



Part A. PERSONAL INFORMATION

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| Date | 25-02-2019 |
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|----------------------------------|---------------|---------------------|---------|
| Name | Juan Soler | | |
| DNI/NIE/Passport | 27266095D | Nacionality | Spanish |
| Researcher Identification Number | Researcher ID | L-4627-2014 | |
| | Orcid code | 0000-0002-8683-5994 | |

A.1. Current position

| | | | |
|---------------|--|-------|--|
| Organism | Universidad de Granada | | |
| Lab/Institute | Matemática Aplicada. Facultad de Ciencias | | |
| Address | Avda, Fuentenueva s/n. 10871-Granada. Spain | | |
| Phone | +34 958243287 | email | jsoler@ugr.es |
| Position | University Full Professor | | |
| Cod. UNESCO | 120220, 221305, 220504, 240499, 221214 | | |
| Key words | Biomathematics, Nonlinear PDEs, Kinetic Theory, Hydrodynamic Limits, Fluid Mechanics, Kinetic, Quantum and Relativistic Theory | | |

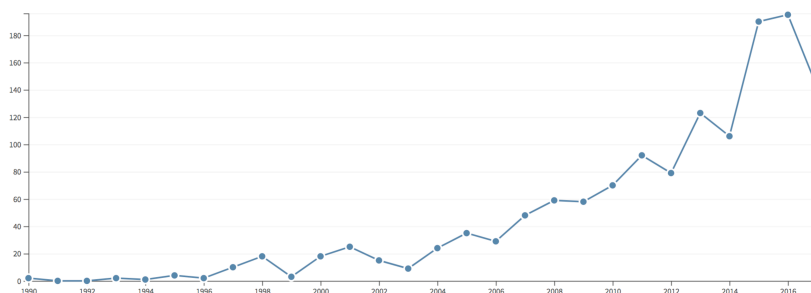
A.2. Education (title, institution, date)

| <i>Bachelor's Degree / PhD</i> | <i>University</i> | <i>Year</i> |
|--------------------------------|----------------------------------|-------------|
| Degree in Mathematics | Universidad de Granada | 1983 |
| DEA. Lab Analyse Numerique | Université Pierre et Marie Curie | 1985 |
| PhD in Mathematics | Universidad de Granada | 1986 |

A.3. General indicators of the quality of scientific production

- Number of PhD theses supervised: 10 (8 + 2)
- Total citations ~ 1430 (Web of Science), ~ 2020 (Google Scholar)
- Total of publications in the first quartile (Q1): 76 (from 88= 86.4%)
- h-Index: 22 (Scopus/Web of Science), 28 (Google Scholar)
- 6 Highly-cited papers WoS
- Evolution of sum of times cited per year in WoS:

Sum of Times Cited per Year



Part B. CURRICULUM FREE SUMMARY

Juan Soler began his research within the team of his PhD. advisor P-A Raviart (U. Pierre et Marie Curie), analyzing some problems in the framework of fluid-mechanical equations. His proof that a vector measure such as a vortex filament is admissible in the functional context of the Navier-Stokes equation was pioneering in the field. Since that time, Euler and Navier-Stokes equations are recurring topics in his research career, along which he has had the opportunity to collaborate with A. Liñán and G-H Cottet, among others.

From a thematic point of view, the study of singularities is a constant in his trajectory: "Every interesting fact takes place at interfaces, which are often singular". In the early 90s, he came into the world of kinetic equations with an original approach that has persisted in his later work, consisting of using in an integrated way techniques and ideas stemming from several disciplines such as fluid mechanics, classical or relativistic kinetic equations, quantum mechanics, biomathematics or social sciences. Among the results of this approach, we can outline the description of the asymptotic behavior and qualitative properties of kinetic equations, the study of variational problems arising in the investigation of orbital stability of gravitating galaxies (Vlasov-Poisson or Vlasov- Einstein models), the behavior of nonlinear Schrödinger equations or the analysis of coagulation-fragmentation models. L.L. Bonilla, I. Catto, J. Dolbeault, Th. Goudon, P-E



Jabin, P. Markowich, Ch. Ringhofer, G. Toscani or J.L. Vazquez have been some of his collaborators in this research.

The pioneering ideas that opened the way to the mathematical formalization of the hydrodynamic low-field (parabolic) and high-field (hyperbolic) limits arose from his collaborations with F. Poupaud. This description propels the relations between the macroscopic models and their microscopic or kinetic counterpart. Later, these ideas were incorporated, in collaboration with N. Bellomo, to multicellular interaction models and growth in order to deduce hyperbolic or dispersive (but not diffusive) models. His approach to flux-saturated mechanisms follows the aim of limiting the diffusive processes in biomathematics. Some of his collaborators in this field have been J. Campos, J.M. Mazón and V. Caselles.

From his recent research, it is worth highlighting the relevant role that he attributes, on one side, to the predictive capability of a model as a cornerstone for its mathematical viability, and on the other side to multiple interactions versus binary interactions in order to detect and understand emerging processes in the collective behavior of species.

In 1998 he founded the program FISYMAT, widely recognized in postgraduate training nowadays, around which he organized BIOMAT, an international school that has been revealed as a benchmark in Biomathematics.

From his training work, a prominent school has emerged: J.A. Carrillo, J.L. López, J. Nieto, Ó. Sánchez, J.A. Cañizo, J. Calvo and P. Guerrero.

He has coordinated 4 projects in Framework Programs (European Commission), besides his extensive experience in Spanish projects. He is currently part of the editorial board of prestigious international publications: "Mathematical Models and Methods in the Applied Sciences", "EMS Surveys in Mathematical Sciences", Biophysics Journal, AMS-RSME book series: Mathematical Surveys and Monographs, University Lecture Series, Graduate Studies in Mathematics.

Lines of research:

- Biomathematics. Cell communication and tumor growth
- Fluid mechanics: Euler and Navier-Stokes equations
- Nonlinear PDEs: Transport equations; Kinetic equations (classic, quantum and relativity models); Flux-saturated mechanisms; Fragmentation and Coagulation mechanisms.
- Mean-field asymptotic and hydrodynamic regimes

Part C. MOST RELEVANT MERITS

C.1. Publications (a selection)

- C. García, T. Hmidi, J. Soler, Non uniform rotating vortices and periodic orbits for the two-dimensional Euler Equations, *preprint arXiv:1807.10017v2*, submitted to *Annals of Math*.
- J. Park, D. Poyato, J. Soler, Filippov trajectories and clustering in the Kuramoto model with singular couplings, *preprint arXiv:1809.04307*,
- A. Enciso, D.Poyato, J. Soler, Stability Results, Almost Global Generalized Beltrami Fields and Applications to Vortex Structures in the Euler Equations, *Comm. Math. Phys.* 360(2018),197-269.
- J.L. López, J. Soler, A space-time Wigner function approach to long time Schrödinger-Poisson dynamics, *SIAM J. Math. Anal.* 49(6), (2017), 4915-4941.
- D. Poyato, J. Soler, Euler-type equations and commutators in singular and hyperbolic limits of kinetic Cucker-Smale models. *Math. Models Methods Appl. Sci.* **27** (2017), 1089.
- J. Campos, J. Soler, Qualitative behavior and traveling waves for flux-saturated porous media equations arising in optimal mass transportation, *Nonlinear Anal.* 137, (2016), 266-290.
- J. Calvo, J. Campos, V. Caselles, O. Sánchez, J. Soler, Qualitative behavior for flux-saturated mechanisms: traveling waves, waiting time and smoothing effects, *J. Eur. Math. Soc.* 19 (2017), 441-472.
- J. Calvo, J. Campos, V. Caselles, O. Sánchez, J. Soler, Pattern formation in a flux limited reaction-diffusion equation of porous media type, *Inventiones Mathematicae* 206 (2016), 57-108.
- M. Verbeni, O. Sánchez, E. Mollica, I. Siegl-Cachedenier, A. Carleton, I. Guerrero, A. Ruiz i Altaba, J. Soler, Morphogenetic action through flux-limited spreading, *Phys. Life Rev.* 10 (2013), 457-475.
- J.L. López, J. Soler, A space-time Wigner function approach to long time Schrödinger-Poisson dynamics, *SIAM J. Math. Anal.* 49 (2017), 4915-4941.
- A. Bellouquid, J. Calvo, J. Nieto, J. Soler, Hyperbolic vs parabolic asymptotics in kinetic theory towards fluid dynamic models, *SIAM J. Appl. Math.* 73 (2013), 1327-1346.
- F. Andreu, J. Calvo, J.M. Mazón, J. Soler, On a nonlinear flux-limited equation arising in the transport of morphogens, *J. Differential Equations*, 252 (2012), 5763-5813



- J. Campos, P. Guerrero, O. Sánchez, J. Soler, On the analysis of travelling waves to a nonlinear flux-limited reaction-diffusion equation, *Ann. I. Henri-Poincaré*, 30 (2013), 141-155.
- N Bellomo, A Bellouquid, J Nieto, J Soler, Multiscale biological tissue models and flux-limited chemotaxis for multicellular growing systems, *Math. Mod. and Meth. in Appl. Sci.* 20 (2010), 1179-1207.
- N. Bellomo, J. Soler, On the mathematical theory of the dynamics of swarms viewed as complex Systems, *Math. Mod. and Meth. in Appl. Sci.*, 22 (2012), 1140006 (29 páginas).
- Calogero S., Sánchez O., Soler J., Asymptotic behavior and orbital stability of galactic dynamics in relativistic scalar gravity, *Archive Rat. Mech. Anal.* Vol. 194 (2009), 743-773
- J. Nieto, F. Poupaud, J. Soler, High-field limit for the Vlasov-Poisson-Fokker-Planck system, *Archive for Rational Mechanics and Analysis* 158 (2001), 29-59.
- L.L. Bonilla, C Pérez Vicente, F. Ritort, J. Soler, Exactly solvable phase oscillator models with synchronization dynamics, *Physical Review Letters* 81 (1998) 3643-3646.
- P.E. Jabin, J. Soler, A Coupled Boltzmann and Navier-Stokes Fragmentation Model Induced by a Fluid-Particle-Spring Interaction, *SIAM Multiscale Modeling & Simulation* 8 (2010), 1244-1268.
- N. Bellomo, D. Knopoff, J. Soler, On the Difficult Interplay Between Life, "Complexity", and Mathematical Sciences, *Math. Models & Methods in Applied Sciences* 23 (2013), 1861-1913.

C.2. Projects (Brief summary)

- 1) Title of the project: eVACUATE: A holistic, scenario-independent, situation-awareness and guidance system for sustaining the Active Evacuation Route for large crowds, Contract number 313161. Source of Funding: European Union
Duration, from: 01/04/2013 until 01/04/2017. Grant amount: 1.250.000,00€
Research Coordinator: Nicola Bellomo and Juan Soler (Spain)
- 2) Title of the project: Dinámica evolutiva, teoría cinética y descripciones hidrodinámicas en ciencias de la vida: MTM2014-53406-R. Source of Funding: MINECO: Ministerio de Economía y Competitividad (Proyectos de I+D+I: Retos de investigación). Duration, from: 01/01/15 until 31/12/18. Grant amount: 142.054,00€. Research Coordinator: Juan Soler. Team 6 members.
- 3) Title of the project: Ecuaciones de evolución para sistemas complejos en ciencias de la vida y teoría cinética: MTM2011-23384. Source of Funding: Ministerio de Economía e Innovación. Duration, from: 01/01/12 until 31/12/14. Grant amount: 127.050,00€. Research Coordinator: Juan Soler. Team 7 members.
- 4) Title of the project: BIOMAT: Modelos matemáticos en vías de señalización originados en dinámica tumoral, sistemas complejos multicelulares, neurociencia y coagulación sanguínea: Proyecto de Excelencia E- 4267. Source of Funding: Junta de Andalucía
Duration, from: 3/01/09 until 12/01/12. Grant amount: 199.500,00€. Research Coordinator: Juan Soler. Team 8 members.
- 5) Title of the project: Mathematical Methods and Computer Simulation of Tumour Growth and Therapy: MRTN-CT-2004-503661. Source of Funding: Unión Europea. Duration, from June 1, 2004 until May 31, 2008. Grant amount: 2.942.447 €. Research Coordinator: Nicola Bellomo (Politecnico di Torino). Coordinator: Miguel A. Herrero (UCM).

C.3. Organization of Events (brief summary):

More information can be found at: <http://www.ugr.es/~jsoler/>
<http://www.ugr.es/~kinetic/>

- BIOMAT schools. Organized annually since 14 years.
- 2006: Organizer, together with Amable Liñán and Antonio Sánchez of the 11th International Conference on Numerical Combustion (SIAM Conference)
- 2006: Organizer, together with Luis L. Bonilla et al., of the 4th European Conference for Mathematics in Industry (ECMI Conference)
- 2008: Organizer, together with Xavier Cabré of Topics in PDE's and applications (CRM-FISYMAT joint activity)
- 2010: Organizer, together with Simone Calogero, Piotr Chruściel and Juanjo Nieto of the PDEs, Relativity and Nonlinear Waves
- 2013: "Lluís Santaló"-U. Menéndez Pelayo: Mathematics of planet Earth: Scientific challenges in a sustainable planet

C.4. Editorial committees (Brief summary). Editor of the following publications:

-Mathematical Models and Methods in the Applied Sciences,

- EMS Surveys in Mathematical Sciences,
- Biophysics Journal
- AMS book series: Mathematical Surveys and Monographs, University Lecture Series, Graduate Studies in Mathematics.

C.5. PhD Research Advisor:

- Title: Study of weak solutions of the Vlasov-Poisson-Fokker-Planck equations
Doctoral student: José Antonio Carrillo Date: May 1996
Current position: Professor Imperial College
- Title: Analysis of PDEs in Kinetic and Quantum Theory
Doctoral student: José Luis López Date: June 1999
Current position: Associate Professor at the Universidad de Granada
- Title: Asymptotic methods in PDEs originated in kinetic and quantum theory
Doctoral student: Juan J. Nieto Date: September 2001
Current position: Associate Professor at the Universidad de Granada
- Title: Deterministic and Stochastic PDE arising in Semiconductor Theory and Stellar Dynamics
Doctoral student: Óscar Sánchez Date: September 2003
Current position: Associate Professor at the Universidad de Granada
- Title: Some problems related to the study of interaction kernels: coagulation, fragmentation and diffusion in kinetic and quantum equations
Doctoral student: José A. Cañizo Date: June 2006
Current position: Ramón y Cajal 2013 contract at the University of Granada.
- Title: Dispersion vs Difusión in Transport PDE Equations
Doctoral student: Juan Calvo Date: March 2010
Current position: Postdoctoral position (similar to Ramón y Cajal position) at the UGR.
- Title: Analysis of dissipation and difusión mechanisms modeled by modeled by nonlinear PDEs in developmental biology and quantum mechanics
Doctoral student: Pilar Guerrero Date: September 2010
Current position: Posdoctoral contract U. College London. Assistant Prof. U. Carlos III.
- Title: Partial Differential Equations for the analysis of biopolymeric models
Doctoral student: María Ofelia Vásquez Date: December 2015
Current position: Associate Professor at the Univ. de Cartagena (Colombia)

C.6. Patents

1. Number: IPR-678. Date 29/05/17
Title: Ultrasonic low-frequency bioreactor as a selective therapy against cancer
Inventors: JA. Marchal, G. Rus, J. Soler, G. Jiménez, J. Melchor, E. López-Ruiz, M. Hurtado
2. Number: IPR-701. Date: 18/04/17
Title: Ultrasonic low frequency portable device for selective tumor therapy
Inventors: JA. Marchal, G. Rus, J. Soler, G. Jiménez, J. Melchor, E. López-Ruiz, M. Riveiro

C.7. Other research merits

- 1) Participation in various projects of the **European Commission**, which has coordinated three consecutive (as responsible for the Spanish node) since 1997 and has coordinated another
- 2) Founder and coordinator of the Master's program in Physics and Mathematics from 1998 to 2009. Scientific coordinator and coordinator of the FISYMAT PhD program up to the present.
- 3) Project reviewer for the European Union, Colciencias, MCYT, NSF, OTAN, ANVUR, AFR, ERC, NSF, ACSUCYL, ANECA and ANEP.
- 4) Participation in relevant committees: National Research Award Committee Julio Rey Pastor 2003, Project Commission of the National Mathematics Plan 2004 - 2007, Committee Juan de la Cierva 2013, Member of the Scientific Committee of the 7ECM (Congress European Mathematical Society)- 2016. Scientific Committee: RSME and SEMA Congresses.
- 5) 37 guest and plenary conferences in the last 10 years.

6) References

- Mathematics Genealogy Project <http://genealogy.math.ndsu.nodak.edu/id.php?id=154711>
- El Árbol de la Matemáticas <http://www.arbolmat.com/juan-soler/>
- Personal web <http://www.ugr.es/~jsoler/>