

Call for proposals – **CLOSED!**

Information for  
Applicants 82b

## Complex Networks as a Phenomenon across Disciplines

### I. Funding Initiative

At the end of 2003 the VolkswagenStiftung established the funding initiative **New Conceptual Approaches to Modeling and Simulation of Complex Systems**. This initiative aims at a better understanding of complex systems by means of modeling and simulation and addresses theoreticians from all scientific disciplines (using) computational approaches. On the one hand individual research scholarships for young theoreticians who strive to change their subject areas as well as sabbaticals for professors, both associated with German universities, scientific meetings, and projects targeted at the fundamentals of complex systems are supported (for details see Information for Applicants 82). On the other hand, topically focused research projects are funded after a preceding call for applications like this one.

### II. Aim

Complexity has gained considerable interest across disciplines when it comes to investigate natural, social, technical, and economic structures and their organization. In this context new research fields have evolved such as systems biology, socio- and econophysics, as well as urban and traffic systems modeling. Pioneering models based on networks have been developed for the vulnerability to corruption in societal organizations, for the emer-

gence of cooperative and parasitic traits in natural and economic systems, for the identification of weak or critical elements in technical applications, and for the relation between the chosen means of travel and urban infrastructure – to give a few examples.

A network – also called graph – consists of nodes and edges which link the nodes. Complex networks cannot be mapped onto a regular grid or lattice, nor do they share the simple statistical properties of a random network (e. g. Erdős-Renyi graph). With most natural complex networks the representation as a graph is only a rough approximation which, however, may capture essential properties. The optimization on a local scale influences the global dynamics. Therefore, dynamical elements such as dynamical nodes or links are indispensable for a realistic description. Complexity is further reflected in a large number of degrees of freedom, high dimensionality, hierarchies, and multiple scales. Examples for real-world complex networks are socio-economic networks (friendships, markets), technical nets (internet, traffic), and biological nets (social insects, immune system).

Common traits in complex networks from different fields hint to underlying universal principles so far unknown. The shift from small model graphs to large scale systems and from static properties to dynamical aspects is still hampered by a lack of proven modeling approaches. Other open questions are: What can

we learn from network concepts regarding fundamental phenomena like emergence, evolution or robustness? What is the origin and function of network structures in nature? Therefore, the analysis of complex networks, their dynamics and optimization with respect to specific applications as well as the development of new analytical or simulation methods to handle complex network structures are in the focus of this call for proposals.

Thus, projects are sought-after which deal with one or more of the following tasks:

- new approaches to the dynamics of complex networks,
- correlations between the distinct measurable quantities in networks,
- combination of methods and algorithms from different fields of network research,
- bridging the gap between network models and real-world systems,
- concepts leading to an understanding of the function of complex network structures.

Scientists are encouraged to team up and submit joint proposals. Applications by single investigators will be considered as well if integrative aspects are clearly identifiable or collaborations are an essential part of the project. In this context the exchange of graduate students or postdoctoral researchers among groups with complementary expertise or a close interchange of experiences with scientists from an application field are conceivable. The research questions outlined above already imply that funding is mainly provided for theoretical and computational work. Experiments and empirical studies are not in the focus of the call, but data compilation in order to validate network models and their limitations are accepted as subsidiary tasks.

The choice of the network modeled and the area of application is up to the applicant.

However, the Foundation expects that the choice and the complexity of the network system examined are substantiated. Ideally, the results strived for are related to a well-defined scientific goal, e.g. better control strategies in technical networks, optimization of information flow in socio-economic networks, or a better understanding of evolutionary principles in biological networks. As a matter of course, the methodology and the aim of the project should go beyond standard graph theory.

### III. Restrictions

The following research topics are excluded: neural networks, signal transduction in cells, topics from systems biology, polymer networks, conventional Ising and spin glass models, as well as systems based on lattice or other trivial geometries. Applications from computational neuroscience must be convincingly delimited from other existing funding programs and are only considered if they involve a cooperation with theoretical physicists or mathematicians.

Moreover, simulation runs with existing codes are not funded unless new conceptual ideas predominate. Further, the Volkswagen Foundation excludes funding of topics which are covered by the programs of other institutions, e.g. the Deutsche Forschungsgemeinschaft, the Federal Ministry of Education and Research, or the European Union.

### IV. Funding Possibilities

This call for proposals aims at research projects with transdisciplinary or methodologically comprehensive character. There is a preference for integrative concepts compared to approaches by single investigators. Not modeling and simulation strategies adapted to specific problems but systematically improvable concepts or solutions for broad classes of prob-

lems are sought-after. Novelty is a major criterion in peer-review.

Research projects are supported with personnel, material and travel costs. Travel and subsistence costs for project related temporary (up to one year) exchange of personnel of the contributing teams as well as means for the integration of foreign guest researchers in the research might be included. Since the focus of the initiative is on conceptual approaches, salaries for technicians and computing equipment is funded only in exceptional cases.

Applications may initially cover a time period of three years maximum. Grants for the benefit of scientific institutions abroad are in general possible. However, in such cases the Foundation requires that the project is coordinated by the obligatory German partner and the necessity for the international cooperation is substantiated.

## V. Application

There is a two-step application procedure. First, short pre-proposals (3 pages) are solicited. The deadline for the submission of pre-proposals is January 30, 2006. They are subject to peer-review by an interdisciplinary and international expert panel. Successful applicants will be invited to submit full proposals (10 pages). An approval of a pre-proposal cannot be considered as a commitment to fund the project, but there is another comparative peer-review of the applications. Presumably the decisions will be disclosed at the end of 2006.

The pre-proposals should be written in English and should contain the information listed in the separate checklist. The Foundation does not accept pre-proposals which are pending at another funding institution, neither in the identical nor in a similar form.

The Volkswagen Foundation can award grants only to scientific institutions. Applicants from outside universities and well-known publicly-maintained research institutions are asked to provide details on the legal status, statutes, trustees and boards, charitable/non-profit status, budgeting and auditing of the institution to be funded. Please include an annual report of the applying institution if any exists.

## VI. Contact

Please do not hesitate to contact the office of the Volkswagen Foundation in Hannover, Germany, if any further questions should arise.

Contact: Dr. Ulrike Bischler  
Phone: +49 (0) 511-83 81 350  
Fax: +49 (0) 511-83 81 4350  
Email: [bischler@volkswagenstiftung.de](mailto:bischler@volkswagenstiftung.de)

.....  
**VolkswagenStiftung**  
Kastanienallee 35  
30519 Hannover  
GERMANY

Phone +49-511-83 81-0  
Fax +49-5 11-83 81-344  
[www.volkswagenstiftung.de](http://www.volkswagenstiftung.de)

## How to apply – Check-list

### Complex Networks as a Phenomenon across Disciplines

The pre-proposals have to be written in **English**; there are no application forms. For processing your pre-proposal a signed version via postal mail as well as the corresponding files either via e-mail, on CD-Rom or on disk are needed **until January 30, 2006**. There is a **page limit** of one cover sheet, three pages for the project draft, and one page each for information on the applicant(s) and the graduate or postdoctoral researcher(s) involved (font 11 pt minimum). Pre-proposals with excessive length and unsolicited enclosures such as reprints of journal articles will not be forwarded to the referees.

The draft proposals should be phrased clearly and should provide sufficient information for an assessment by the Foundation and the scientists involved in peer review. The following information is expected:

- brief informative **project title** and institutional addresses of all **applicants** (cover sheet)
- **project description**  
(1) topic and objectives, (2) brief description of the international state of the art, own preliminary work, work plan and methods, (3) statement on the relevance for the topic of the call and on the complexity of the network chosen, and  
if applicable: (4) work assignment and coordination in collaborative projects, (5) delimitation of the chosen topic from specific programs of other funding agencies
- **estimative costs and project duration**  
divided into costs for personnel, travel and consumables, if applicable: separate for each participating research team
- **signatures** of all applicants

As enclosure (or separate file, respectively):

- brief **curriculum vitae** with indication of the current position at the institute and **list of up to five relevant publications** from the applicant(s) and assigned postdocs/graduate students (one page each)

**Please submit your pre-proposal and the corresponding files to:**

VolkswagenStiftung  
Dr. Ulrike Bischler  
Kastanienallee 35  
30519 Hannover  
Germany

E-Mail: [bischler@volkswagenstiftung.de](mailto:bischler@volkswagenstiftung.de)  
Telefon: +49 (0) 511-83 81 350