In memoriam Walter Köhler (1940 – 2003)

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Dr. Walter Köhler died June 17, 2003. Before his illness forced him to give up his position at the research laboratory of Siemens in Erlangen, he was also teaching as "Privatdozent" for Theoretical Physics at the University Erlangen-Nürnberg. Some remarks on his biography and on his scientific work as well as a list of his publications are presented here.

Walter Köhler was born in Schwabach (Bavaria) on November 11, 1940. There he graduated from high school in 1960 and he began studying Physics and Mathematics in Erlangen in 1960. He got the "Diplom" (master degree) in physics in 1966. His master thesis, prepared under the supervision of D. Fick at the Institute for Experimental Physics (director Prof. R. Fleischmann) dealt with the theory of nuclear reactions with polarized deuterons. For his dissertation he worked under the supervision of Prof. L. Waldmann at the Institute for Theoretical Physics, at the same time he was teaching assistant. In 1971 he received his PhD (Dr. rer. nat.) with the grade "excellent". In the same year he was awarded the price of the faculty for his outstanding dissertation with the title "Transport phenomena in gases of linear molecules and non-spherical intermolecular interaction".

After the pioneering experiments, in the mid-sixties, of J. J. M. Beenakker and coworkers in Leiden, Holland, on the influence of external magnetic and electric fields on the transport properties, in particular the viscosity and heat conductivity of (electrically neutral) molecular gases, the group of L. Waldmann in Erlangen worked intensively on the Kinetic Theory of these "anisotropy phenomena". The basis of the theory is a generalized Boltzmann equation which L. Waldmann, and independently R. F. Snider had derived previously. In this equation, the collisions between particles with internal rotational degrees of freedom are treated by quantum mechanics. The collision term of this Waldmann-Snider equation contains the scattering amplitude matrix or T-matrix in linear and bilinear form. Only for noble gases the collision term reduces to that of the Boltzmann equation involving the differential cross section. Within the framework of the Kinetic Theory, many of the properties measured for polyatomic gases like H_2, HD, N_2, O_2, CO_2 were expressed in terms of generalized collision integrals. Here also Walter Köhler made important contributions, in particular for gas mixtures (cf. the list of publications given below). The specific calculation of the quantities of interest required the scattering amplitude. The new and appealing feature of these studies was the fact that data were available of which one knew that they would be zero when the molecular interaction would not contain a non-spherical part, i.e. when it would not depend on the molecular orientation. The Lippmann-Schwinger equation of the scattering theory links the scattering amplitude with the interaction potential. Thus one knew that one had experimental probes for the non-spherical part of the interaction potential which is not easily accesible by measurements. For a quantitative comparison between experiment and theory, however, the solution of the scattering problem for realistic interaction potentials was lacking. Here Walter Köhler, together with J. Schaefer (MPI for Astro-Physics, Munich), made seminal and significant contributions (e. g. see the publications [44] and [45]). These outstanding articles constitute one of the few examples where the goal of Statistical Physics, which is to build a bridge between the microscopic properties of molecules, in particular their interaction and the macroscopically measurable properties has, been achieved in a seamless fashion.

In 1976 Walter Köhler worked in the Molecular Physics Group, directed by Prof. Beenakker and Prof. Knaap, at the University of Leiden, Holland. His expertice was highly appreciated, about 10 publications appeared with the Dutch experimentalists and with other theoreticians visiting in Leiden. During this time the foundation was laid for the two volume monography (about 900 pages) by F. R. McCoourt, J. J. M. Beenakker, W. E. Köhler, and I. Kuscer (cf. [53, 54]). This still is *the* standard publication on the physics of non-equilibrium phenomena in molecular gases. In addition to the articles in refereed journals

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listed below and many contributions to national and international conferences, Walter Köhler was co-author of three more books (cf. [32, 47, 48]). The last two are closely related to his teaching. Exercises and solutions to problems regularly handed out to students of theoretical physics are presented in the books.

I have many pleasant memories to our common time in Erlangen. Walter liked to tell humorous stories, he was an expert for railroads, was fond of playing table-football and cards with colleages. Most remarkable was his ability to play, by heart, entertaining music on the piano. I was most impressed shortly after I had met him about 35 years ago, when Walter, at a physics summer school, played all Italian opera arias which the Italian physists could sing.

Dr. Walter Köhler leaves his wife and a son, born in 1986. Colleagues and friends will keep fond memories of him.

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