TRIBUTE

Emil Wolf: 'A Scientist and Friend Like No Other'

A student of the noted physicist counts up some of his mentor's contributions to science and to his colleagues.

1 Emil Wolf, the former Wilson Professor of Optical Physics, a faculty member in the University's Institute of Optics and the Department of Physics and Astronomy, died in June at the age of 95. He is survived by his children, Bruno and Paula, and his beloved wife, Marlies. He was decorated with numerous prestigious national and international awards, honorary degrees, and appointments. He was my mentor and my friend and my measuring stick for what is good and what is decent.

2 He was a refugee. When the Nazis invaded Czechoslovakia in 1939, Emil's brother, Karel, joined the Czech army. Emil was too young for the army and their parents sent him to Italy in hopes that he could somehow get to France or England. Trading valuable stamps his father had collected, Emil made his way from Prague to the Italian coast and then illegally into France by boat. Once in Paris, he found work with the Czech government in exile with whom he evacuated to Britain when Paris fell. There he completed high school, attended Bristol University, and eventually earned his PhD. None of his extended family survived the Holocaust except Karel and one cousin who both settled in Canada.

In England, Emil came to be friends with future Nobel laureate and Hungarian refugee Dennis Gabor. Certainly Gabor recognized Emil's genius, but in Emil's recollection, it was simply good fortune, "I was very lucky, at these meetings, I got to know Gabor." Gabor introduced him to another future laureate, Max Born, who had himself left the rising virulent xenophobia and religious bigotry in 1930s Germany. Born and Wolf, as the duo would be known, went on to write what is now the single most cited book in physics, *Principles of Optics*. Of Born, Emil said, "It was a wonderful collaboration. He was a remarkable person and I feel extremely fortunate that I was able to work with him. Not only as a scientist. He was a wonderful human being." He also met his closest friend and collaborator, Len Mandel. There, in the smoking wreckage of postwar England, a country trying to rebuild and resurrect itself welcomed people fleeing the very worst that man can do to man and by chance gave refuge to some of the greatest minds of 20th-century physics.

UNIFYING SPIRIT: Wolf is credited with providing the first unified framework for describing the observable, measurable properties of light, work now known as the Wolf equations.

3 In 1958, Robert Hopkins, then director of the institute, traveled to England for a conference and to meet with Emil. The meeting nearly didn't happen. The letter from Hopkins got misfiled by a secretary and was only discovered by Emil as he was searching for another misfiled document. "It was all a matter of luck, particularly that phone call in Paris at three in the morning saying to get on the lorry, the truck. . . . It just shows you how much luck there is in life. First to get out of Paris and then to get to America." Of course the meeting did happen and Emil came to the institute and shortly thereafter joined the physics department. He recruited his friend Mandel and then the two of them brought in a bright young talent named Joseph Eberly, and the modern face of optics and optical physics at Rochester was shaped. All a matter of luck.

4 Among the graduate students in the 1990s, Emil was viewed with a sort of awe, in the way that small children might believe that adults who can drive a car must posses magical superpowers. Those who could muster the courage to attend office hours or otherwise engage him beyond the classroom were rewarded with the experience of spending time with one of the

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most generous, kind, and open people you could hope to meet. I was fortunate to join his group in 1995. He took me aside and explained that he was then 72 years old and that while any advisor could die at any time, the odds of him surviving to the end of my thesis were worse than for younger advisors. I shouldn't worry though: he had arranged with a recent graduate of his group, Dr. Daniel James, that if he should die before I could defend, Daniel would supervise the rest of the thesis. Emil was the sort of man who stared down into the abyss of the great inevitability and came away making contingency plans for his students.

He was deeply committed to the welfare of his students and to equality and justice. While he could occasionally get himself flustered by some new process or technology in the way that academics of a certain age are allowed to do, I only ever saw him truly angry when he thought a student had been treated unfairly because of race or creed or gender or orientation. Maybe it was his own history, or maybe it was built in, or maybe it was the output of a clear moral compass processed through one of the greatest intellects on the planet, but he would have none of it. Emil took people one at a time and accepted them on their merits. He would not brook anything else in his sphere of influence as long as he could do something about it.

5 In 1865, J. C. Maxwell presented the first unified field theory in physics, uniting electricity and magnetism, and in the process explained light as fundamentally an electromagnetic phenomenon. But in as much as the physics of a ball rolling down an inclined plane fails to explain why water boils the way it does, Maxwell's theory failed to satisfactorily explain the observed behavior of light. Various statistical theories of light were thrust forward with sometimes overlapping and sometimes disjoint realms of validity. In 1954, Emil published the first of a long series of papers on the statistical nature of light, introduced the double wave equations, the Wolf equations, and provided a unified framework for the panoply of quantities describing the observable, measurable properties of light. As Peter Milonni so aptly described in 2012, modern classical coherence theory seems almost trivial. It only does so because Emil's brilliant foundation makes it all so clear. Before Emil, there was just chaos, and now there are the Wolf equations.

6 He was a scientist of the highest caliber, but more importantly to those of us who knew and loved him, he was a friend like no other. My favorite picture of him was taken with the late Len Mandel, on vacation, sitting at the beach together, notebooks out and contemplating together the deep mysteries of the universe. While I'm sure the science was important to him, I'm also sure it was just as important to be working with his friend. Friendships with Emil were for life. Anyone who collaborated with him eventually had the experience of a real barn burner of an argument at the blackboard, only to be followed by having him take your arm and lead you away for a coffee break saying, "Well, that's OK, we're still friends after all." And we were. And that was all that really mattered.

7 Of my own time with Emil, all I can manage is to borrow: it was a wonderful collaboration. He was a remarkable person, and I feel extremely fortunate that I was able to work with him. Not only as a scientist. He was a wonderful human being. ®

—SCOTT CARNEY '99 (PHD)

Carney is director of the Institute of Optics.

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