MAP-fis Essay Proposal, 2013-2014

(*please write in English*)

Supervisor

Name: ***Dr. Gareth Baxter***

E-mail: gjbaxter@ua.pt

Title

Time dependent interactions in copying processes

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Condensed Matter Theory (Complex Systems)

Summary of Proposal

Numerical models of opinion dynamics[1], language change[2], population genetics [3], and biodiversity [4], among many others, can be considered as examples of copying processes: objects (whether genes, information, ideas etc.) are copied from one place to another one according to some stochastic rules, and so may spread over the whole system.

These models have been generalised to consider complex patterns of interactions, by locating the sites on a network which defines which site is a neighbour of which [5]. Heterogeneous rates of activity or interaction have also been introduced [6].

Now researchers have started to consider another important generalisation. What happens if the rates of interaction or the copying rules change with time? Time varying rates of copying that do not depend on the site's state [7] or that introduce an aging or latency to the sites state [8-10] have been considered. A related area of study is when the network connections themselves are time dependent [11].

There are many ways to introduce time dependence in these models. Important questions to answer are: What new generalisations are being studied? How are all of these models are related to each other? What kinds of dynamic rules make sense for different domains of application? What new kinds of dynamics might be important, that haven't been studied yet?

(*continue if necessary*)

References

(*to allow students first look at topic*)

[1*] C. Castellano, S. Fortunato, and V. Loreto, *Reviews of Modern Physics* **81**, 591 (2009)

[2*] G. Baxter, R.A. Blythe,W. Croft, and A. J. McKane, *Physical Review E* **73**, 046118 (2006)

[3] J. F. Crow and M. Kimura, *An Introduction to Population Genetics Theory* (Harper & Row, New York, 1970); M. Kimura, *The neutral theory of molecular evolution, (*Cambridge University Press, 1984)

[4 S. P. Hubbell, *The Unified Neutral Theory of Biodiversity and Biogeography* (Princeton University Press, Princeton, NJ, 2001)

[5] G. J. Baxter, R. A. Blythe, and A. J. Mckane, *Physical Review Letters* **101**,258701 (2008)

[6] N. Masuda, N. Gibert and S. Redner, *Physical Review E* **82**, 010103(R), (2010)

[7*] G. J. Baxter, *Journal of Statistical Mechanics, Theory and Experiment* **2011**, P09005 (2011)

[8*] H. U. Stark, C. J. Tessone and F. Schweitzer, *Physical Review Letters* **101,** 018701 (2008)

[9] R. Lambiotte, J. Saramaki and V. D. Blondel,Physical Review E **79,** 046107 (2009)

[10*] J. Fernández-Gracia J, V. M. Eguíluz and M. S. Miguel, *Physical Review E* **84,** 015103(R) (2011)

[11] N. Masuda, K. Klemm, and V. M. Eguíluz, *Physical Review Letters* **111**, 188701 (2013)

*Student could start by reading these references to get an introduction to the topic.