Obituaries

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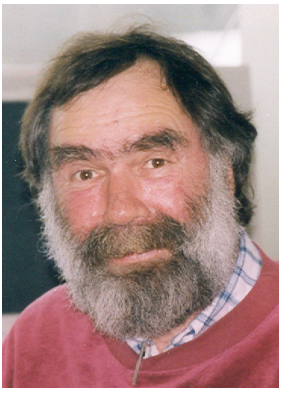
In 2012 two very sad news reached the physics community and – frankly speaking – shocked me. Two of my former students and coworkers, Arne Wunderlin and Rudolf Friedrich had untimely died.

Arne Wunderlin (1947 – 2012)

Arne studied physics at the University of Stuttgart from 1966 till 1971. His diploma thesis was entitled "Behandlung von elektronischen Kollektivanregungen im Festkörper mit Hilfe von Quasiwahrscheinlichkeiten" [Treatment of electronic collective excitations in a solid by means of quasi-probabilities]. His Ph.D. thesis (1975) had the title "Über statistische Methoden und ihre Anwendung auf Gleichgewichts- und Nichtgleichgewichtssysteme" [On statistical methods and their application to equilibrium- and nonequilibrium systems]. The topic of his "habilitation" (1985) was "Mathematische Methoden der Synergetik und ihre Anwendungen auf den Laser" [Mathematical methods of synergetics and their applications to the laser]. In 1992 Arne Wunderlin was nominated apl. Professor at the University of Stuttgart and in the summer term 1995 he served as visiting professor at the University of Potsdam.



Arne Wunderlin

The research areas of Arne were widespread. Here I can name only the most important.

1. In solid state physics, he developed new mathematical methods to deal with superconductivity, including nonequilibrium states.
2. He dealt with excitons of high density as well as with the convection instability of fluid dynamics.
3. His contributions to the development of Synergetics were quite substantial. Arne dealt with nonlinear partial stochastic differential equations at instabilities. In particular he had the idea of how to extend my "slaving principle" to arbitrary order.
4. Then his research activities turned to a newly developing field: delay differential equations at instability points.

A. Pelster and G. Wunner (eds.), *Selforganization in Complex Systems: The Past, Present, and Future of Synergetics*, Understanding Complex Systems,
DOI: 10.1007/978-3-319-27635-9_17

5. Arne dealt, jointly with Axel Pelster, also with highly abstract problems such as nonintegrable space-time-transformations.
6. Finally, Arne's widespread interests are witnessed by his contribution to the theory of elasticity: general solution of incompability problems of 3-dim. linear anisotropic media.

Arne published (jointly with me) a book (1990): "Die Selbststrukturierung der Materie" It is a pity that we never have tried to translate this book into English. (Probably a title could have been: How matter forms its structure) He also edited the book Evolution of Dynamical Structures in Complex Systems, 1992, (jointly with Rudolf Friedrich) and also the book Lasers and Synergetics (jointly with Robert Graham and me).

Arne was a dedicated academic teacher whose lectures were highly esteemed by his students. His lectures comprised both the regular courses in theoretical physics as well as special courses on turbulence, synergetics, relativistic quantum field theory, light and matter, to mention a few of them.

Arne was all the time willing to discuss problems with my diploma and Ph.D. students. He was of an enormous help to all of us. We appreciated him highly also because of his great kindness. Arne was married and had three children. We will keep him in good memory.

Rudolf Friedrich (1956 – 2012)

Rudolf studied physics at the University of Stuttgart from 1975 till 1982. His diploma thesis (1982) was devoted to "Höhere Instabilitäten beim Taylor Problem der Flüssigkeitsdynamik" [Higher Instabilities of the Taylor problem of fluid dynamics]. In his Ph.D. thesis (1986) he dealt with "Stationäre, wellenartige und chaotische Konvektion in Geometrien mit Kugelsymmetrie" [Stationary, wave-like, and chaotic convection in geometries with spherical geometry]. The topic of his "habilitation" (1992) was: "Dynamische Strukturen in synergetischen Systemen" [Dynamical structures in synergetic systems]. In 1999, Rudolf Friedrich was nominated apl. professor at the University of Stuttgart, and in 2001 he became professor of theoretical physics and director of the institute of theoretical physics of the University of Münster.

Rudolf Friedrich

The research areas of Rudolf Friedrich were very broad. His work was not only characterized by its depth, but also by its close connection with experiments.

1. In fluid dynamics, he dealt with a variety of instabilities, i.e. changes of one spatio-temperal structure into another one, where he took different geometries (e.g. cylindrical, spherical) into account.
2. He dealt with analogies between pattern formation and pattern recognition.

3. In brain research, he developed a spatio-temporal analysis of multi-channel Alpha EEG (electro encephalogram) map series. Here the goal was to demonstrate that the underlying dynamics is governed by few order parameters. In particular, Rudolf was able to show that in the case of "petit mal" epilepsy the dynamics is that of Shilnikov Chaos. A beautiful result!
4. A good deal of Rudolf's research activities in Münster was devoted to various aspects of turbulence. Here I can mention only a few examples:
   Derivation of a Fokker-Planck-equation, statistics of Lagrangian velocities, spiral turbulence, time series analysis, magnetic fields in turbulent fluids. Rudolf introduced fractional substantial derivatives, and dealt with anomalous transport.
5. His interest in practical problems in engineering is witnessed by his work on the effects of water jets on metal cutting.

Rudolf Friedrich edited the book Evolution of Dynamical Structures in Complex Systems, 1992 (jointly with Arne Wunderlin). Rudolf was a dedicated academic teacher giving courses and seminars on theoretical physics. Since 2008 he had been member of the "Dynamics and Statistics" section of DFG (German Science Foundation). He was speaker of the center for nonlinear science of the University of Münster, a member of the board of German-Chinese Sonderforschungsbereich Transregio 61 (special research section), and director of research, Sonderforschungsbereich 458.

During his time at my institute, I got to know Rudolf as a very helpful and humorous student and colleague. Rudolf was married and had three children. His son is just about to finish his physics study, and I wish him heartfully to be able to carry on the fundamental work of his father.

Quite obviously, my obituaries can hardly do justice to the wonderful personalities of Rudolf Friedrich and Arne Wunderlin, and their important scientific work. But nevertheless, I hope my remarks will contribute to keep both of them in our minds.