

In this issue

Harish-Chandra

We publish in this issue a special section on Harish-Chandra – one of the greatest mathematicians India has produced in recent times. It consists of the memorial speech made in 1984 by V. S. Varadarajan, Harish-Chandra's 'spiritual student' (page 918); a biographical memoir by the Princeton mathematician R. P. Langlands (page 922); some recollections of Harish-Chandra by his friend, the brilliant Armand Borel (page 919) and another entitled 'My Father' by Premi Chandra (page 921) – the latter two being talks given when Harish-Chandra's bust was unveiled in Allahabad this year; a paper by N. Mukunda (page 936) and two brief papers by Harish-Chandra himself – papers he wrote in the beginning and at the end of his career.

I knew Harish-Chandra but not too well. I shall mention in this rather disjointed account a few incidents I know of (which are not too well known) and give a string of statements made by him and his colleagues to present a picture of this man of remarkable achievement and one whom I admired greatly.

In the summer of 1943, a tall, thin, strikingly handsome young man, immaculately dressed in western clothes met me in front of the main building of the Indian Institute of Science and asked me where Sir C. V. Raman's office was. This was my first encounter with Harish. The story of how he secured 100% marks in his theory paper in M Sc, when Raman was his examiner is well known. But not so well known is that when this young man of 19 came to Bangalore to do research at the Institute, Raman actually received him at the Railway Station; further Raman had advised him earlier that instead of working with him (as Harish-Chandra had desired) he should rather work with Homi Bhabha who at that time was Reader

in Physics (see Mukunda's article). Harish-Chandra lodged with the Kales. Kale was the librarian at the Institute with *élan* and much *joie de vivre*; both husband and wife were also teachers of French and German language. Their little daughter, Lily – charming, mischievous and fun-loving – the heart-throb of all the youth in the vicinity and afar was also there. I have often seen Harish going on walks with Raman – a most incongruous sight; Raman walking bear-style talking loudly and roaring with laughter while Harish straight and erect taking measured graceful steps, venturing occasionally a comment followed by sparkling laughter. Harish Chandra became Harish-Chandra, because of the fault of a copy editor, and he decided to retain the hyphen 'as it seemed appropriate'. Once in 1945 I saw Raman coming out of his office followed by Harish who had a very troubled look. Raman espied me emerging from of the dark room and he requested me to take a photograph of Harish and make four 'dry prints' within an hour (as something had gone wrong in the passport office.) I think with P. S. Narayanan's help Harish was photographed and the prints were produced and delivered. We still do not know whether these photographs were ever used or not.

'His remarkable appearance, bearing and sparkling laughter would have melted many female hearts. However, he preferred the puritanical mores of his homeland. When he returned to India he married (the above-mentioned) Lily'. Here again there is a story (told by Lily herself). In October 1952 Harish visited Bangalore again. He was coming from Mysore and the Kales were with him. C. V. Raman received him again at the Railway Station but this time he put a garland of beautiful roses around Harish's neck. Beside him was standing Lily – beautiful and sweet 17. On an

impulse and to her utter surprise Raman garlanded her too; an on-looker said that her face became as red as the roses that adorned her. To Lily it was such a warm and beautiful gesture that she cherishes it even now 'for after that things rolled on with an inevitability – as though pre-ordained', she said. Harish proposed to her and they were married on 28 December 1952.

In late 1954 I met an English mathematician in Oxford who told me that he had seen in Amsterdam the most perfect and beautiful couple – an Indian mathematician and his wife. I knew it could be none other than Harish and Lily. Langland confirms this. 'I am told that he and his young bride Lily were the uncrowned prince and princess of the Amsterdam Congress in 1954.' It was a wonderful marriage. It is sometimes difficult to imagine what would have happened to Harish-Chandra without Lily, especially when he fell ill. 'Much of his work could hardly have been completed without the brave support of his dear wife who with patience and courage during his serious illness remained the mainstay of his life.'

Raman said even in the early days that Harish-Chandra would make a big splash in the annals of mathematics if not in physics. There was an inexplicable bond of affection between these two. Harish always visited Raman when he came to India. I know of one more meeting after which Harish said: 'I cannot, but admire the intuition that physicists have – of seeing things much before an experiment is performed. Sir C. V.'s work seems to be mainly dependent on this sixth sense. The danger often in this is that if one does not keep close contact with the nuances that physics is taking one can make very grave mistakes.' We talked of many things but it is most succinctly and beautifully summarized in what he said almost thirty

years later at a conference held in Dirac's honour.

'I have often pondered over the roles of knowledge or experience on one hand and imagination or intuition on the other in the process of discovery. I believe that there is a fundamental conflict between the two; knowledge by advocating caution tends to inhibit the flight of imagination. Therefore some naiveté unburdened by conventional wisdom can sometimes be a positive asset.'

Once Harish-Chandra told Dirac 'my proofs are not rigorous' to which Dirac replied 'I am not interested in proofs but in what Nature does', indicating clearly the chasm that existed between the two points of view. Even so Dirac was perhaps the only person for whom Harish-Chandra had unreserved admiration. He credited 'Dirac having the sixth sense of intuition in a large measure' which to him was close to a spiritual quality.

Harish-Chandra felt this sixth sense had been denied to himself by providence. In point of fact most mathematicians are certain that Harish had outstanding intuition and that he relied on it very much. Stimulated by the presence of Herman Weyl, Claude Chevalley and Dan Mastow he turned to a systematic study of the Lie groups. In two years he devoured voraciously all the existing Lie Group theorems and published his first paper on this subject – a new algebraic proof of Ado's theorem – one of the major theorems on this subject. Around 1950 with a complete command of the Lie groups theory Harish-Chandra embarked on a project – his *magnum opus* 'The Harmonic Analysis of Semi Simple Lie

Groups'. This work which stretched over 25 years has been described as monumental. Unfortunately, this word 'does not do justice to the courage and the pioneering efforts which were needed to overcome the formidable obstacles along the way'. It has been described 'as an engraved jewel'. Mathematical papers flowed from his pen revealing a structure of surprising beauty. He was amongst the few mathematicians who wrote with extreme clarity, often giving 'tedious' details which left practically nothing for the reader to verify. It is acknowledged by most mathematicians that the appearance of Harish's selected works along with the inspired introduction by V. S. Varadarajan was a major publishing event and is truly a fitting monument to Harish-Chandra's wonderful achievement.

When he died, at the memorial meeting at the Institute of Advanced Studies it was said: 'The Institute has lost a jewel and India has lost one of her greatest sons. Gentle in nature, generous in spirit, brilliant in his perception he gave liberally of himself to all who knew him; his personal kindness, his absence of any vanity or anger, his sense of simplicity combined with his deep respect for the elegant complexities of his field.' Again, 'his decency, humility and gentleness made his friendship all the more precious in the world inclined to be otherwise'.

No mathematician has successfully completed so long and arduous a climb solo. There can be little doubt that future generations of mathematicians will regard him as one of the giants of our era, a creator of ideas, an architect of an entire subject and that he will take his

place amongst the succession of great ones of mathematics.

'The mathematics he created still stands like ... a Gothic cathedral heavily buttressed below. And in spite of its great weight, light and soaring into the upper reaches, coming as close to heaven as mathematics can'.

'I do not believe in God as a figure enthroned in a green chamber; I have a profound respect for the philosophical aspiration of the Indian religion'.

'Many of the most exalted mathematical results are the creation of a superior culture or even of a divine force. The role of a mathematician is to uncover these creations like an archaeologist or foresee them like a clairvoyant rather than to invent them with his own mind (A true platonic point of view).'

He saw mathematics as mediating between man and what one can call God. He saw as his task not to bring men closer to God but God closer to men. For those who can understand his work and who accept that God has a mathematical side, he accomplished it.

As his health began to falter in his final years, Harish fell back on the teachings of classical philosophy – a phased withdrawal from a life of action, to the life of contemplation.

A truly remarkable human being.

S. R.