K. Ramachandra: reminiscences
by
Michel Waldschmidt

I was thrilled when I received a letter from Ramachandra around 1974, who invited me to spend some months at the Tata Institute of Bombay and give a course on transcendental numbers. When I was young it was my dream to visit India, and I did not expect that I would have such an opportunity. I knew very well his paper [1] *Contributions to the theory of transcendental numbers* published in Acta Arithmetica in 1968: this was the main reference of my thesis, submitted in 1972. I was able to pursue his work in several directions, including algebraic groups. My first attempt to prove a new result was motivated by one of his problems which is now called the four exponentials conjecture, which had been proposed independently by S. Lang and Th. Schneider. This has been the problem on which I have spent most of my efforts during all my mathematical life, and it is still open. I believed a couple of times that I had a solution, especially in 1970; it turned out that there was a gap in my argument, but that I could nevertheless get something new: instead of solving the four exponentials conjecture, which is the first open problem proposed by Th. Schneider in his book, I could solve the 8th of these problem, on the transcendence of one at least of the two numbers e^e and e^{e^2}. As a matter of fact, the same solution was found at the same time and independently by W.D. Brownawell. For this result, we shared the Distinguished Award of the Hardy-Ramanujan Society which was attributed to both of us by Ramachandra in 1986.

When I received the invitation of Ramachandra, I decided to accept it and to go to India with my wife. However, shortly afterwards, she became pregnant, so I postponed this visit and came alone, after the birth of my son Alexis in May 1976. I visited TIFR from the end of October to end of December 1976. It was not easy for me to quit my young son for such a long time at his early age. My stay in India has been an unforgettable experience for me. I loved it immediately, even if it took me some time before I could adjust to the food.

My lectures were on *transcendental numbers and group varieties*. Since I was going to deliver lectures on that topic at Collège de France (*cours Peccot*) a few months later, I used this opportunity to polish my presentation. The precise topic was a development of Ramachandra's work with applications to commutative algebraic groups. These notes were going to be published in Astérisque in 1979. I did not know that Ramachandra had shifted his interest from transcendental number theory to the Riemann zeta function two year earlier (so I had no influence on this shift!); and, most of all, I did not know that he was disliking commutative groups as much as he loved numbers. To mix both was not the best thing to do to please him, but I was innocent. My TIFR course was supposed to be published by the Tata Institute, a research student of Ramachandra was supposed to write it down. I left him the notes (it was not that easy at that time to make xerox copies), but the course was never written down, my notes got lost and I had to reconstruct them form scratch.

This was my first experience of spending some time in a non–French speaking country, and my English was quite poor. To spend two months like this was very efficient from this point of view, and since Ramachandra was among the people with whom I spoke often, I made progress during this stay to understand him better. Later, it happend quite a few times that I was with an English speaking mathematician, from UK or USA, and I served as a translator, repeating with my French accent what Ramachandra said with his Indian accent, and it was helpful for the concerned colleague!

I met Ramachandra again in 1979 in Kingston at Queen's University where we participated in a conference on recent developments in number theory, organized by P. Ribenboim, where I was with my family. I also met him later, in July 1987, again in Canada, during an International number theory conference held at Université Laval organized by Jean–Marie De Koninck and Claude Levesque.

My second trip to India was in 1985. A conference in honor of Bambah was scheduled in Chandigarh. My trip was supported by an agreement between the two Academy of Sciences of India and France; I already had my ticket when the conference was postponed for security reasons. Nevertheless I was allowed by the two academies to maintain the project and I first visited Bombay. In Bombay I was invited by Ramachandra, at his apartment and in the evening at the Tanjore restaurant of the Taj Mahal. I also went to Madras and visited *Matscience* (which became later *IMSc - Institute of Mathematical Sciences*), and on my way back I visited Delhi.

I came back in 1987 for the centenary of Ramanujan, and I could participate to a conference in Annamalai University (next to Chidambaram in Tamil Nadu), and this was the opportunity for my first trip to Kumbakonam. I visited the home town of Ramanujan three more times later (December of 2007, 2008 and 2009) when I was in the selection committee of the Ramanujan SASTRA Prize.

This visit in 1987 gave me the opportunity to organize my next visit, one year later, with my family. I had been invited by Alf van der Poorten to spend two months (July and August 1987) in Australia. The advantage of my trip to the southern hemisphere was that it was giving us the opportunity to visit India on the way back. This visit to India for my family was threatened at the last minute (at the airport of Sydney, just before boarding for Bombay) for a question of visa, but fortunately we could make it. With my wife Anne, my son Alexis who was just 12, and my daughter Hélène who was 10, we arrived in Bombay on August 20, 1988, we went to Madras on 22, we visited Pondicherry from 23 to 25, and came back to France on 28. This was a tight schedule, but this has been an unforgetable experience, one of the high points in my life as well as in the life of my children (my daughter Hélène came back on her own to India in 2000 and in 2001). In Bombay we stayed at the Tata Institute. We were invited by Ramachandra, who took us to the Prince of Wales Museum and was our guide. My children were to remember that he had a pink shirt during that visit: this is not common for us that a man would wear a shirt of that color.

After that I was to come back on a regular basis to India, on the average

more than once a year, and I met Ramachandra very often. I was there for the two major conferences which were organized for his birthdays, the sixtieth in July 1993 (organized by R. Balasubramanian in Madras) and the seventieth in 2003 (organized by K. Srinivas in Bangalore). I wrote a survey based on Ramachandra's paper [1]. This survey was completed after the first conference and published after the second one [2]. In December 2003, during this conference, I visited Ramachandra's office at NIAS. It was almost empty. Only a picture of G.H. Hardy and a picture of S. Ramanujan were on the wall, to whom he was deeply devoted. He told me that once a year, he had to leave his office which was used by other people for a few days, so he could not keep anything personal there.

I have a specially fond and very moving memory of our meetings in Bangalore in early 2005 (end of January – beginning of February). I was the representative of CIMPA for the school on *Security of computer systems and networks*, organized at the Indian Institute of Science by K. Gopinath. This was only four months after my daughter passed away, and Ramachandra found the right words to speak with me. He also gave me his personal reminiscences. He told me the difficulties he had during his own life. He spoke of his brother and his nephews. He mentioned that his father passed away while he was only 13, that he needed to take care of his family, and that he was fully dedicated to mathematics - this much I already knew! He told me how difficult it has been for him to take certain decisions, like that of moving from one place to another. And, of course, we shared our concerns as fathers who care about their daughters. This is certainly one reason why I had the feeling to be so close to him, and I did my best to meet him as often as possible. I stayed in India two months in December 2009 - January 2010. I was ready to go from Chennai to Bangalore in December, 2009 to visit Ramachandra, but Kishor Bhat, who was taking care of the arrangement, told me that the daughter of Ramachandra had to go to the hospital and he suggested me to postpone my visit, which I did. So this visit took place in January 2010, and this was to be our last meeting. At that time he gave me some money for P. Philippon, to whom he attributed the Hardy–Ramanujan award. When I told this to Philippon he was grateful and suggested that the money go to an orphanage, which I could do immediately thanks to Prem Prakash in Chennai.

I came back to India for ICM2010 in Hyderabad in August 2010 and for a satellite conference just after in Chennai, I was in transit in Bangalore on the way, but my schedule was too tight and I did not visit him that time - I missed an opportunity.

It has been a great privilege for me to know Ramachandra. I never met anyone else who would be so dedicated to mathematics. I also knew him on a more personal basis. I admire him, he was truly exceptional. I miss him.

Michel Waldschmidt, May 9, 2011.

This text is an abstract of a Colloquium talk given at TIFR CAM Bangalore on April 26, 2011, at the invitation of C.S. Aravinda. The author is thankful to C.S. Aravinda for this invitation, to K. Sandeep who took care of the organisation, to Kishor Bhat and K. Srinivas who made possible a visit the same day to Mrs Ramachandra.

The colloquium talk included also a mathematical discussion concerning Ramachandra's contributions to transcendental number theory. The pdf file of the talk is available on the web site of the author. The main reference is

[1] RAMACHANDRA, K. – *Contributions to the theory of transcendental numbers* (I); Acta Arith., **14** (1968), 65–72; (II), id., 73–88.
http://matwbn.icm.edu.pl/tresc.php?wyd=6& tom=14

A description of this work is given in

[2] WALDSCHMIDT, M. – *On Ramachandra's contributions to transcendental number theory;* Ramanujan Mathematical Society, Lecture Notes Series Number 2, *The Riemann Zeta function and related themes: papers in honour of Professor K. Ramachandra*, Proceedings of International Conference held at National Institute of Advanced Studies, Bangalore 13-15 December, 2003 Ed. R. Balasubramanian, K. Srinivas (2006), 155–179.
http://www.math.jussieu.fr/∼miw/articles/ps/ramachandra.ps

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