

K. Chandrasekharan (1920–2017)

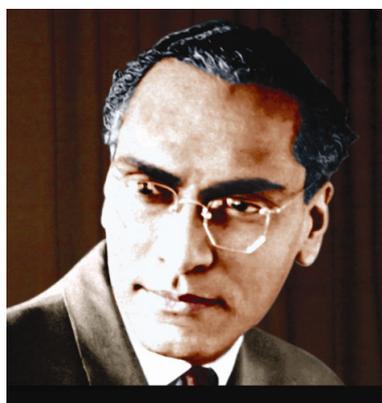
Komaravolu Chandrasekharan (KC) went to high school in Bapatla in present-day Andhra Pradesh. He obtained his M A in mathematics from the Presidency College, Madras (now Chennai) and his Ph D degree in 1942 from the University of Madras under the supervision of K. Ananda Rau, a contemporary of Srinivasa Ramanujan who was also associated with G. H. Hardy. At that time there was a lively group of mathematicians in Madras. Apart from KC and Ananda Rau, this included R. Vaidyanathaswamy, Fr. Racine, T. Vijayaraghavan, S. Minakshisundaram and K. G. Ramanathan. During the period 1940–1946, KC was associated with Madras University, first as a research scholar and then as a lecturer. In 1946, he went to the Institute for Advanced Studies, Princeton, USA. During his three-year stay at the Institute, he came into close contact with famous mathematicians like Hermann Weyl, S. Bochner, John von Neumann and C. L. Siegel (KC was assistant to Weyl). His view and approach to mathematics were influenced by them and he became aware how training and research in mathematics at a high level were organized in Germany and USA. He collaborated with Bochner on harmonic analysis; they co-wrote a well-known book on Fourier transforms. During this period, he also established contact with a large number of eminent mathematicians from all over the world.

All this was crucial when KC joined the Tata Institute of Fundamental Research (TIFR), Bombay/now Mumbai in 1949, at the invitation of Homi Bhabha, and started setting up the School of Mathematics at the institute. He was then just 29 years old. In 1965, KC left TIFR for ETH, Zurich, Switzerland.

In the span of 15 years, KC set up an institution in India which was soon recognized internationally as a leading centre of research in mathematics. His extraordinary gift for organization and administration, his leadership qualities, and his complete devotion to mathematics made this possible.

At that time (1949), there was no dearth of young Indians fascinated by mathematics, but they were ‘without proper training and foundations’. There was no mechanism to channel their talents into creative research. There was no

expertise in the country in many important fields of modern mathematics. In order to introduce young Indian students to these fields, KC invited the foremost experts from abroad to give structured courses at TIFR. (These visits were made possible by his personal contacts.) Students were exposed to the latest developments in various fields of mathematics and had personal contact with famous mathematicians. Students also wrote up the lecture notes and these were published in the famous *TIFR Lecture Notes Series in Mathematics*, edited by KC. (In those days there was no tradition of graduate courses in India.)



At that time France was the main centre of mathematics, in the sense that most of the fundamental and deep developments in mathematics came from French mathematicians. Accordingly, KC invited several famous French mathematicians to visit and give courses on these developments. The constant stream of French (and German) mathematicians visiting TIFR, a fortunate influx of brilliant young Indian students, and the leadership of KC resulted, in a few years, in the formation in TIFR of a group of first-rate mathematicians working in the areas of algebraic geometry, differential geometry, complex analysis, Lie groups, number theory and algebra. Many of the outstanding contributions made by Indian mathematicians in the fifties and sixties can be traced to interactions with mathematicians from France and Germany visiting TIFR.

The following quotations testify to the achievements of the School of Mathematics in TIFR, which was created by KC.

Homi Bhabha: ‘The School of Mathematics has established an international reputation for itself through outstanding contributions which its members have made to various branches of mathematics’ (1962).

Laurent Schwartz: ‘I consider that (the School of Mathematics of) Tata Institute is a remarkable achievement and is without parallel in any other country’ (1971).

André Weil, who had written an article in 1936 on the state of mathematics then in India, wrote in 1979: ‘Since then, as one knows, this has greatly changed due to the creation of Tata Institute of Fundamental Research in Bombay.’

KC also established an excellent library of mathematics in TIFR. There was a large collection of books and journals, including back volumes. For example, TIFR had the complete set of *Mathematische Annalen* beginning with vol. 1. As another example, the Library contained copies of the *Cartan Seminars* which gave expositions of the deep mathematics being done in France. It was not an easy matter to obtain these. The access to such a vast classical and current mathematical literature, like the *Cartan Seminars* and the notes of the Bourbaki seminars, played an important role in the work of mathematicians in TIFR.

KC also organized summer schools intended for teachers and research students and the notes of the lectures given in these schools were published in a new series titled *Mathematical Pamphlets*. He wrote in the Editorial Note: ‘This series of Mathematical Pamphlets is issued in response to a widespread demand from university teachers and research students in India who want to acquire a knowledge of some of those branches of mathematics which are not part of the curricula for ordinary university degrees.’

Starting from 1956, KC organized the meticulously planned, high-level International Colloquia in Mathematics at TIFR, once in four years. These conferences became well known and were later co-sponsored by the International Mathematical Union (IMU). Their role in the initial years was two-fold, I think: to give an opportunity to graduate students at TIFR, who were basically isolated at that time, to interact with experts from abroad, and also to make TIFR visible to

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the international mathematical community.

His major mathematical contributions have been to the fields of Number theory and Analysis. I will just mention two of his important contributions to Number Theory.

- (1) He studied (with Bochner) the number of linearly independent solutions of a pair of Dirichlet series satisfying a Riemann-type functional equation, generalizing the well-known theorem of Hamburger on the solution of Riemann's functional equation for the Riemann zeta function.
- (2) In a much-cited paper he obtained (with Raghavan Narasimhan) a far-reaching generalization of the well-known approximate functional equation for the Riemann zeta function, due to Hardy and Littlewood. In particular, they obtained an approximate functional equation for the Dedekind zeta function of an algebraic number field.

KC authored several books (in which the exposition is elegant and precise): *Fourier Transforms* (with S. Bochner), *Typical Means* (with S. Minakshisundaram),

Classical Fourier Transforms, Introduction to Analytic Number Theory, Arithmetical Functions, Elliptic Functions, A Course on Topological Groups, A Course on Integration Theory and Lectures on the Riemann Zeta Function.

He was closely associated with international organizations of science. He played a major role in International Mathematical Union (IMU) during his long association with this organization: he was President of IMU (1971–74), Secretary (1961–66) and earlier a member of the Executive Committee of IMU. The initiatives he took in IMU were numerous and much valued.

KC was Vice-President of the International Council of Scientific Unions (ICSU) during 1963–66 and Secretary-General of ICSU during 1966–70.

His greatest legacy was the setting-up of a world-class institution which transformed the mathematical landscape of India. Several Indian mathematicians of my generation are indebted to KC for his guidance and above all, for creating an ambiance in TIFR for pursuing mathematical research at a high level.

I had the good fortune to know KC well. In addition to mathematics, he

taught me the art of administration both by example and (on occasions) advice. I learnt above all that it is the duty of established mathematicians to mentor younger ones and help them in their careers.

In one of the books he presented to me, KC inscribed a quotation from Tagore: 'I slept and dreamt that Life was joy. I awoke and saw that Life was duty. I acted and behold, Duty was joy'. This serves as an apt epitaph for this great Indian.

For his contributions KC was awarded the S.S. Bhatnagar Award (1963) and the Ramanujan Medal (1966). He was elected to the Fellowship of the Indian National Science Academy (New Delhi) in 1954 and the Indian Academy of Sciences (Bengaluru) in 1959.

He leaves behind his wife (Sarada) and two sons.

M. S. NARASIMHAN

*No. 9, Guruparadise Apartments,
24, 4th Main Road,
Amarjyothi Layout, Sanjaynagar,
Bengaluru 560 094, India
e-mail: narasim@math.tifrbng.res.in*