

ANNUAL REPORT 2008

Physics of Physiological Processes Faculty of Physics, University of Vienna

STAFF

Group speaker: Ao. Univ. Prof. Dr. Karl W. Kratky
Guest scientist: Univ. Doz. Dr. Karl E. Kürten
Lecturers: Mag. Werner Gruber, Univ. Doz. Dr. Karl E. Kürten, Mag. Dr. Hans Günter Löw
Volunteer: Dipl. Phys. Dr. Axel Schäfer
Administration: Andrea Hnizdo
Diploma student: Matthias Fukac, Jasmin Köndorfer, Marvin Kovacs
PhD students: Mag. Werner Gruber, Mag. Peter F. Hüttner, Mag. Dr. Said Ibrahim, Mag. Ivan Lucić

RESEARCH

The research group "Physics of Physiological Processes" deals with complex dynamical systems (chaos and systems research) in general and with the physics of the human body in particular. The following topics are considered: nonlinearity and feedback, self-organization and synchronization, chaos and fractals, neural networks and cellular automata. These topics are treated in various ways: from a fundamental point of view, studying computer experimental results and interpreting experimental data.

These topics are interdisciplinary, connecting physics especially with biology, psychiatry/ medicine and ecology. In this context, biophysical theses have been studying the effect of light and sound on biological systems. For instance, the fractal dimension of mushroom mycelium was analyzed, and the change of heart-rate variability of human beings was investigated. The fields of research in some detail:

Physics of physiological processes: inter- and transdisciplinary aspects

With the help of chaos and systems research, bridges to other sciences can be built, in research as well as in teaching. Attention is focused on biology and medicine. Among other things, it is investigated how chaos control is used by organisms to regulate their body functions efficiently. Furthermore, several therapies in complementary medicine are interpreted from the view-point of chaos and systems research.

Neurophysics

The mental processes of the brain are described by physical methods. At the moment the problem of cognitive learning and stammering is in the focus of investigation.

The effect of light and sound on heart-rate variability (HRV)

- a) Humans are being exposed to light of different spectral composition and of different and varying intensity. Data of biophysical parameters (e.g. ecg, emg, breath) are acquired and then analyzed by nonlinear time series and other methods. The heart-rate variability (HRV) is a major point.
- b) In a further step, three kinds of sound were presented to humans: 'pink noise', 'water' (wellspring), and 'frogs' (croaking). Their influence on HRV was again investigated.
- c) Calculating the breathing rate via HRV (utilizing the respiratory sinus arrhythmia) yields another interesting variable that makes new interpretations possible.

In addition to the research, several lectures are offered, e.g., "Complex Dynamical Systems", "Physics of Physiological Processes", "Complementary medicine" and "Theory of complex interconnected systems I & II".

REFEREED PROJECTS

K.E. Kürten

- Theory of interconnected systems: from cellular automata to genetic, social, and neural network models (supported by the European Science Foundation ESF and by the Department of Physics, Loughborough University)

We study phase transitions from ordered to chaotic behavior applicable to various real-world networks such as gene regulation networks, social networks, multi-agent networks, majority voter networks, epidemic networks, chemical reaction networks, and neural network models. One focus of this study is the determination of critical parameters, where the network is placed "at the edge of chaos", i.e. at a subtle compromise between stability and flexibility, where biological systems have both, the necessary stability and the potential for evolutionary improvements.

Scale-free network topologies have been found almost everywhere in the real world. Many networks expand through the addition of nodes to an already existing network, and those nodes attach preferentially to nodes which are already well connected. (the rich get richer) When this is the case, a scale-free network naturally arises. In fact, a scale-free network is a very specific kind of network in which the distribution of connectivity is extremely uneven: some nodes act as "very connected" hubs using a power-law distribution, whereas most of the nodes are rather sparsely connected. Examples are computer networks and the world wide web, which react significantly different from randomly connected networks in the presence of perturbations. If nodes fail randomly, scale-free networks behave much better than random connectivity networks, because random failures are unlikely to harm an important hub. However, if the failure of nodes is not random, scale-free networks can fail catastrophically.

Conclusion: We have shown that the stability of these models depends crucially on the probability distribution of the connectivity structure as well as on the probability distribution of the Boolean interaction weights. The widely discussed scale free distributions clearly outperform the conventional choices. The mean connectivity of the systems, which was limited to $\langle K \rangle = 2$, in the original models, can be largely shifted to higher values of $\langle K \rangle$ giving rise to more realistic models of biological networks, where the nodes are usually governed by more than two incoming connections on average.

H.G. Löw

- Biophysical investigation of energetic metabolic parameters of muscle tissue during electrostimulation: papillary- and skeletal muscles as examples (cooperation-project with the Institute for Toxicology, University of Vienna)

Based on the physical developments during the refereed project "Continuous fluorescence-optical detection of energetic metabolic parameters of cardiomyocytes during stress induction by electrostimulation" (University of Vienna and Facultas Verlag), further developments are performed. Primary specific aim of this project is to investigate biophysical parameters in vital muscular biomolecules under presence of short pulsed magnetic fields. Modulating the chemical and environmental conditions of the buffer solutions as well as coil-conformations and current pulse shapes studies are focused on influences of dynamic contraction-force-development as well as on autofluorescence, oxygen demand, calcium-fluorescence which represent ionic channel activities under pulsed magnetic stress induction. Force-frequency relations under presence of ionic channel blockers as well as under normoxic and hypoxic conditions are measured. Influences of spectral components of magnetic pulses on penetration depth and biomechanical transduction efficiency are studied using a novel type organ bath. This instrument allows combining fluorescence excitation, optical detection of muscle tissue as well as simultaneous measurement of muscle-tension. All data are recorded and time-stamped within a datastream using LABVIEW-Software packages and a novel developed software protocol which allows minimizing stochastic signal deviations during acquisition. This application oriented project allows specifying the electrodynamic field-parameters influencing muscle contraction and characterizes a novel kind of muscle-stimulation from biophysical and biomedical point of view.

H.G. Löw

- Fluorescence diagnosis, mini-FACS on chip research and development of miniaturized fluorescence diagnostic components using single cellular and single molecular spectroscopy methods (cooperation-project with the Ludwig Boltzmann Institute for Andrology and Urology, KH Lainz, Vienna, and with the Max F. Perutz Laboratories, Campus Vienna Biocenter)

Based on the results of the refereed project 9675 (Austrian National Bank, see above), time-correlated methods for detection of molecular binding properties between biomolecules are applied to develop and construct a miniaturized fluorescence detection device for small liquid samples in context to establish binding assays for medical diagnosis. The aim of this project is focussed to construct an "easy to use+ low-cost" fluorescence device for diagnostic physicians, which allows performing pre-screening-tests on patients blood and liquid samples. Incubation the novel developed tumor-targetting substance Photovidon (Hypericin-PVP-Complex derivative) urinary samples of potential bladder-wall cancer patients are investigated using a "mini-FACS" device as well as an ordinary standard fluorescence cell-sorter (FACS). The correlations between both methods are compared and related to the clinical data supplied by the hospital. The novel device is a contribution to early cancer diagnosis methods in biomedicine and may enhance diagnostic performance at low cost levels.

COOPERATIONS

a. INTERNATIONAL COOPERATIONS

K.W. Kratky

CANADA

- International Institute for Advanced Studies in Systems Research and Cybernetics, Tecumseh, Ontario (G.E. Lasker)

GERMANY

- Department of Music Education and Music Therapy, Siegen University, Siegen (C.-L. Zhang)

UK

- Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol (Q.M. Zhu)

VARIOUS COUNTRIES:

- Eurasia-Pacific Uninet (Network Office: Salzburg, B. Winklehner)

K.E. Kürten

GERMANY

- Institut für Theoretische Physik, Universität Köln (L. Ristig)

UK

- School of Mathematical and Physical Sciences, Loughborough University, Loughborough (F.V. Kusmartsev)

USA

- Department of Physics; Washington University, St. Louis (J.W. Clark)

W. Gruber

GERMANY

- P.M.- Zeitschrift, München (Thomas Vasek)
- BV1 - Bildungsverlag EINS, Troisdorf (Daniela Roland)

H.G. Löw

GERMANY

- Ludwig-Maximilians-University of Munich, Laser Research Laboratory Großhadern / München (C. Betz, R. Baumgartner et al.)

RUSSIA

- Rostov state university, Biophysics department, Rostov-on-Don (A. Uzdensky)

NORWAY

- Institute for Cancer Research, Montebello, Oslo (J. Moan)

USA

- Wellman Laboratories for Photomedicine, Harvard medical school, Boston (M. Hamblin et al.)

I. Lucić:

ISRAEL

- Bar Ilan University, department of physics, Ramat-Gan (A. Vishne, S. Havlin)

b. NATIONAL COOPERATIONS

K.W. Kratky

- Atominstitut der Österreichischen Universitäten, Wien (H. Klima)
- Interuniversitäres Kolleg für Gesundheit und Entwicklung, Graz / Schloss Seggau (P.C. Endler)
- Universitätsklinik für Neuropsychiatrie des Kindes- und Jugendalters der Medizinischen Universität Wien (K. Toifl).

K.E. Kürten

- Fakultät für Mathematik der Universität Wien (C. Krattenthaler)

W. Gruber

- Wiener Volkshochschulen, Programm 'University meets public' (M. Ludwig)
- Atominstitut der Österreichischen Universitäten, Wien (H. Oberhummer)

H.G. Löw

- Institut für Biomolekulare Strukturchemie der Universität Wien (G. Grabner, G. Köhler, M. Edetsberger)
- Institut für Theoretische Chemie der Universität Wien (E. Gaubitzer)
- Institut für Physiologie der Medizinischen Universität Wien (D. Schmid, C. Plass, P.G. Spieckermann)
- Institut für Medizinische Chemie der Medizinischen Universität Wien (P. Chiba, H. Goldenberg)
- Geriatriezentrum Am Wienerwald, Lainz (H. Löw-Weiser, R. Werni)
- Department für Pharmakologie und Toxikologie der Universität Wien (C. Studenik)
- Ludwig Boltzmann Institut für Andrologie and Urologie, KH Lainz (H. Pflüger)

I. Lucić

- Phonogrammarchiv der österreichischen Akademie der Wissenschaften, Wien (G. Lechleitner)

A. Schäfer

- ARC Seibersdorf Research, Seibersdorf (K. Schulmeister)
- Fa. ProQuant Systeme, Graz (F. Senekowitsch, F. Tschinder)

PUBLICATIONS

a. ALREADY ISSUED

1. **A. Schäfer** and **K.W. Kratky**, *Estimation of breathing rate from respiratory sinus arrhythmia: comparison of various methods*. *Annals of Biomedical Engineering* **36** (2008) 476-485.

Although respiratory sinus arrhythmia (RSA) is a well-known and often studied phenomenon, methods to estimate (average) respiratory rate from heart rate variability via RSA have been investigated and published only sparsely. We reinvestigate three published techniques and contrast them to our own approaches. All methods were also evaluated for respiration signals to yield approximations of the true breathing rate for comparison. Our analyses are based on physiological recordings available at PhysioNet, an online database. Results show that the RSA of young supine subjects yields good approximations of mean respiratory rate in the case of time series longer than 1 min, while the estimations become noticeably less accurate for elderly persons. Our own "advanced counting method" produced the best results, and in addition principally permits even the definition of instantaneous respiratory rates. Consequently, it is recommended for further investigations.

2. A. Kubin, **H.G. Loew**, U. Burner, G. Jessner, H. Kolbabeck, F. Wierrani, *How to make hypericin water-soluble*. *Pharmazie* **63** (2008) 263–269. doi: 10.1691/ph.2008.7292

Hypericin, isolated from *Hypericum perforatum*, is an effective photodynamic substance as demonstrated by various studies. Practical forms of applications of hypericin solutions for systemic use and introduction into body cavities are, however, lacking. We developed an aqueous solution of hypericin non-covalently bound to polyvinylpyrrolidone (PVP). PVP is a poly-N-vinylamide of various degrees of polymerization and forms of intermolecular crosslinks suitable for diagnostic and therapeutic applications. We used PVP (molecular weights of PVP between 10 kD and 40 kD) as a complex forming agent to prepare hypericin for photodynamic therapy and diagnostics. In pure water, hypericin forms aggregates which are non-soluble and non-fluorescent. The hypericin-PVP complex binds more than 1000 mg of hypericin in presence of 100 g PVP or less and is soluble in 1 liter of pure water. Aqueous complex solutions of hypericin-PVP display a characteristic absorption spectrum and fluorescence emission band around 600 nm wavelength. Varying concentrations of hypericin do not cause a blue- or red-shift in the absorption maximum at 595 nm. Excitation at 200 nm to 500 nm leads to emission at 590 nm; a property conducive to diagnostic investigations both in vitro and in vivo. Furthermore, hypericin-PVP exhibits high photostability in the presence of oxygen and broad band light which ensures reproducible photodynamic therapy and diagnosis. Conclusion: Hypericin forms liquid molecular chromophore complexes in water when bound to PVP thus allowing investigations in biological media.

3. **K.E. Kürten** and J.W. Clark, *Critical dynamics of randomly assembled and diluted threshold networks*. *Phys. Rev. E* **77**, 046116 (2008)

The dynamical behavior of a class of randomly assembled networks of binary threshold units subject to random deletion of connections is studied based on the annealed approximation suitable in the thermodynamic limit. The dynamical phase diagram is constructed for several forms of the probability density distribution of nonvanishing connection strengths. The family of power-law distribution functions $\rho_0(x) = (1-\alpha)/(2|x|^\alpha)$ is found to play a special role in expanding the domain of stable, ordered dynamics at the expense of the disordered, "chaotic" phase. Relationships with other recent studies of the dynamics of complex networks allowing for variable in-degree of the units are explored. The relevance of the pruning of network connections to neural modeling and developmental neurobiology is discussed.

4. F.V. Kusmartsev and **K.E. Kürten**, *Physics of the mind: Opinion dynamics and decision making processes based on a binary network model*. *International Journal of Modern Physics B* **22** (2008) 4482-4494.

We propose a new theory of the human mind. The formation of human mind is considered as a collective process of the mutual interaction of people via exchange of opinions and formation of collective decisions. We investigate the associated dynamical processes of the decision making when people are put in different conditions including risk situations in natural catastrophes when the decision must

be made very fast or at national elections. We also investigate conditions at which the fast formation of opinion is arising as a result of open discussions or public vote. Under a risk condition the system is very close to chaos and therefore the opinion formation is related to the order- disorder transition. We study dramatic changes which may happen with societies which in physical terms may be considered as phase transitions from ordered to chaotic behavior. Our results are applicable to changes which are arising in various social networks as well as in opinion formation arising as a result of open discussions. One focus of thesis study is the determination of critical parameters, which influence a formation of stable mind, public opinion and where the society is placed "at the edge of chaos". We show that social networks have both, the necessary stability and the potential for evolutionary improvements of self-destruction. We also show that the time needed for a discussion to take a proper decision depends crucially on the nature of the interactions between the entities as well as on the topology of the social networks.

5. **K.E. Kürten**, *Dynamical phase transitions in opinion networks: Coexistence of opportunists and contrarians*. International Journal of Modern Physics **B 22** (2008) 4647-4683.

We study a model for the emergence of collective decision making, consisting of N interacting agents, whose opinions are described by Ising spin variables. In particular, we present dynamical phase transitions from ordered to chaotic behavior in the space-time evolution of the binary choice networks. One focus of this study is the determination of critical parameters, where the network is placed "at the edge of chaos", i.e. at a subtle compromise between stability and flexibility, where the system has both, the necessary stability and the potential for "evolutionary" improvements.

6. M. Forrester, E. Kovacs, **K.E. Kürten** and F.V. Kusmartsev, *Astroid curves of high-moment anti-ferromagnetic nanoparticles with tunable magnetic properties*. J. of Magnetism and Magnetic Materials, online Dec 7 (2008). doi:10.1016/j.jmmm.2008.11.104

We have determined astroids for high-moment antiferromagnetic nanoparticles (AN), which have been recently discovered and used in numerous biomedical applications. The astroid curves for such a system, which is a stack of two isolated disk-shaped ferromagnetic nanoparticles interacting anti-ferromagnetically, show the regions in the magnetic field plane where different numbers of minima associated with stable or metastable states may exist. We describe the properties of these ANs and estimate their other characteristic parameters such as magnetic saturation field and exchange anti-ferromagnetic coupling. We argue that the finding of these astroids and the properties of ANs is crucial for the use of ANs in numerous applications and for modeling stable information storage devices.

7. H. Klima, **I. Lucić** and **K.W. Kratky**, *Ultraweak photon emission of *Psilocybe cubensis* mycelium tissue: Comparison of tissue treated with acoustic waves and non-treated tissue*. International Journal on Modelling, Identification and Control **5** (2008) 210-213.

Every kind of living matter (cells, organ tissue or organism) emits certain amount of light quantum that can be measured as ultraweak photon emission, also called biophoton emission [1,2]. In this research we investigate the photon emission of mycelium cultures of *Psilocybe cubensis* that were treated with acoustic waves of 194.71 Hz for 13 days compared with non-treated control samples.

8. C.M. Kacher, H. Klima and **K.W. Kratky**, *Suppressive Influence Of Periodic And Chaotic Laser Light On Cancer Cells*. International Journal on Modelling, Identification and Control **5** (2008) 214-220.

HeLa-cells have been irradiated with a HeNe-laser of 633 nm in the lag-phase at initial cell densities of 10^4 cells per ml. It is shown that cancer cells react differently to the 633 nm laser light (100 J/m^2 or 200 J/m^2). Energy densities of 100 and 200 J/m^2 and different kinds of radiation (constant, periodic and pseudo-chaotic radiation) have been applied. The relative cell densities have been measured immediately, 24 hours and 48 hours after the radiation. We could show that all three kinds of radiation show different effects. Soon after the exposure constant radiation is very effective. Periodic radiation is least effective and pseudo-chaotic radiation is little effective soon after the radiation but gets more effective with time.

b. ACCEPTED

1. **K.E. Kürten** and F.V. Kusmartsev, *Chaotic modes in scale-free opinion networks*. International Journal of Modern Physics **B**.

We study a model for the emergence of collective decision making, consisting of N interacting agents, whose opinions are described by Ising spin variables. We find that a phase of social chaos may arise at various dynamical opinion formation processes in many realistic models. The existence of such a phase reflects a main feature of the human being associated with some doubts and uncertainty.

2. **K.E. Kürten**, *Dynamical stability of scale-free opinion networks Coexistence of opportunists and contrarians*. International Journal of Modern Physics **B**.

We extend Galam's majority/minority model for the emergence of collective decision making consisting of N interacting agents, whose opinions are described by Ising spin variables, to flexible network architectures and damage spreading analysis. We show how the dynamical stability of these models depends crucially on the probability distribution of the connectivity structure, where the power-law distribution clearly outperforms the conventional homogeneous distribution. Variation of the power-law exponent eventually stabilizes the system.

c. SUBMITTED

1. **A. Schäfer, K.W. Kratky** and K. Schulmeister, *The effect of colored illumination on breathing rate and cardiorespiratory dynamics*. Journal of Alternative Medicine Research.

d. BOOKS

1. **W. Gruber**, "Die Genussformel. Kulinarische Physik. Ecowin, Salzburg 2008.
2. **K.W. Kratky**, Complementary medicine systems. Nova Science, Hauppauge, NY 2008.

e. PATENTS

1. A. Kubin and **H.G. Löw**: Preparation of hypericin bonded with poly-N-vinylamides. United States Patent No. US 7,390,510 B2 (June 24, 2008)

The invention relates to an active agent combination for diagnosing and treating tumours, comprising a water-soluble complex or a water-soluble compound of pure hypericin and a poly-N-vinylamide, especially PVP.

LECTURES, POSTERS

a. LECTURES

K.W. Kratky

- Menschenbild und Heilkunde: Vergleich und Integration von Verfahren (Modulabschluss für Gr. 20 & 23, Interuniversitärer Fernstudiengang für komplementäre, psychosoziale und integrative Gesundheitsförderung, Schloss Seggau), 26.1.08.
- Gemeinsamkeiten komplementärmedizinischer Richtungen aus interkultureller Sicht (1. Ausbildung der Akademie für Traditionelle Europäische Medizin, Windischgarsten), 19.4.08.
- Menschenbild und Heilkunde: Vergleich und Integration von Verfahren (Modulabschluss für Gr. 24 & 26, Interuniversitärer Fernstudiengang für komplementäre, psychosoziale und integrative Gesundheitsförderung, Schloss Seggau), 14.6.08.
- Weltbilder komplementärmedizinischer Richtungen: die vier Blickwinkel (Seminar "überlebensmittelsphilosophie – Systeme und Netzwerke" an der Universität für Bodenkultur, Wien), 11.11.08.
- Komplementäre Medizinsysteme (Weiterbildung "Energetische Modelle und Methoden – Therapeutische Berührung", Zentrum – Lebensenergie, Wien), 5.12.08.

K.E. Kürten

- The chaotic edge of competing opinions (Ecole Polytechnique, Paris), 22.10.08

b. CONFERENCE CONTRIBUTIONS

- **K.E. Kürten:** Dynamical Phase Transitions in Social and Biological Binary Network Models (invited lecture at the Symposium on Neural Networks and Cellular Automata, February 4-5, 2008 in Loughborough, UK), February 5, 2008.
- **K.E. Kürten:** Multistability and fractal behaviour in Josephson junction arrays (invited lecture at the XXXII International Workshop on Condensed Matter Theories, August 13-18, 2008 in Loughborough, UK), August 17, 2008.
- **W. Gruber:** Can consciousness be defined mathematically? Brain Modelling as a way to the brain? (Vienna Conference on Consciousness 2008, Vienna), 26.9.08.
- **K.E. Kürten:** Dynamical properties of binary opinion networks: coexistence of opportunists and contrarians (invited lecture at the 1st ICC Conference on Network Modelling and Economic Systems, October 9-11, 2008 in Lisbon, Portugal), October 10, 2008.
- **K.W. Kratky:** Ganzheitlichkeit in der Heilkunde (Internationales und interdisziplinäres Symposium der Osteopathie "KÖRPER/GEIST: fühlen, denken, be-handeln", 20.-23.11.08 in Berlin), 20.11.08.

c. POSTERS

- **H.G. Löw:** PVP-Hypericin: ultralow bleaching rate, high performance fluorescence diagnosis (7th Symposium on Photodynamic Therapy and Photodiagnosis in Clinical Practice, October 7-11, 2008 in Brixen, Italy).

TEACHING AND WEB-BASED DIDACTICS

W. Gruber

Vorlesung "Brain Modelling I + II, Physikalische Modelle für das Gedächtnis", steht auch online zur Verfügung: <http://brain.exp.univie.ac.at>

Im Rahmen dieser Lehrveranstaltung werden aktuelle Forschungsergebnisse aus den Bereichen der Neuroscience vorgestellt und ihre Relevanz diskutiert. Der Streifzug durch die Neuroscience beginnt bei der Beschreibung von Neuronen, technischen neuronalen Netzen und dem Vergleich zu biologischen Netzwerken. Nach der Vorstellung von einigen konkreten Modellen aus der Biologie (Beispiele: Erkennen von Objekten durch das visuelle System, Synchronisation im Gehirn, Steuerungen und Regelungen im Nervensystem) endet der Streifzug bei philosophischen Fragestellungen. Da in diesem Forschungsgebiet noch viele Fragen offen sind beziehungsweise noch gar nicht gestellt wurden, wird auch auf die Grenzen des aktuellen Wissens hingewiesen.

DIPLOMA THESES – PHD THESES (Supervisor: K.W. Kratky)

a. CURRENT DIPLOMA THESES

- **M. Fukac**
Simulation des menschlichen Sehsystems
- **J. Kölnsdorfer**
Klassifizierung von Sprache und Geräuschen mittels eines Biologischen Neuronalen Netzwerks von Integrate-and-Fire Oszillatoren
- **M. Kovacs**
Die Auswirkung von Hathayoga-Atemtechniken auf die Herzfrequenzvariabilität

b. CURRENT PHD THESES

- **W. Gruber**
Synchronisationszustände des Gehirns und die Bedeutung für die Informationsverarbeitung
- **P.F. Hüttner**
Zeitreihenentwicklung von metabolischen Systemen: Analyse, Vorhersage, Steuerung
- **S. Ibrahim**
Naturwissenschaftliche Grundlagen der medizinischen Systeme
- **I. Lucić**
Der Einfluss unterschiedlicher Frequenzen auf biologische Systeme

PRIZES AND AWARDS

W. Gruber

- Goldenes Buch für das Buch "Unglaublich einfach. Einfach unglaublich" (wird noch verliehen)
- Goldenes Buch für das Buch "Die Genussformel" (wird noch verliehen)

PRESENCE IN THE MEDIA

K. W. Kratky

Print media and electronic journals

- Beiträge zu "meinprof.at: Guter Professor, schlechter Professor" von Rosa Schmidt-Vierthaler (DiePresse.com, 20.10.2008)

W. Gruber

He features on all relevant media – as print, radio and television – in Austria, Germany and Switzerland. Some examples:

Print media and electronic journals

- "Galileo Culinary", Profil, Nr. 35, 25.8.08
- "Unser Eischnee-Erklärer", Kurier, 31.8.08
- „Das Universum bei 180°C“, Profil, Nr. 36, 1.9.08
- „Kochen wie McGyver“, Salzburger Nachrichten, 6.9.08
- „Die Physik der guten Küche“, Österreich, 6.9.08
- „Genuss und Trends“, Neue Kronen Zeitung, 7.9.08
- „Physik in der Küche“, Die Presse, 8.9.08
- „Kochen ist immer auch Physik“, Der Blick, 8.9.08
- „Der Physiker im Labor Küche“, Tiroler Tageszeitung, 30.9.08
- „Physikalische Kulinarik“, Neue Züricher Zeitung, 1.10.08
- „Auf den Geschmack gekommen“, SonntagsZeitung, 12.10.08
- „Kurtis Erbe“, Wiener Zeitung, 23.10.08

Radio and television

- „Physik des Kochens“, J.B.Kerner, ZDF, 28.10.08
- „Physik der Weihnachtsgans“, W wie Wissen, ARD, 22.12.08
- „Von der Ernährung zum Genuss“, CLUB 2, ORF 2, 15.10.08

MISCELLANEOUS

K.W. Kratky

- Member of the Scientific Board of the journals "Research in Complementary and Classical Natural Medicine" and "Systeme".
- Member of the Editorial Board of the "Journal of Alternative Medicine Research" and reviewer of the journals "Evidence-based Complementary and Alternative Medicine Research" and "Research in Complementary and Classical Natural Medicine".
- Member of the Scientific Board of the Viennese International Academy of Complementary Medicine as well as the Institute of Ethno-music Therapy, Gföhl, Austria.
- Fellow of the International Institute for Advanced Studies in Systems Research and Cybernetics, Tecumseh, Ontario, Canada.
- Member of the team of the Interuniversity College for Health and Development, Graz / Castle of Seggau. There, also lecturer at the European Master's Degree Program for Integrated Health Sciences.
- Lecturer at the International Pilot Course for Oriental Music Therapy, Gföhl, Austria.
- Lecturer at the Academy for Traditional European Medicine (Windischgarsten, Austria).
- Member of the Board of Governors of the Scientific Society 'Dynamics – Complexity – Human Systems', Vienna.

K.E. Kürten

- Guest Scientist and Lecturer.

W. Gruber

- General Editor at CISCI (Cinema and Science), an EU-Project for teaching physics.
- Lecturer at various adult evening classes ("Wiener Volkshochschulen") within the context of the project "University meets public".
- Accountant of the Austrian Biophysical Society.
- Member of the "ScienceBusters".

COURSES IN THE ACADEMIC YEAR 2007/08

K.W. Kratky

WS: Physik physiologischer Prozesse	VO, 2h
WS: Komplementärmedizin: naturwissenschaftliche, psychologische und ethnologische Zugänge	SE, 2h
WS: Übungen zur Einführung in die Physik I - Gruppe 6	UE, 2h
WS: Spezialisierungspraktikum Umwelt- und Biophysik (als Mitveranstalter)	PR, 10h
SS: Physik physiologischer Prozesse	SE, 2h
SS: Gemeinsamkeiten komplementärmedizinischer Methoden – aus naturwissenschaftlicher und interkultureller Sicht	VO, 2h
WS: Spezialisierungspraktikum Umwelt- und Biophysik (als Mitveranstalter)	PR, 10h

K.E. Kürten

WS: Einführung in die Theorie vernetzter Systeme I - Vom zellulären Automaten zu genetischen und neuronalen Netzwerkmodellen	VO, 2h
WS: Neuere Entwicklungen in der Theorie vernetzter Systeme	SE, 2h
SS: Einführung in die Theorie vernetzter Systeme II - Vom zellulären Automaten zu genetischen und neuronalen Netzwerkmodellen	VO, 2h
SS: Spezielle Anwendungen in der Theorie vernetzter Systeme II	SE, 2h

W. Gruber

WS: Biophysikalisches Praktikum (als Mitveranstalter)	PR, 5h
WS: MEi:CogSci Cognitive Science Ringvorlesung (als Mitveranstalter)	VO, 2h
WS: Komplexe dynamische Systeme	VO+UE, 1h
WS: Wie erkläre ich es meinen SchülerInnen?	VO, 2h
SS: Praktikum für Schulversuche II (als Mitveranstalter)	PR, 8h

H.G. Löw

WS: Biophysikalisches Praktikum (als Mitveranstalter)	PR, 5h
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