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OBITUARY

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Obituary for Walter Glöckle

On August 1, 2012 the Few-Body physics community lost one of its most respected members, Walter Glöckle.

Walter Glöckle was born in Stuttgart, where he also studied physics at the University of Stuttgart (former Technical University). He graduated in 1964 and thereafter embarked on his doctoral studies at the Institute of Theoretical Physics of the University of Heidelberg. A year later Walter obtained his doctor's degree by presenting a thesis on "Analytical properties of the S-matrix in many-channel scattering". In 1966 he was offered a research assistant position in Heidelberg. In these years, his scientific activity concentrated on nuclear spectroscopy and on the shell-model approach to nuclear reactions. It was, however, also the time he first got interested in few-body physics, the field which later became his main focus of research. Starting from 1968 Walter spent two years in France as a visiting scientist at the Centre d'Etude Nucleaire in Saclay working on a new approach to the three-body problem. After returning to Heidelberg, he continued research along this line which resulted in 1972 in the habilitation for the Faculty of Physics and Astronomy of the University of

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Heidelberg with a work entitled "A new treatment of the quantum mechanical three-body problem". Immediately thereafter, Walter Glöckle was appointed Professor of Theoretical Physics at the Ruhr-University of Bochum. There he established his own research group and stayed in Bochum for the rest of his life.

Among the most visible of Walter's achievements are exact numerical solutions of the Faddeev equations for three-nucleon systems with realistic nucleon-nucleon and three-nucleon potentials. This effort was built up over many years starting with a breakthrough work carried out in collaboration with H. Witała in which, for the first time, numerical algorithms were developed and numerical solutions of the 3N continuum Faddeev equations with realistic nucleon-nucleon forces were obtained. Studies carried out within a larger collaboration (including but not limited to Th. Cornelius, J. Golak, D. Hüber, H. Kamada, A. Nogga, R. Skibiński, and H. Witała) covered three-nucleon bound states as well as nucleon-deuteron scattering, both below and above the breakup threshold, with and without three-body forces. These theoretical investigations had a great impact on the field of few-body physics and stimulated vigorous experimental activity which led to Walter's interactions with experimentalists from Cracow (Poland), PSI (Switzerland), Bochum, Bonn, Erlangen (Germany), TUNL (USA), RIKEN, RCNP, Kyushu (Japan), KVI (The Netherlands) and Bloomington (USA). These efforts, along with those of other groups, provided, for the first time, the quantitative justification that nuclear physics could be understood as a theory of nucleons interacting with two and three-body interactions motivated by meson-exchange. Calculations carried out by Walter and his collaborators enabled one to design experiments sensitive to specific features of the nuclear Hamiltonian such as the structure of the three-body force. Walter and his collaborators also participated in a number of benchmark calculations which provided crucial checks of these very complicated numerical calculations. Significant progress along these lines was reported at almost every few-body meeting. Many of the computational methods which are standard in the field of few-body physics were developed or refined by Walter and his collaborators. In this area, both Walter's book, "The Quantum Mechanical Few-Body Problem", and the review article "The three-nucleon continuum: Achievements, challenges and applications" by W. Glöckle, H. Witała, D. Hüber, H. Kamada and J. Golak, published in Physics Reports, are essential references for anyone who wants to perform realistic few-body calculations. They cover a wide selection of topics ranging from numerical solutions of large systems of singular integral equations to experimentally important information such as e.g. standard conventions used to define three-body polarization observables.

Over the years, Walter and his collaborators successfully applied these highly developed few-body methods to problems in hypernuclear physics (with K. Miyagawa, T. Mart, C. Bennhold, H. Yamamura, and J. Golak), systems of more than three particles (with A. Nogga, H. Kamada, B. Barrett and H. Witała) and few-nucleon electromagnetic reactions (with J. Golak, S. Ishikawa, H. Kamada, R. Skibiński, and H. Witała) leading to a fruitful collaboration with experimental groups from NIKHEF (The Netherlands), Mainz (Germany), MIT Bates, Jefferson Lab, TUNL (USA) and Lund (Sweden).

While Walter with his collaborators continued to push the envelope of what can be calculated using conventional partial-wave treatments of the Faddeev equations, he was well aware of the limitations of this approach and, therefore, actively explored new methods for future applications. In particular, he applied a complex energy method used in atomic physics to nuclear physics problems with the goal of having a better treatment of scattering boundary conditions in complex systems (with J. Golak, H. Kamada, Y. Koike, H. H. Oo, A. M. Phyu, H. Witała). He also pioneered the application of direct integration methods based on operator expansions to treat realistic bound and scattering states (with Ch. Elster, I. Fachruddin, J. Golak, T. Lin, H. Liu, A. Nogga, W. Schadow, R. Skibiński, K. Topolnicki, H. Witała). Walter also tried to overcome the limitations of the standard, nonrelativistic approach to the few-nucleon problem. Starting from his first work along these lines devoted to a perturbative construction of Poincaré generators on the nucleon space within a meson-nucleon field theory (with L. Müller), he explored a number of different relativistic formulations of the few-nucleon problem (with F. Coester, Ch. Elster, H. Kamada, A. Krüger, T. S. H. Lee, T. Lin, W. Polyzou, H. Witała et al.).

In the late 1990s Walter became interested in applying chiral effective field theory to describe low-energy nuclear dynamics in harmony with the symmetries of QCD (with E. Epelbaum, U.-G. Meißner et al.). Their work towards developing two- and three-nucleon forces in chiral effective field theory and incorporating them into Faddeev calculations brought interesting new insights and contributed considerably towards establishing this novel theoretical framework. After Walter's Physics Reports work, these are his most cited contributions.

This prolific research activity resulted in Walter's impressive record encompassing more than 300 scientific publications, which also led to official recognition of his scientific achievements. Walter served as a member of the Editorial Board of Few-Body Systems since 1990. In 1990, he was elected Fellow of the American Physical Society. During 1995–1996 he was Putnam Visiting Professor at the University of Ohio (Athens, Ohio), and in 1998 he was awarded an Alexander-von-Humboldt Honorary Research Fellowship by the Polish

Science Foundation. In 2003 he co-organized (with W. Tornow) the 17th International IUPAP Conference on Few-Body Problems in Physics (FB17, Durham, USA). In 2005 Walter was a Visiting Professor at the University of Connecticut. In 2006 he was elected by Polish-German Academic Society as a Guest Professor at Institute of Physics of Jagiellonian University in Cracow. In 2009 Walter was awarded a Medal "Plus ratio quam vis" by the Rector of Jagiellonian University for his very fruitful, 25-year-long collaboration with the Cracow group of few-body physicists.

Walter Glöckle was a very good teacher. One should especially mention in this connection his lectures on quantum theory which always enjoyed great popularity among students. His lucidly written monograph on "The Quantum-Mechanical Few-Body Problem" represents yet another important contribution to educating young researchers and is viewed as a standard textbook on few-body theory. Numerous students graduated successively under his guidance during the more than three decades that he served as a member of the Faculty for Physics and Astronomy of the Ruhr-University. He always gave students time to tackle problems in their own way, but never left them alone when the problems sometimes turned out too difficult. His students and collaborators greatly appreciated his style of working, his continuous inspiration and support as well as the open and creative atmosphere in his group. His great success was due to his superior ability and focus. In addition, Walter was able to enlist a large number of talented collaborators who were influenced and attracted by his vision, encouragement, and strong work ethic. His expertise and scientific leadership were unquestioned as witnessed, for example, by numerous invited review talks he gave at major international conferences and workshops in the field of few-body physics.

Walter always believed that political conditions should not be a barrier for a scientific collaboration. Already in the 1980s he collaborated with scientists from the other side of the Iron Curtain. More recently, he supported young physicists from Egypt and from Mandalay University in Myanmar.

Walter Glöckle was an outstanding physicist and a wonderful human being. It was always a great pleasure to work with him—as a student, scientist and colleague. His impact on few-body physics will not be forgotten and the example that he set is something we can all strive for.