Photograph by Ruth Bestgen

Obituary: Ferenc Niedermayer (1945 – 2018)

Ferenc Niedermayer was born on March 6, 1945, in Budapest. After obtaining a Master degree at Leningrad State University in 1968 — where he also met his wife Tamara — in 1971 he received his Ph.D. degree in particle physics at Eötvös University in Budapest. Following a stay at CERN in 1979, until 1986 he worked at the Joint Institute for Nuclear Research in Dubna and at the University of California in San Diego. Since 1989 he has been a member of the Institute for Theoretical Physics at the University of Bern, but he was also a regular visitor at the Max Planck Institute in Munich, where he spent large amounts of time.

During the early stages of his career, Ferenc worked on a variety of topics ranging from polarized lepton-hadron scattering to J/Ψ production in hadron-nucleus collisions and to neutrino oscillations. When he came to Bern, Ferenc had begun to work on lattice field theory. Over the years he obtained numerous important results, some of them in collaboration with his friends Janos Balog, Peter Hasenfratz, and Peter Weisz. Ferenc had a deep physical intuition and he was extremely talented in combining analytic and numerical methods, leading to highly nontrivial results that could not have been obtained otherwise. His analytic work stands out because of its high level of mathematical sophistication. For example, using the intricate Wiener-Hopf technique, together with Peter Hasenfratz and Michele Maggiore he derived the massgap of the 2-d $O(3)$ model from the conjectured exact S-matrix. While other people might have stopped at this point, Ferenc worried whether this "exact" result is in fact correct, i.e. whether it can be confirmed in a fully controlled nonperturbative regularization, as it is provided by a Euclidean space-time lattice. Indeed, using the very efficient Wolff cluster algorithm, the analytic result was soon confirmed with very high numerical accuracy. Cluster algorithms, to whose development Ferenc made important contributions, were a powerful tool in his numerical work. The exact massgap of the 2-d $O(3)$ model even had a large impact on the $(2+1)$-d undoped antiferromagnetic precursors of high-temperature superconductors. At low temperatures these materials undergo dimensional reduction to 2-d, which even led to an experimental confirmation of the analytic result.

Exceptionally high accuracy is indeed a recurring theme in Ferenc' research. After completing a 1-loop calculation, he would often work out the 2-loop corrections. His last papers with Peter Weisz on the finite-volume spectra of nonlinear σ-models follow this scheme very well. Peter once said: "We may be retired, but we are not tired." Ferenc generously shared his broad and deep knowledge of quantum field theory and his large experience with numerical simulation methods with numerous young students and postdocs. He was extremely patient in explaining complicated points, when he noticed that a student was having difficulties to understand. His positive questions and comments during seminars were very helpful and constructive, without undermining the speaker. In a project on the θ-vacuum effects in the 2-d $O(3)$ model he showed a beginning graduate student, Michael Bögli, how to numerically simulate at $\theta = \pi$ (which is highly nontrivial due to a sign problem) and to obtain the finite-volume mass gap with the very impressive numerical accuracy of four decimal places. After completing the numerical calculation, Ferenc asked Janos Balog to calculate the same quantity analytically, using the corresponding conjectured S-matrix. The observed agreement to all four significant figures shows not only that the "exact" S-matrix is indeed correct. It also shows that Ferenc was able to control both statistical and systematic errors at a level that goes way beyond the common standards of lattice field theory.

Together with Peter Hasenfratz, Ferenc has contributed tremendously to lattice QCD. Both were very good friends and very close collaborators, who thought along similar lines and who complemented each other very well. They could be so deep in their common thoughts, that in physics discussions they would sometimes switch from English to Hungarian without noting this themselves, until a third person would remind them that he could no longer follow. They would laugh in surprise and immediately switch back to make sure that everybody was again included. Ferenc and Peter developed the powerful concept of perfect lattice actions, which may lead to results that are completely free of lattice discretization artifacts. These actions work extremely well in the 2-d $O(3)$ model, and they also provide deep insights into lattice artifacts in gauge theories. Based on the by now famous Ginsparg-Wilson relation, together with Victor Laliena, Ferenc and Peter have rigorously established the Atiyah-Singer index theorem in a fully nonperturbative lattice framework. This provides a solid field theoretical basis for nonperturbative effects related to the axial anomaly, θ-vacua, or the Witten-Veneziano formula, which until then were understood only at a somewhat formal and not yet at a fully satisfactory constructive level.

Ferenc talked openly about his cancer. He always had a wonderful attitude towards work and life in general, and it was very inspiring to see how he spent his time. At the end of his life, when he knew that he had not much time left, together with his wife Ferenc went to Hungary to say good-bye to many old friends and colleagues. He died peacefully on August 12, 2018, a few days after their return to Bern. Many of his friends and colleagues, both from Switzerland and from Hungary, honored a great scientist and a wonderful man at his funeral. Ferenc was very proud of his family, of which he took very good care. He leaves behind his wife Tamara, and their sons Andras and Daniel, together with two grandchildren.

Ferenc was a very friendly, patient, and kind person, who contributed a lot to the pleasant atmosphere at the Institute for Theoretical Physics in Bern. At the weekly lunch seminars he was a source of deep knowledge about a broad spectrum of topics, way beyond his own expertise, if necessary, for example, even reaching out to molecular genetics. In physics discussions we are often reminded of him, because we refer to his many important results. We miss him, especially when high numerical accuracy and deep analytic insights need to go hand in hand, and simply because it was very nice to be together with him.