

# Juan A. Bonachela, CURRICULUM VITAE

## PERSONAL INFORMATION:

*Current Position:* Assistant Professor

*Current Address:* Department of Ecology, Evolution and Natural Resources,  
and Department of Marine and Coastal Sciences  
Rutgers University  
14 College Farm Road,  
New Brunswick, NJ 08901 (USA)

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*Publication Statistics:* <http://scholar.google.com/citations?hl=en&user=pAS9jgYAAAAJ>

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## PROFESSIONAL HISTORY:

2019- Visiting Research Collaborator, Princeton University, USA.

2018- Honorary position, University of Strathclyde, UK.

2018- Assistant Professor, Rutgers University, USA.

2014-17 Lecturer (equivalent to Assistant Professor in USA), University of Strathclyde, UK.

2009-14 Postdoctoral Research Associate, Princeton University, USA.

## EDUCATION:

2015: FHEA, Fellow of the Higher Education Academy, UK.

2008: Ph.D. Physics with European Degree (Doctor Europeus), Summa Cum Laude.

Thesis Committee: Romualdo Pastor-Satorras, Claudio Castellano, Albert Diaz-Guilera, Pedro L. Garrido. University of Granada (Spain). December 2008.

English version available at: <http://www.ugr.es/~jabonachela/thesis/thesis.pdf>

2005: M.Sc. Physics and Mathematics (Diploma de Estudios Avanzados, DEA). University of Granada (Spain).

2003: B.Sc. Physics, University of Granada (Spain).

## GRANTS, FELLOWSHIPS, AND AWARDS:

2018: Gordon and Betty Moore Foundation Grant, *Self-organization across ecological scales*. Role: Co-supervisor.

2017: The Research Council of Norway. Role: Co-supervisor.

2016: MASTS Visiting Fellowship. Role: Supervisor.

- 2014: Extraordinary Doctorate Award, awarded by the University of Granada to the best PhD theses of the 2008-2009 academic year with Cum Laude qualification.  
Typical success rate  $\sim 8\%$ .
- 2010: Postdoctoral Fellowship, awarded by the Spanish Ministry of Science and Education. Department of Ecology and Evolutionary Biology, Princeton University (USA). Adviser: Simon A. Levin. Declined by applicant (administrative reasons, and alternative funding sources).  
Typical success rate  $\sim 20\text{-}25\%$ .
- 2009: Research Fellowship, awarded by the University of Granada. Institute Carlos I for Theoretical and Computational Physics and Department of Electromagnetism and Condensed Matter Physics, University of Granada (Spain). Adviser: Miguel Ángel Muñoz. April 2009 - October 2009.
- 2005: Graduate Fellowship, awarded by the Spanish Ministry of Science and Education. Institute Carlos I for Theoretical and Computational Physics and Department of Electromagnetism and Condensed Matter Physics, University of Granada (Spain). Adviser: Miguel Ángel Muñoz.  
Typical success rate  $\sim 25\text{-}30\%$ .
- 2003: Research Grant, awarded by the Spanish Ministry of Science and Education. Department of Electromagnetism and Condensed Matter Physics, University of Granada (Spain). Adviser: Pedro L. Garrido. 2002-2003.
- 2002: Research Grant, awarded by the University of Granada. Department of Electromagnetism and Condensed Matter Physics, University of Granada (Spain). Adviser: Pedro L. Garrido. 2002.

## **PAST FUNDING SOURCES (salary and/or travel):**

- Marine Alliance for Science and Technology for Scotland (MASTS).
- Norwegian Government, Nordic Council of Ministers, NordForsk (GreenMAR project).
- John Templeton Foundation.
- Andrew W. Mellon Foundation.
- Defense Advanced Research Projects Agency (DARPA), Fundamental Laws of Biology (FunBio) Program.
- National Science Foundation (NSF), Dimensions of Biodiversity Program.
- Cooperative Institute for Climate Science (CICS) of Princeton University and the National Oceanographic and Atmospheric Administration's (NOAA) Geophysical Fluid Dynamics Laboratory (GFDL).
- Spanish Ministry of Science and Technology, National Plan of Research and Development Program.
- Andalucía Regional Government, Excellence Projects Program.

## **RESEARCH VISITS:**

- Institute for Cross-Disciplinary Physics and Complex Systems, Universitat de les Illes Balears, Spain, 2017.
- Centre for Ecological and Evolutionary Synthesis, University of Oslo, Norway, 2013 (March and November), 2014, 2015 (May and September), 2016 (February and April, August).
- Department of Ecology and Evolutionary Biology, Princeton University, 2016.
- Institute Carlos I Theoretical and Computational Physics, University of Granada, Spain, 2014-17.

- Institute of Biodiversity, Animal Health and Comparative Medicine, University of Glasgow, UK, 2015, 2016, 2017.
- Earth System Science and Ecology and Evolutionary Biology Departments, University of California - Irvine, U.S.A. 2011, 2012, 2013, 2014.
- Department of Earth, Atmosphere and Planetary Sciences, Massachusetts Institute of Technology, U.S.A. 2010, 2013.
- Visiting researcher in the Department of Theoretical Physics III of the University of Würzburg, Germany. Adviser: Hays Hinrichsen. July-September 2007.
- Visiting researcher in the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy. Adviser: Matteo Marsili. July-September 2006.

## COMMISSION OF TRUST:

### Peer-review Experience:

Science, Nature Communications, Proceedings of the National Academy of Sciences USA, American Naturalist, Proceedings Royal Society B, Ecology Letters, Global Biogeosciences, Forests, International Society for Microbial Ecology Journal, PLoS Comp. Biol., Scientific Reports, Theoretical Ecology, Journal of Theoretical Biology, Journal of Plankton Research, Journal Royal Society Interface, Ecosystems, Ecological Indicators, Europhysics Letters, Journal of Statistical Mechanics, Limnology and Oceanography, Marine Ecology Progress Series, Mathematical Biosciences, Open Academic Press ("Self-Organized Critical Systems" book), Physica A, PLoS One.

### Grant Reviewer:

National Science Foundation, Division of Environmental Biology; Division of Ocean Sciences.  
European Research Council, Advanced Grant Program.

## ACADEMIC SERVICE:

### Mentoring Experience:

PhD supervision (Project: Eco-evolutionary interactions in marine viruses; candidate: Melinda Choua).

Postdoctoral supervision (current): Dr. Adriano Garcia.

Postdoctoral supervision (former): Dr. Carlos Caceres.

### Teaching experience:

2019: Mathematical and computational methods in theoretical biology (graduate level); Fundamentals of Ecological and Environmental Modeling (undergraduate level), Rutgers University (USA).

2017: Mathematical Biology (undergraduate level); Statistics and Data Presentation (undergraduate level); Research-project supervision in Communicating Mathematics and Statistics (undergraduate level); Linear Algebra and Differential Equations (undergraduate level); Research-project supervision MSc. Quantitative Finance (masters level), University of Strathclyde (UK).

2016: Statistics and Data Presentation (undergraduate level); Research-project supervision in Communicating Mathematics and Statistics (undergraduate level); Linear Algebra and Differential Equations (undergraduate level); Mathematics 2D (undergraduate level); Research-project supervision MSc. Quantitative Finance (masters level), University of Strathclyde (UK).

- 2015: Statistics and Data Presentation (undergraduate level); Research-project supervision in Communicating Mathematics and Statistics (undergraduate level); Linear Algebra and Differential Equations (undergraduate level); Mathematics 2D (undergraduate level), University of Strathclyde (UK).
- 2014: Research-project supervision in Communicating Mathematics and Statistics (undergraduate level); Linear Algebra and Differential Equations (undergraduate level); Mathematics 2D (undergraduate level), University of Strathclyde (UK).
- 2011: Complex Systems (invited lecturer, postgraduate level). Center for Mathematical Sciences Research, Rutgers University (USA).
- 2004-08: Statistical Physics, Computational Physics, Non-linear Physics (undergraduate level). Dept. Electromagnetism and Condensed Matter Physics, University of Granada, Spain.

## PUBLICATIONS:

### Review Article:

41. **Juan A. Bonachela**, C. A. Klausmeier, K. F. Edwards, E. Litchman, and S. A. Levin, *The role of phytoplankton diversity in emergent oceanic stoichiometry*, J. Plankton Res. **38**, 1021 (2016).

### Book Chapter:

40. S. M. Vallina, R. Martinez-Garcia, S. L. Smith, **Juan A. Bonachela**, *Models in Microbial Ecology*, in "Encyclopedia of Microbiology, 4th Edition" Elsevier, USA (2019).
39. S. A. Levin, **Juan A. Bonachela**, and C. D. Nadell, *Mathematical and Computational Challenges in the Study of Complex Adaptive Microbial Systems*, in "The Social Biology of Microbial Communities" Institute of Medicine of the National Academies Workshop Summary Report, National Academies Press, USA (2012).

### Book Review:

38. **Juan A. Bonachela**, "*Natural Complexity*", by Paul Charbonneau, The Quarterly Review of Biology (2019).

### Research Articles:

37. B. Knowles\*, **Juan A. Bonachela**\*, N. Cieslik\* et al., *Density-dependence of viral lysis and nanoflagellate grazing of phytoplankton at micro-scales*, to be submitted (2019). (\* Joint 1st authors)
36. J. Castillo-Vardaro\*, **Juan A. Bonachela**\*, C. C. M. Baker, M. L. Pinsky, D. F. Doak, R. Pringle, and C. Tarnita, *The role of resource availability and heterogeneity on *Odontotermes* termite mound spatial distribution*, to be submitted (2019). (\* Joint 1st authors)
35. J. Pourtois, C. Tarnita, and **Juan A. Bonachela**, *Impact of lytic phages on phosphorus- versus nitrogen-limited marine microbes*, under review in Frontiers Microbiology (2019).
34. B. Knowles, **Juan A. Bonachela** et al., *Temperate infection in a canonically virulent host-virus system*, under review in Nature Microbiology (2019).
33. M. T. Wortel, H. Peters, **Juan A. Bonachela**, and N. C. Stenseth *Coupled fast and slow feedbacks lead to continual evolution: a general modeling approach*, under review in PNAS (2019).
32. P. Villegas, M. A. Muñoz, and **Juan A. Bonachela**, *Evolution in the Debian GNU/Linux software network: analogies and differences with genetic regulatory networks*, under review in Proceedings of the Royal Society Interface (2019).

31. M. Choua, M. R. Heath, D. C. Speirs, and **Juan A. Bonachela**, *The effect of viral plasticity on the persistence of host-virus systems*, under review in *Journal of Theoretical Biology* (2019).
30. **Juan A. Bonachela**, M. Burrows, M. Payne, and M. Pinsky, *Rate of community response to climate change depends on species traits and community composition*, under review (2019).
29. C. Caceres, S. Spatharis, E. Kaiserli, E. Smeti, H. Flowers, and **Juan A. Bonachela**, *Temporal phosphate gradients reveal diverse acclimation responses in phytoplankton phosphate uptake*, *The ISME Journal* **13** 2834 (2019).
28. M. Choua and **Juan A. Bonachela**, *Ecological and evolutionary consequences of viral plasticity*, *Am. Nat.* **193**, 346 (2019).
27. R. Martinez-Garcia, C.D. Nadell, R. Hartmann, K. Drescher, and **Juan A. Bonachela**, *Cell adhesion and fluid flow jointly initiate biofilm genetic structure*, *PLoS Comp. Biol.* **14**, e1006094 (2018).
26. **Juan A. Bonachela**, M.T. Wortel, and N.C. Stenseth, *Eco-evolutionary Red Queen dynamics regulate biodiversity in a metabolite-driven microbial system*, *Scientific Reports* **7**, 17655 (2017).
25. C.E. Tarnita\*, **Juan A. Bonachela\***, E. Sheffer, J.A. Guyton, T.C. Coverdale, R.A. Long, R.M. Pringle, *A theoretical foundation for multi-scale regular vegetation patterns*, *Nature* **541**, 398 (2017). (\* Joint 1st authors). (**Cover article**)
24. N.S. Garcia, **Juan A. Bonachela**, and A.C. Martiny, *Interactions between growth-dependent cell size, nutrient supply and cellular elemental stoichiometry of marine Synechococcus*, *ISME J.* **10**, 2715 (2016).
23. **Juan A. Bonachela**, R. M. Pringle, E. Sheffer, T. C. Coverdale, J. A. Guyton, K. K. Caylor, S. A. Levin, and C. E. Tarnita, *Termite mounds can increase the robustness of dryland ecosystems to climatic change*, *Science* **345**, 651 (2015). (**Cover article**)
22. C. Mouginot, A. E. Zimmerman, **Juan A. Bonachela**, H. Fredricks, S. D. Allison, B. A. S. Van Mooy, and A. C. Martiny, *Resource allocation by the marine cyanobacterium Synechococcus WH8102 in response to different nutrient supply ratios*, *Limnol.Oceanogr.* **60**, 1634-1641 (2015).
21. P. Villa, **Juan A. Bonachela**, S. A. Levin, and M. A. Muñoz, *Eluding catastrophic shifts*, *PNAS Plus* **112**, E1828-E1836 (2015).
20. M. W. Lomas, **Juan A. Bonachela**, S. A. Levin, and A. C. Martiny, *Impact of ocean phytoplankton diversity on phosphate uptake*, *PNAS* **111**, 17540 (2014).
19. P. Villa, **Juan A. Bonachela**, and M. A. Muñoz, *Quenched disorder forbids discontinuous transitions in non-equilibrium low-dimensional systems*, *Phys. Rev. E* **89**, 012145 (2014).
18. **Juan A. Bonachela** and S. A. Levin, *Evolutionary Comparison Between Viral Lysis Rate and Latent Period*, *J. Theor. Biol.* **345**, 32 (2014).
17. **Juan A. Bonachela**, S. D. Allison, A. C. Martiny, and S. A. Levin, *A Model for Variable Phytoplankton Stoichiometry Based on Cell Protein Regulation*, *Biogeosciences* **10**, 4341 (2013).
16. **Juan A. Bonachela**, M. A. Muñoz, and S. A. Levin, *Patchiness and Demographic Noise in Three Ecological Examples*, *J. Stat. Phys.* **148**, 723-739 (2012).
15. **Juan A. Bonachela**, M. Raghil, and S. A. Levin, *Dynamic Model of Flexible Phytoplankton Nutrient Uptake*, *PNAS* **108**, 20633 (2011).
14. M. A. Fortuna, **Juan A. Bonachela**, and S. A. Levin, *The Evolution of a Modular Software Network*, *PNAS* **108**, 19985 (2011).
13. **Juan A. Bonachela**, C. D. Nadell, J. Xavier, and S. A. Levin, *Universality in Bacterial Colonies*, *J. Stat. Phys.* **144**, 303 (2011).

12. F. Vázquez, **Juan A. Bonachela**, C. López, and M. A. Muñoz, *Temporal Griffiths Phases*, Phys. Rev. Lett. **106**, 235702 (2011).
11. **Juan A. Bonachela**, S. de Franciscis, J. J. Torres, and M. A. Muñoz, *Self-Organization Without Conservation: Are Neuronal Avalanches Generically Critical?*, J. Stat. Mech. P02015 (2010).
10. **Juan A. Bonachela** and M. A. Muñoz, *Self-Organization Without Conservation: True or Just Apparent Scale-Invariance?*, J. Stat. Mech. P09009 (2009).
9. A. C. Barato, C. E. Fiore, **Juan A. Bonachela**, H. Hinrichsen, and M. A. Muñoz, *The Simplest Nonequilibrium Phase Transition into an Absorbing State*, Phys. Rev. E **79**, 041130 (2009).
8. **Juan A. Bonachela** and M. A. Muñoz, *Boundary-Induced Heterogeneous Absorbing States*, in *Modeling and Simulation of New Materials: Tenth Granada Lectures*, Eds. P. L. Garrido, J. Marro and P. I. Hurtado, American Institute of Physics Conference Proceedings **1091**, 204 (2009).
7. **Juan A. Bonachela**, M. Alava, and M. A. Muñoz, *Cusps, Self-Organization, and Absorbing States*, Phys. Rev. E **79**, R050106 (2009).
6. **Juan A. Bonachela** and M. A. Muñoz, *Confirming and Extending the Hypothesis of Universality in Sandpiles*, Phys. Rev. E **78**, 041102 (2008).
5. **Juan A. Bonachela**, H. Hinrichsen, and M. A. Muñoz, *Entropy Estimates of Small Data Sets*, J. Phys. A **41**, 202001 (2008).
4. **Juan A. Bonachela** and M. A. Muñoz, *How to Discriminate Easily Between Directed-Percolation and Manna Scaling*, Physica A **384**, 89 (2007).
3. **Juan A. Bonachela**, H. Chaté, I. Dornic, and M. A. Muñoz, *Absorbing States and Elastic Interfaces in Random Media: Two Equivalent Descriptions of Self-Organized Criticality*, Phys. Rev. Lett. **98**, 155702 (2007).
2. O. Al Hammal, **Juan A. Bonachela**, and M. A. Muñoz, *Absorbing State Phase Transitions with a Non-Accessible Vacuum*, J. Stat. Mech. P12007 (2006).
1. **Juan A. Bonachela**, J. J. Ramasco, H. Chaté, I. Dornic, and M. A. Muñoz, *Sticky Grains do not Change the Universality Class of Isotropic Sandpiles*, Phys. Rev. E **74**, 050102(R) (2006).

## PRESENTATIONS AND CONTRIBUTIONS TO CONFERENCES:

- *Quantifying ecological transitions*, Ecology and Evolution Graduate Program Seminar, Rutgers University, 2018.
- *Catastrophic ecological transitions and management possibilities*, ESA Annual Meeting, New Orleans, 2018.
- *Emergent spatio-temporal patterns and ecological transitions*, Regular Patterns in Biology Workshop, Princeton University, 2018.
- *The ecological and evolutionary dynamics of viral plasticity*, Ocean Sciences Meeting, Portland, 2018.
- *The ecological and evolutionary dynamics of viral plasticity*, University of Glasgow, 2017.
- *Patrones emergentes en ecología: sistemas semi-áridos*, Viernes Científicos, Universidad de Almería, 2017.
- *Emergent patterns in ecology: semi-arid ecosystems*, Instituto de Física Interdisciplinar y Sistemas Complejos, Universitat de les Illes Balears, 2017.
- *Emergent patterns and ecological transitions*, Rutgers University, 2017.

- *Eluding catastrophic ecological transitions*, Imperial College London, 2017.
- *Large-scale emergent patterns in semi-arid ecosystems*, University of Edinburgh, 2016.
- *Emergent ecological patterns*, Granada, 2016.
- J. A. Bonachela, *Connecting scales in space and time*, GreenMar Annual Meeting, Iceland, 2016.
- J. A. Bonachela, *Emergent patterns and ecological interactions: the termite case*, Quantitative Laws Summer School: From physiology to ecology, from interaction structures to collective behavior, Como, 2016.
- J. A. Bonachela, *Catastrophic ecological transitions and how to avoid them*, Modeling and Predicting Ecological Transitions, Paris, 2016
- *Eluding catastrophic shifts*, CEES, University of Oslo, 2016.
- J. A. Bonachela, R. M. Pringle, E. Sheffer, T. C. Coverdale, J. A. Guyton, K. K. Caylor, S. A. Levin, and C. E. Tarnita, *Friend or foes: using physics to unravel the role of social insects in semi-arid ecosystems*, 13th Granada Seminar, Granada 2015.
- *Friends or foes: unraveling the role of termites in semi-arid ecosystems*, University of Glasgow, Glasgow, 2015.
- *Friends or foes: using physics to unravel the role of social insects in semi-arid ecosystems*, CEES, University of Oslo, 2015.
- *Microscopic Processes and Macroscopic Patterns in Marine Ecosystems*, Heriot-Watt University, Edinburgh, 2015.
- J. A. Bonachela, A. C. Martiny, S. D. Allison, M. W. Lomas, and S. A. Levin, *The Importance of Diversity in Phytoplankton Nutrient Uptake Strategies for Marine Biogeochemical Cycles*, Aquatic Sciences Meeting, Granada, 2015.
- J. A. Bonachela and S. A. Levin, *Microscopic Processes and Macroscopic Patterns*, Core Research for Evolutionary Science and Technology workshop, Tokyo University of Marine Science and Technology, 2014.
- J. A. Bonachela, A. C. Martiny, S. D. Allison, M. W. Lomas, and S. A. Levin, *The Importance of Phytoplankton Diversity on Marine Nitrogen and Phosphorus Cycles*, Marine Alliance for Science and Technology for Scotland: Annual Science Meeting, Edinburgh, 2014.
- J. A. Bonachela, S. D. Allison, A. C. Martiny, and S. A. Levin, *Dynamic Model For Phytoplankton Stoichiometry Based On Protein Regulation*, Ocean Sciences Meeting, Hawaii, 2014.
- *Evolutionary Comparison of Models for Viral Infection*, CEES, University of Oslo, 2013.
- *Improving the Predictability of Marine Ecosystem Models*, CEES, University of Oslo, 2013.
- *Linking Phytoplankton Nutrient Uptake and Stoichiometry*, Princeton University, 2012.
- *Acclimation or Starvation: A Dynamic Description of Phytoplankton Nutrient Uptake*, Lewis-Sigler Institute for Integrative Genomics (Princeton), 2012.
- *Universality in Bacterial Colonies*, Rutgers University, 2011.
- *Improving the Predictability of the New Generation of Models for Oceanic Biogeochemistry*, UC Irvine, 2011.
- *Self-Organized Criticality in Nature*, Princeton University, 2009.
- C. E. Fiore, J. A. Bonachela and M. A. Muñoz, *Bosonic and Fermionic Descriptions for a Simple Nonequilibrium Model*, in *Modeling Cooperative Behavior in Neural Systems: Ninth Granada Lectures*, Eds. P. L. Garrido, J. Marro, and J. J. Torres, American Institute of Physics (2007).

- J. A. Bonachela, H. Chaté, I. Dornic, and M. A. Muñoz, *Absorbing States and Pinned Interfaces in random media: Two descriptions of the same Phenomenon*, Congreso Nacional de Física Estadística FISES'06, Granada (Spain) (2006).
- J. A. Bonachela, J.J. Ramasco, H. Chaté, I. Dornic, and M. A. Muñoz, *Non all Conservation Laws Alter the Directed Percolation Universality Class*, in *Modeling Cooperative Behavior in the Social Sciences: Eighth Granada Lectures*, Eds. P. L. Garrido, J. Marro and M. A. Muñoz, American Institute of Physics (2005).

## **FURTHER PERSONAL DEVELOPMENT:**

- Workshop “Diversifying your funding mechanisms”, Office of Grants Facilitation, Rutgers University (2018).
- Module “What about me.....supporting staff, supporting students” (2016).
- H2020 modules “Marie Sklodowska-Curie Individual Fellowship Scheme” and “MSCA - Innovative Training Networks: how to prepare a winning proposal” (2016).
- Module (PG Diploma, Advanced Academic Studies): “Course (Re)Design” (2015).
- Module (PG Diploma, Advanced Academic Studies): “Teaching, Learning and Assessment within the Disciplines” (2015).
- Module (PG Diploma, Advanced Academic Studies): “Supervising Postgraduate Research” (2015).
- Module (PG Diploma, Advanced Academic Studies): “Enhancing Learning, Teaching, and Assessment at Strathclyde” (2015).
- Session chair, 2015 Association for the Sciences of Limnology and Oceanography biennial meeting. Session: Impact of microbial biodiversity on aquatic ecosystem functioning and biogeochemistry (total 140 sessions).
- Grant writing and program modules (“Winter Fellowships Challenge”, “Horizon 2020 Getting to know the programme”, “European Research Council: Meet the Expert Session”).
- Workshop: “Gateways to Emergent Behavior in Science and Society”, Santa Fe Institute (2013).
- Workshop: “Writing an Effective Research Proposal”, Princeton Writing Program, Princeton University (2013).
- Workshop: “Designing a Course”, McGraw Center for Teaching and Learning, Princeton University (2012).
- Workshop: “Parallel Computing”, Princeton Institute for Computational Science & Engineering (PIC-SciE), Princeton University (2012).
- Workshop/Symposium: “Microenvironments modulating biological interactions in the ocean”, Aspen Center for Physics (2011).
- Workshop/School: “Complexity Science”, Imperial College (Wye College) (2007).
- Workshop/School: “School and Conference on Fundamental Aspects of Complexity”, the Abdus Salam International Centre for Theoretical Physics (ICTP) (2004).
- Assistance organizing the 2005, 2006 and 2008 editions of the Granada Seminar/Lectures on Computational and Statistical Physics.
- Assistance launching an early version of the supercomputing cluster Proteus, University of Granada (2005) (webpage: <http://proteus.ugr.es/index.php?id=1>).