
Demetrios Christodoulou

Dr. Demetrios Christodoulou received his PhD in physics from Princeton University in 1971 under the supervision of John Archibald Wheeler. After temporary positions at Caltech, CERN, and the Max Planck Institute for Physics, he became Professor of Mathematics, first at Syracuse University, then at the Courant Institute, and at Princeton University, before taking up his last position as Professor of Mathematics and Physics at the ETH Zurich in Switzerland. He is an Emeritus Professor since January 2017. He works on hyperbolic partial differential equations and general relativity.

Christodoulou was rewarded Otto Hahn Medal in 1981, MacArthur Fellows Award in 1993, Bôcher Memorial Prize in 1999, Tomalla Foundation Prize in 2008 and Shaw Prize in 2011. He is a member of the American Academy of Arts and Sciences and of the National Academy of Sciences. In 2014 he was a plenary speaker at the International Congress of Mathematicians in Seoul. Since 2016 he is also a member of the Academia Europaea.

Reminiscences of Yau

I first met Yau in September 1981. I had arrived in New York from Germany a few days earlier for what turned out to be a 2-year visiting membership at the Courant Institute. I knew the Princeton area well because I had been a Ph.D. student in physics in the period 1968–1971, so I looked for housing there, the plan being to commute by train to New York. I sought people at the University and at the Institute and Yau was one of the first people I met. I knew of his theorem with Ric Schoen on the positivity of mass in general relativity, but had not gone through it in any depth. While I had a Ph.D. in physics since 1971, I had only started studying mathematics in 1977, and my working mathematical knowledge at that point was limited to the field of analysis. I had no working

knowledge of geometry. Yau's directness of character and his hands on approach to mathematical problems, cutting through formalities to get to the heart of the matter, won me over from the beginning. He was giving a course on minimal surface theory and applications, in particular the application in the proof of the positive mass theorem, a course which continued for the next academic year. So I decided to stay most of each week at Princeton, follow his course, and learn as much as I could from him.

In September 1983 I accepted an associate professorship in physics at Syracuse University. However this did not an end to my apprenticeship with Yau, because Yau secured a visiting membership for me at the Institute for Advanced Study for the academic year 1983–1984. So I arranged my classes at Syracuse for the first part of each week, and Wednesday evenings I would fly to Newark and from there take the bus to Princeton and on Sunday evenings fly back to Syracuse.

From Yau I learned how to combine geometric and analytic methods into what was later named “geometric analysis”. Although Yau had predecessors in this way of mathematical thinking, he was the first to bring it to full fruition in contemporary mathematics. Looking back, I can say that my own chief contribution has been in extending the area of application of geometric analysis to the field of hyperbolic partial differential equations.

The years when Yau was at the Institute in Princeton were unforgettable. His office was the center of mathematical activity. Several distinguished mathematicians, like Eugenio Calabi, Leon Simon, Karen Uhlenbeck, Ric Schoen, and others, would come in to discuss and Yau was full of ideas and boundless energy. His office was very well stocked with fine Chinese liquor, which he would not touch, but the visitors were free to help themselves, with the effect of becoming quite tipsy on some occasions. In the spring of 1984 his family had already moved to California. I recall working with him in his office late into the



Figure 1.

night. At about 1 AM he would pick up the phone and would start singing what to me sounded like opera. I found this quite puzzling at first, but as it turned out he was singing lullabies to his children who were going to sleep at that time, 10 PM in California.

In the summer of 1984 Yau moved to the University of California at San Diego. I visited him there soon after he moved, and then again in the summer of 1985. In the fall of 1985 he paid a visit to me at Syracuse (see Figure 1). By the end of 1984 I had assimilated the way of thinking of geometric analysis which I learned from Yau, and I was ready to tackle, in collaboration with Sergiu Klainerman, the problem of the global nonlinear stability of the Minkowski space-time. In the spring of 1985 I had become professor of mathematics at Syracuse. Starting in January and up to the end of August 1986 I was with Yau at San Diego, on leave from Syracuse. This was another very

exciting period, in some ways even richer than the Institute period. Richard Hamilton was already in San Diego and Ric Schoen followed. Many mathematicians visited during this period. Besides Leon Simon, Karen Uhlenbeck and Gerhard Huisken, also Tai-Ping Liu and Tom Sideris in fluid mechanics, and many others, essentially anybody with a worthy contribution in differential geometry or partial differential equations was a visitor during this period. Many important problems, like the Yamabe problem were solved then, and many important projects, like my own work with Klainerman on the stability of Minkowski, or even the Hamilton-Perelman proof of the Poincaré conjecture, which were brought to fruition years later, were fleshed out during this period. At this point in time San Diego was the world center for mathematics. And everybody enjoyed it tremendously. Yau had a big house near the ocean and I was a guest there on sev-



Figure 2.

eral occasions. I recall the great dinners at Chinese restaurants with everybody at the round table and the lively discussions.

But this euphoria was not to last. In the fall of 1986 things fell apart and most people, including Yau himself, left. Hamilton stayed on for a few more years, but eventually also he left for Columbia. After a brief sojourn at the University of Texas at Austin, Yau settled at Harvard. Life moved on for me as well. In the beginning of 1988 I became professor of mathematics at Courant, in the summer of 1992 the same at Princeton, and in the fall of 2001, I returned to Europe as professor of mathematics and physics at ETH in Zurich, where I stayed until my retirement in January 2017.

From this later period I recall three memorable visits to Harvard to see Yau, in October 2006, in September 2008 in anticipation of his 60th birthday, and in the fall of 2010, when I was on leave to Harvard for the whole semester. Thanks to Yau I established a cherished connection with China. I made month-long visits in the spring of 2009 and 2011, a week-

long visit to Hong Kong in September 2011, another month-long visit to China in the spring of 2013, and a 3-week visit to the mathematical conference center in Hainan, December 2015 to January 2016, where I participated in the Riemann 150th memorial conference as well as the general relativity 100th anniversary conference. I took in from China two brilliant Ph.D. students, Shuang Miao, who is starting as professor of mathematics in Wuhan University this January, and Pengyu Le, who is now a postdoctoral fellow at the University of Michigan. I also made a lasting friendship with Pin Yu, whom I first met through Yau at Harvard in 2010 and is now a professor of mathematics at Tsinghua University.

I was very happy and honored that Yau came to my retirement conference in Zurich in July 2017 (see Figure 2). I have learned more mathematics from him than from anybody else, as I learned from him the way of thinking which combines analysis and geometry. Most remarkable is his boundless energy, which continues to this day unabated.