

Biography

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Arrowtic K -Theory

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He was not like this always. He used to think everyone around him was smarter than him. His perception of this kind changed. He touts his slogan "We do algebra without apology". If and when he gets stuck with some written mathematics, he mutters that the author is so confused.

It was in his ninth grade. He thought he answered the question correctly. He wrote that $2^x \cdot 2^y = 2^z$ implies that $2^{x+y} = 2^z$. Since the base is equal, $x + y = z$. Bagchi-babu marked it wrong and gave zero for this problem. He explained the same to him again. Bagchi-babu acknowledged and gave him full credit, without adding any further encouragement. No one else in the class had any clue what this problem was about. He had faint hope that he may have been the best in math, in the class. However, there was no such hint from the teachers. At undergraduate level, Professor Ram Ghosh said even Satya seems to have done well in the exam. That did not aid to his faint hope. By the time he joined his master program in Indian Statistical Institute (ISI), he was ready and eager to learn mathematics. His confidence and eagerness was boiling when he joined ISI. B. V. Rao started his course on measure theory, by introducing the index function I_A of a set A . He said $I_A(x) = 1$ if x is in A , otherwise $I_A(x) = 0$. Satya was stunned by the beauty and thought "I can do it". When Amiya Mukherjee defined the connecting homomorphism of the homologies for short exact sequences of complexes, he thought, this was so natural. He was oblivious that this was, perhaps, not that natural to all, and he failed to appreciate the depth of what Amiya-babu introduced. By the end of the Master program (M. Stat) he understood the enormity of mathematics and felt intimidated. He joined the PhD program at ISI and started working on Descriptive Set Theory with Professor Ashok Maitra. Ashok Maitra was a legendary figure in ISI. He made Satya read the book of Kuratowski and then the book of Kuratowski and Mostowski. He read them both.

He was not thinking of moving. Then he moved to Tata Institute (TIFR) next year (1978). The stunning view of the Arabian Sea from anywhere in the Institute campus dazzled him and his friends, during the interview trip. After much hesitation, and encouragement from Ashok Maitra, he purchased a train ticket to Bombay, for sixty two rupees.

His sister came to the Jamshedpur railway station to see him, and gave him some Kalakhand (sweets). Upon arrival in Tata Institute, he was pleasantly surprised to learn that he would have a hostel room all for himself. There was even a wash basin in the room. There was plenty of food in two canteens (West and East). All that one was left to do was to look at the Arabian sea and do mathematics all day (and night). The towering presence of M. S. Raghunathan (MSR) in the institute was felt on the first day. MSR tricked him to respond in negative to his question whether he was excited with math or not. Next question was, then why you do it? He responded that he could not find anything more interesting to do.

First year in Tata was spent on routine course work on Algebra, Analysis and Topology. In the second year, he invested good amount of time in Algebraic Topology. He also explored other areas of mathematics. Beginning of third year, he decided to work on Algebra. The landing felt effortless due to the two semester dense courses in Algebra that were taught by Sridharan and Balwant Singh. In the Fall semester of third year he read some basic commutative algebra (Matsumura, J. P, Serre). In late Fall, he approached Amit Roy for his guidance. Amit Roy gave him the paper of Daniel Quillen on projective modules and some related papers. Soon enough Amit Roy suggested a problem. Satya knew that it was a solve it or perish situation. He got the complete solution in eighteen days. He submitted first paper before the end of spring semester, in third year (March 9, 1981). Satya himself proposed a complete intersection problem for ideals in polynomial rings, with a monic polynomial in it. Problem attracted some active attention from other researchers. In his third paper he settled this problem completely, and the paper appeared in *Inventiones Mathematicae* (*Invent. math.* 75, 59-67 (1984)). However, he was unsure if his position in Tata Institute was any more secure than before. He took the dismissive look from the faculty more seriously than his publications. In the meanwhile, Amit Roy left for USA.

Shekhar Cowsik kindly guided him to look for opportunities. Earnst Kunz offered him a postdoctoral position in Universität Regensburg. Satya had dreams, but he did not dream that such an opportunity would come in his way. Going to the West was considered a symbol of success in India, and its financial value was a fortune. Those were the days of Indian Rupees and Deutsch Mark. Kunz was writing his book on Kähler Differentials and was giving a course on the same. He learned the same. He also wrote a paper in Regensburg. However, visit to Regensburg was a lonely experience, in spite of good friends like Helmut Knebl and others. After return from Regensburg, he continued to be productive. One of the constant theme, in his early career, was complete intersection problems for ideals in polynomial rings, with a monic polynomial in it. In 1987, he visited MSRI, Berkeley with a post doctoral job. By then he understood the fortune of earning in US dollars. He thought he will try his luck for a Tenure Track job in US. His sense of insecurity in Tata Institute, was an obvious inducement. He joined University of Kansas (KU) in 1988.

He spent a good part of his tenure in KU working on the obstruction theory problems for splitting projective modules, proposed by Madhav V. Nori (1989). He was mostly influence by the Homotopy obstruction problem of Nori. He made the first break through on this problem, within about ten days after Nori stated the problem to him. He also settled the

problem in the local case (essentially smooth). Soon enough, Satya saw this problem as a program on obstruction theory for splitting projective modules. Such thoughts became further enriched and substantial when Berge and Morel (2000) provided an alternative approach to such obstruction theory. The approach of Nori and Satya's methods are ideal theoretic (classical bricks and mortar) , while Berge-Morel approach was more K-theoretic (or category theoretical and non classical). Satya thought these two approaches must converge to each other. Satya established Homotopy obstruction problem of Nori into a complete obstruction theory, by proving that Homotopy obstructions detect splitting of projective modules (under reasonable conditions). He also established its relationship with Berge-Morel obstructions. It remains to be seen if Berge-Morel obstructions detect splitting.

While his prior research interest have been Classical K -theory and projective modules, starting from 2015 he is mostly focussed in Quillen (Higher) K -theory. His publication in Quillen K -theory includes his recent book, which has been very well received.

He published about fifty papers and books, including two books. His book on projective modules was published early in his career (1987). His recent book on Algebraic K-Theory (2023) is a must read for any K-Theory student. His books are written with the intent to reach out to a wider readership.