COMPLEX SYSTEMS NETWORK OF EXCELLENCE

EXYSTENCE Thematic Institute and Workshops

From Many-Particle Physics to Multi-Agent Systems

• July 19 - September 17, 2004 •

Scientific Coordinators:

EXYSTENCE Thematic Institute

Eshel Ben-Jacob   **Dirk Helbing**   **Frank Schweitzer**
Tel Aviv University   TU Dresden   ETH Zürich

Topical Workshop I (July 26 - 30, 2004):

Driven Many-Particle Systems - Hopping Particles, Granular Media, and Colloidal Systems

Jason A.C. Gallas   **Hans J. Herrmann**
Universidade Federal do Rio Grande do Sul,   Universität Stuttgart
Porto Alegre

Topical Workshop II (August 30 - September 3, 2004):
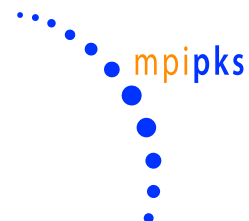
Multi-Agent Systems - Swarms, Ecology, and Society

Iain Couzin   **Frank Schweitzer**
Oxford University   ETH Zürich

Local Organization:

Claudia Pönisch
MPI PKS Dresden

mpipks

EXYSTENCE Thematic Institute:
From Many-Particle Physics to Multi-Agent Systems

The Thematic Institute (TI) - together with the two accompanying Topical Workshops (TW I / II) - is part of the activities of the European Network of Excellence (NoE) "Complex Systems" (EXYSTENCE). It takes place at the Max-Planck Insitute for the Physics of Complex Systems (MPI PKS) in Dresden from Monday, 19 July 2004, to Friday, 17 September 2004, and is jointly financed by EXYSTENCE and the MPI PKS.

EXYSTENCE is founded by the European Commission within the Future Emerging Technologies (FET) Programme of the Information Society Technologies (IST) Programme of the Fifth Framework (IST-2001-32802) from March 2002 until September 2005. The NoE aims to develop collaboration among European researchers interested in Complex Systems, from fundamental concepts to applications, and involving academia, business and industry.

TI/TW of the NoE have to focus on issues of Complex Systems from a broader perspective. They should cover transdisciplinary aspects of Complex Systems, in order to develop a commonality of concepts and methods applicable to different fields.

The TI "From Many-Particle Physics to Multi-Agent Systems" matches these conditions in various respects. It aims at a transfer of methods developed primarily in statistical physics to deal with many-particle systems in other scientific areas, such as biology, artificial intelligence, or social sciences. Certainly, the basic entities in these fields differ from physical "particles" in that they already have an intermediate complexity themselves. Therefore, these entities today are commonly denoted as agents. This term means a subunit of the system that may already have internal degrees of freedom to allow certain activities, such as (active) movement, and interaction with other agents.

Systems comprised of a (usually large) number of (usually strongly) interacting agents (entities, components, ...) are denoted as Complex Systems, because the system behavior cannot be simply inferred from the behavior of the components. That is, self-organization and emergent properties play an important role in determining the resulting spatio-temporal patterns, or the collective "behavior" on the macroscopic level.

In order to gain insight into the interplay between microscopic interactions and macroscopic features in Complex Systems, it is important to find a modeling level, which on one hand considers specific features of the system and is suitable to reflect the origination of new qualities, but on the other hand is not flooded with microscopic details. In this respect microscopic, i.e. particle-based and agent-based models have become a very promising approach to investigate and to simulate complex systems. A commonly accepted theory of multi-agent systems that also allows analytical investigations is however still pending. It will be a multi-disciplinary challenge to improve this situation, in which also statistical physics needs to play its part, both by contributing concepts and formal methods. Its long lasting experience in describing many-particle systems, to deduce the structure, properties and dynamics of matter from microscopic interaction laws, may serve as a paragon also for other scientific areas, where one would finally like to explain the observed macroscopic dynamics based on non-linear interactions among a large number of different agents.

The TI/TW want to contribute to this development, by bringing together scientists from different fields who deal with many-particle and multi-agent systems, to allow mutual interaction and new insights - both for physicists who want to apply their methods to interdisciplinary problems, and for scientists from other fields interested in formal methods developed for interacting particle systems.

Topical Workshop II:
Multi-Agent Systems - Swarms, Ecology, and Society

The workshop primarily focuses on agent-based models of collective interaction in animated systems. This includes "microscopic" models for collective biological phenomena, such as aggregation, swarming behavior (global vs. local coupling, energetic conditions), or complex interaction in insect societies (nest building, trail following, chemical communication). Another focus will be applications of agent-based models to population dynamics, in particular for spatial interactions of populations. This also involves approaches from evolutionary game theory to understand the evolution of cooperation and the adaptation of strategies to a changing environment. Eventually, agent-based models in the social science shall play a considerable role, in order to explain phenomena such as the coordination of decisions via information exchange, collective opinion formation, or the establishment of (social) networks among agents.

The workshop shall further discuss the striking analogies in the collective behavior of biological or socio-economic systems and driven many-particle systems (see workshop I), that are observed on a phenomenological level. This includes phenomena such as self-organized criticality, fluctuation-induced ordering phenomena (e.g. agglomeration or segregation), non-equilibrium phase transitions and spontaneous structure formation. It should, therefore, be explored in which respects and to what extent conclusions from driven many-particle systems are relevant for the functionality, stability, reliability, and efficiency of biological and ecological systems, of societies, organizations, administrations, companies, production processes, etc.

Program[1]

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08:45 – 09:00	Opening				
09:00 – 09:45	**Rubenstein**	**Deneubourg**	**Bonabeau**	**Saam**	**San Miguel**
09:45 – 10:30	**Nagel**	**Simpson**	**Helbing**	**Ahrweiler**	**Brückner**
10:30 – 11:00	Coffee	Coffee	Coffee	Coffee	Coffee
11:00 – 11:30	Carvalho	Krause	Battiston	Ebeling	Harder
11:30 – 12:00	Shnerb	Chaté	Hahn	Lorenz	Hassas
12:00 – 12:30	Szabo	Hemelrijk	Richiardi	Namatame	
12:30 – 14:30	Lunch	Lunch	Lunch	Lunch	Lunch
14:30 – 15:00	Sumpter	***Working Groups*** *"MAS and collective motion"* (lead by Couzin & Sumpter) *"MAS in the social sciences"* (lead by Ahrweiler & Hemelrijk)	Excursion	Fent	
15:00 – 15:30	**Tutorial: Brückner** *"Implementing Swarming in Real-World Applications"*			Platkowski	Departure
15:30 – 16:00				Bradley	
16:00 – 16:30	Coffee	Coffee		Coffee	
16:30 – 17:00	**Posters**	**Working group reports and plenary discussion**		**Tutorial: Grimm** *"Agent-based Models in Ecology and Natural Resource Management"*	
17:00 – 17:30					

Program[1]

Sun, 29 Aug	18:00	Registration
	19:00	Welcome buffet
Mon, 30 Aug	08:45 - 09:00	Frank Schweitzer/Jan-Michael Rost *Opening*
	09:00 - 09:45	Dan Rubenstein *The dynamics of multi-agent systems in space and time:* *Comparing idealized with real animals*
	09:45 - 10:30	Kai Nagel *Large scale multi-agent traffic simulations*
	10:30 - 11:00	Coffee break
	11:00 - 11:30	Rui Carvalho *Agent-based modelling of urban change:* *From regional to small scale events*
	11:30 - 12:00	Nadav Shnerb *Threshold, noise and adaptation in multi agent reactive systems*
	12:00 - 12:30	Gyorgy Szabo *Competing associations in spatial predator-prey models*
	12:30 - 14:30	Lunch
	14:30 - 15:00	David Sumpter *Multi-agent decision making: Lessons from the ants*
	15:00 - 16:00	**TUTORIAL:** Sven Brückner *Implementing swarming in real-world applications*
	16:00 - 16:30	Coffee break
	16:30 - 17:30	**Poster session** Hoi-Yeung Chan *Dynamical transitions in agent-based models of competing population* Niloy Ganguly *A biology-inspired multi-agent system for* *efficient search of unstructured networks* Petr Hedbavny *A viable pension reform: The importance of mechanisms* *which promote listening to each other*

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[1]Abstracts available at http://www.mpipks-dresden.mpg.de/~multi04/

Program[1]

Mon, Aug 30		Fernando Peruani *Mimicking swarming of Myxobacteria: Collective behavior* *of active Brownian particles with rod-shape*
		Diemo Urbig *Opinion dynamics and innovation diffusion*
		Harold de Vladar *Tumor growth velocities inferred from survival analysis:* *Linking microscopic tumor dynamics to cancer prognosis*
		Jürgen Vollmer *Vortex formation in Daphnia swarms*
		Jamie Wood *One-dimensional flocks revisited: Results from* *the O'Loan and Evans model*
	18:30	Dinner
Tue, Aug 31	09:00 - 09:45	Jean-Louis Deneubourg *Communal decision-making and patterns of aggregation*
	09:45 - 10:30	Steve Simpson *Swarming in locusts: From neurones to populations*
	10:30	Group photo
	10:30 - 11:00	Coffee break
	11:00 - 11:30	Jens Krause *Social networks in group-living animals*
	11:30 - 12:00	Hugues Chaté *Moving and staying together without a leader:* *Minimal ingredients for collective and cohesive motion*
	12:00 - 12:30	Charlotte Hemelrijk *Despotism, boldness and female dominance: A model*
	12:30 - 14:30	Lunch
	14:30 - 16:00	**WORKING GROUPS** **Multi-agent systems and collective motion** (lead by Iain Couzin & David Sumpter) **Multi-agent systems and the social sciences** (lead by Petra Ahrweiler & Charlotte Hemelrijk)

[1]Abstracts available at http://www.mpipks-dresden.mpg.de/~multi04/

Program[1]

Tue, Aug 31   16:00 - 16:30   Coffee break

16:30 - 17:30   Working group reports and plenary discussion

18:30   Dinner

Wed, Sep 01   09:00 - 09:45   Eric Bonabeau
Real-world applications of multi-agent simulations

09:45 - 10:30   Dirk Helbing
Interactive decision dynamics: Theories and experiments

10:30 - 11:00   Coffee break

11:00 - 11:30   Stefano Battiston
Networks of social agents and decision making dynamics
in organizations

11:30 - 12:00   Christian Hahn
Improving theory: Building robust organizational forms
for holonic multiagent systems

12:00 - 12:30   Matteo Richiardi
Generalizing Gibrat. Reasonable stochastic multiplicative models
of firm dynamics with entry and exit

12:30 - 14:15   Lunch

14:15   Meeting our tour guides in the institute hall

14:32   Tram to the city centre (tickets provided)

15:00 - 16:30   Guided city tour

18:30   Dinner at restaurant Waldschlösschen

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[1]Abstracts available at http://www.mpipks-dresden.mpg.de/~multi04/

Program[1]

Thu, Sep 02	09:00 - 09:45	Nicole Saam *Simulating intergovernmental negotiations with MAS*
	09:45 - 10:30	Petra Ahrweiler *Simulating knowledge dynamics in innovation networks using MAS*
	10:30 - 11:00	Coffee break
	11:00 - 11:30	Werner Ebeling *Stochastic models of socio-economic processes:* *Innovations and transitions to new technologies*
	11:30 - 12:00	Jan Lorenz *Continuous opinion dynamics formulated in matrix language* *and its relation to swarms*
	12:00 - 12:30	Akira Namatame *Evolutionary design of desired collective behavior*
	12:30 - 14:30	Lunch
	14:30 - 15:00	Thomas Fent *Social influence on marriage: An agent based model*
	15:00 - 15:30	Tadeusz Platkowski *Some experimental and numerical results on Minority Game*
	15:30 - 16:00	Jeremy Bradley *Internet worm attacks and stochastic agent models*
	16:00 - 16:30	Coffee break
	16:30 - 17:30	**TUTORIAL:** Volker Grimm *Agent-based models in ecology and natural resource management*
	18:30	Dinner
Fri, Sep 03	09:00 - 09:45	Maxi San Miguel *Neighborhood models of minority opinion spreading*
	09:45 - 10:30	Sven Brückner *The swarm in the box - Systematic simulations for the evaluation* *of engineered swarming systems*
	10:30 - 11:00	Coffee break

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[1]Abstracts available at http://www.mpipks-dresden.mpg.de/~multi04/

Program[1]

Fri, Sep 03   11:00 - 11:30   Uli Harder
                              An agent-based model for price dynamics in a GRID market

             11:30 - 12:00   Salima Hassas
                              Managing dynamic flows in production chains through self-organization

             12:30 - 14:30   Lunch

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[1]Abstracts available at http://www.mpipks-dresden.mpg.de/~multi04/

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Frequently asked questions

- **SEMINAR AND WORKSHOP SECRETARIAT:** Office 2 A 7 (second floor) from Monday to Thursday 08:00 - 12:00 and 13:00 - 16:45. On Friday 08:00 - 12:00 and 13:00 - 15:30.

- **SCIENTIFIC COORDINATOR'S OFFICE:** Iain Couzin office 2 A 9 (tel.: 2109) and Frank Schweitzer office 1 B 8 (tel.: 1208).

- **WORKSHOP II WELCOME:** On the evening of August 29, 2004 at 07:00 p.m. a welcome reception will take place in the hall of the institute as an occasion to get to know each other while enjoying a buffet. Everybody is invited to join! Non-participants pay 8,50 Euro to Mr. Schneider from the cafeteria.

- **COMPUTERS:** The computers in the offices 2 A 11, 2 A 13, 2 A 14, 2 A 15, 2 A 16, 2 A 18 and 2 A 20 are reserved for the participants. Every participant gets an own computer account. Your login is the one you specified in your registration/application form or in case you specified none the first 8 letters of your last name. If your name has less than 8 letters then just leave the rest unfilled. Please log on to the machine "milou". The password is $\boxed{\textbf{mul?TI}}$. Please change your password as soon as you have logged in. The command is **passwd**. After changing your password it is also possible to work on the machines "janus" and "titania".
  The computer account will be deleted two months after September 17, 2004. Please get in contact with Hubert Scherrer-Paulus (2 A 6) for keeping your account longer than November 17, 2004.
  Information on the institute's computer system is available through:
  http://www.mpipks-dresden.mpg.de/closed/getting_started/getting_started.html
  If you have any questions please contact Thomas Müller (2 A 4) or Torsten Goerke (2 A 12) in computer-related questions. Help with hardware (terminals, printers) can be obtained from Helmut Deggelmann (2 A 10).

- **PRINTERS:** A list of all available printers in the institute can be found under:
  http://www.mpipks-dresden.mpg.de/closed/getting_started/Available_printers.html

- **LIBRARY:** Our library is a reference library, which means that books must remain in the institute. You are allowed to check out books and use them in your office. Please ask Mrs. Näther, our librarian, for details. Journals should not be taken out of the library. Articles, which are not available in our library may be requested from other libraries in Germany. Information concerning the library is available at
  http://www.mpipks-dresden.mpg.de/library/library.html, including an on-line catalogue.

- **COPY MACHINES:** You can use the copy machines in 1 C 11 and 2 C 11.

- **OFFICE SUPPLIES:** Paper and everyday office materials are available in room 1 C 11. To request further material please contact Mrs. Dohrmann at the institute's reception desk.

- **HEALTH INSURANCE:** If you do not have a health insurance which is valid for Germany please come to the workshop secretariat in order to arrange one.

- **SOCIAL PROGRAM:** Please check the conference board in the hall and the webpage for details.

- **TELEPHONE CALLS:** For private calls you can buy a telephone card at the institute's reception desk. It costs 10 Euro. You can also use the coin phone in the entrance hall of the institute. For business calls please come to office 2 A 7.

Frequently asked questions

- **FAX:** A fax machine is available on the ground floor at the institute's reception desk.

- **MAIL:** Internal and external outgoing mail can be left at the reception desk at the entrance. Stamps are also available there upon request.

- **PRIVATE CAR:** You need a special permit to park your car at the institute's parking lots, please contact Mrs. Dohrmann at the institutes reception desk in order to get the permit.

- **SHOPPING:** Throughout Germany shops are open Monday to Friday from 09:00 to 18:00 (in the city centre until 20:00 or even 22:00) and Saturday from 09:00 to 20:00

  - The main shopping centre "Prager Strasse" is close to the Main Railway Station. Take tram no. 3 to the stop "Walpurgisstrasse" and keep to the left. You will find a large department store (Karstadt) as well as many other shops on "Prager Strasse". If you walk in direction of the "Altmarkt" you will find another shopping mall called "Altmarktgalerie" with more than 100 shops.

  - Food and beverages: within 5 minutes walk along the tram tracks towards the city centre you will find a bakery and a butcher on the right hand side of the street (on Landsberger Strasse). A few more minutes in the same direction, but on the left hand side, you will find a small supermarket (Konsum) and a shop selling fresh fruits and vegetables, as well as beverages. Every Wednesday and Saturday there is a small market at Münchner Platz from the morning until early afternoon.

- **FOR THOSE ACCOMMODATED IN THE MPI GUEST HOUSES:**

  - Breakfast: is served weekdays from 08:00 a.m. onward at the cafeteria. On weekends there is the possibility to have breakfast in the nearby bakery on Münchner Platz - Bäckerei Möbius. They serve breakfast on Saturdays from 6 a.m. onward. On Sundays they are open only from 1:30 p.m. onward.
    The student's pub "B'Liebig" on Liebigstr. 24 is offering a breakfast buffet (cost: 7,00 Euro) on Sundays from 9 a.m.

  - Guest house keys: you can open each entrance of the institute as well as the library with your guest house key. Within the blue part of the key is a chip: move it along the little box at each entrance, after a beep you can open the door.
    On your departure day please drop the guest house keys into the box in the entrance hall of your guest house. Please vacate the guest house <u>before</u> 9 a.m.

- **FOR THOSE ACCOMMODATED IN THE HOTEL OR B&B KÄUBLER:**

  - Breakfast: is served in the hotel or B&B.

  - Keys for entering the institute: please come to room 2 A 7 in order to get one. Please do not forget to give it back when leaving.

- **LAUNDRY:** There is the possibility to wash your clothes in the basement of guest house no. 2. Please dry your clothes there and not in your room!

- **SECURITY:** After 6:30 p.m. the entrances of the institute should be locked. Please check after entering or leaving the institute that the door is correctly shut. Please leave your window shut or tilted, but not open.

YOUR SUGGESTIONS AND QUESTIONS ARE ALWAYS WELCOME!