physics and/or nonlinear physics. This could be taught in a purpose-built postgraduate taught curriculum (MSc), for instance. The anticipated course work should deliver high quality know-how via sharply focused topics, from mathematical modelling through applications.

I have always enjoyed student mentoring and guidance. Keeping track of students' needs is a non-trivial -albeit often overlooked- task, that should be based on individual student aims. A win-win scenario should always be developed, combining student's personal development, University's (or Department's) targets and teaching staff areas of expertise.

Finally, I have substantial material to design a number of undergraduate and postgraduate projects, providing inspiration, guidance and skills, on an ongoing basis. I indulge in supervising students, and this has always been an enjoyable experience for me. I have always made it a point to combine project supervision with a range of skills (beyond, strictly speaking, knowledge transfer), encouraging e.g. my supervisees to publish their original results and to make announcements at conferences and meetings. Training through hands-on experience in the context of a supervised project is one thing, but when this is combined with personal development in terms of real-life experience (giving seminars, proactively engaging with peers, and eventually submitting one's work to peer review), supervised students are happy to engage and often motivated to pursue an academic or research career in STEM; a real need in today's academic reality, which often lacks stimulus and target setting for students, as evident in recent student survey campaigns (NSS and others) in UK, but also in other countries.

My students' and supervisees' positive feedback has always spoken of a positive experience, throughout my academic trajectory. I find this to be extremely rewarding, at a personal level, and a source of encouragement to proceed with proactive teaching and assertive mentoring work.