Harish-Chandra

I first met Harish-Chandra when I was an instructor at the University, in the fall of 1961, when he was visiting the Institute before taking up a position as professor in 1963. At that time the current literature seminar still was held every Wednesday in the old Fine Hall, and for me, in my youth, it was the central event of the week, with the best of mathematics and its brightest stars. Everyone attended, all of the Institute, or so it seems to me in retrospect, coming over to the University for that one afternoon, Harish-Chandra without fail, always on foot, and usually in the company of Armand Borel and André Weil.

I believe it was at the first meeting of the term – I had written to him earlier with questions and comments on his papers, but had not yet seen him – that he had searched me out to give me, somewhat tardily, some reprints that I had requested. He was not yet forty, but already the man I remember. The carriage was erect and aristocratic. The magnificent features, which had, I am told, made of him and his young bride Lily the uncrowned prince and princess of the Amsterdam Congress in 1954, were austere and chiselled, the outward expression of an almost unbearable inner intensity. But the flashing smile and the sparkling laugh, often triumphant, occasionally mischievous, were more frequent then than they later became.

His greatest achievement, the construction of the discrete series, still lay before him, and I have always reckoned it my great good fortune to have met him before 1964, when he proved their existence, and to have been close to him at the time. The discrete series are the keystone of his own theory of harmonic analysis and, it seems to me, the clue to all later developments in representation theory, especially of the cohomological methods, which Harish himself never assimilated, and the source of its vigor, transforming it from a peripheral to a central mathematical domain.

This is not the place for a technical exposition. However, we can perhaps recall the beginnings of Harish-Chandra's mathematical career and of the subject with which he was identified and which was identified with him.

He took the M.Sc. degree in 1943 at the age of nineteen in Allahabad and, as was natural for an ambitious young man of a theoretical bent in India at the time, when Raman's fame and influence were strongly felt, he chose to study not mathematics but theoretical physics, moving to the Indian Institute of Science in Bangalore, where he met the very young girl who was later to become his wife and where he studied with H.J. Bhabha. Bhabha was perhaps too easy-going for Harish-Chandra's taste, but he did recognize the young man's promise and sent him off to study with Dirac, apparently as soon as wartime conditions permitted, for Harish was on board the ship bound for England before the war in the Pacific had ended.

During the time with Dirac, partly as a student in Cambridge and partly at this Institute, which Dirac visited in 1947/48, bringing him along as his assistant, Harish-Chandra abandoned physics and turned to mathematics. I suppose he followed his own inclinations, but I gather that Dirac did not conceal that he had a much higher regard for Harish's abilities as a mathematician than as a physicist. In no way did this diminish Harish's affection for Dirac. On the contrary, he was, and remained until the end, the only person for whom Harish expressed unreserved admiration. He credited Dirac, and perhaps a few other physicists of that generation, with a sixth sense or intuition, for him a spiritual quality, which he felt was denied himself and other mathematicians. We were, I am afraid, lesser beings.

In the last years in India and in England, Harish-Chandra was busy with relativistic field theory; his ideas have since found their way into some texts. Fields imply an infinite number of dimensions and relativistic entails the Lorentz group, a non-compact semi-simple group, and the focus of all Harish-Chandra's efforts, in spite of several attempts in his early years in America to break away, was to remain the theory of infinite-dimensional representations of semi-simple Lie groups.

Almost immediately upon his arrival in Princeton he began working at a ferocious pace, setting standards that the rest of us may emulate but never achieve. For us there is a welter of semi-simple groups: orthogonal groups, symplectic groups, unitary groups, exceptional groups; and in our frailty we are often forced to treat them separately. For him, or so it appeared because his methods were always completely general, there was a single group. This was one of the sources of beauty of the subject in his hands, and I once asked him how he achieved it. He replied, honestly I believe, that he could think no other way. It is certainly true that he was driven back upon the simplifying properties of special examples only in desperate need and always temporarily.

He very quickly set himself a goal, that of establishing a Plancherel formula for semi-simple groups, which at first glance seems idle, and one of those misguided attempts at generalization, in this case of Fourier analysis, to which mathematicians are so often tempted. I think Harish himself saw it a little that way, affirming repeatedly in the early years that he intended to finish up his work in group-representation theory and get on with something else, that it seemed wrong to him to spend most of his life on the subject.

Indeed, he turned to mathematics eager to conquer all that was best or most exciting at the time, taking courses on Lie algebras and class field theory from Chevalley and Artin at Princeton, and then moving on to Harvard to study algebraic geometry with Zariski. For those who knew him only later, it is astonishing and moving to hear him in a letter of 1949 to Irving Segal in which he describes his ideas for proving the Plancherel formula for complex groups stating that he knew too little analysis at the moment to do much with them, and then adding, "Besides there is algebraic geometry to be learnt" – the bar on the final "t" three-quarters of an inch long!

But Harish-Chandra's temperament did not allow him to disperse his energies. So, more and more taken up with semi-simple groups, which demanded complete concentration of his enormous abilities and whose features and significance only slowly revealed themselves, he never became an active geometer or arithmetician. Nonetheless, as we understand better each day, his work holds the key to some central and previously intractable problems in these domains. Harish knew this and, from the very beginning, greeted these developments with encouragements and, in my own case, great generosity. He struggled to master them, which for him meant turning the ideas over again and again until they caught and reflected the light of his own imagination, a long, sometimes almost impossible, task.

He was a man who kept no useless papers, apparently taking his manuscripts once published, turning them over, and using the backs for scrap. The rest, those still open, and there were several boxes full, he heaped on his desk, leaving only a small working space in the middle. Among them at his death were not only his own manuscripts in the course of preparation but also notes from Artin's lectures taken thirty-five years earlier, the papers of younger mathematicians with whose ideas he was preoccupied – there were several – and even notes from a current seminar which I had left in his pigeonhole two days earlier, on the Friday, as a gesture, little thinking he would look at them. But on the Saturday morning he came and sat down beside me before one of the lectures at the Borel conference, as he had not done for a long time, and inquired, "Do you really understand Arthur's work?" It had been the topic of the seminar. I replied, in what I thought was a self-depreciating fashion, that after all I had been studying it for six weeks. "Ah," he sighed. "I have been struggling with it for months."

Life at the Institute was not easy for Harish, but he felt that here was where he should be. He liked to lecture, and did so often, usually delivering courses on his own work, and more than one person has confided in me that it was at these lectures that he learned what it was to be a mathematician. However, Harish was in some ways a timid man and the rough-and-tumble and give-and-take which are also a part of life here did not appeal to him. Besides he always thought of himself as an outsider, perhaps because he came to mathematics late. He was a passionate admirer of two other great outsiders, Cézanne and Van Gogh, seeing himself in them. This I always felt, but I did not discover until after Harish's death that he himself had been an enthusiastic and talented painter in his youth.

It is difficult to communicate the grandeur of Harish-Chandra's achievements and I have not tried to do so. The theory he created still stands – if I may be excused a clumsy simile – like a Gothic cathedral, heavily buttressed below but, in spite of its great weight, light and soaring in its upper reaches, coming as close to heaven as mathematics can. Harish, who was of a spiritual, even religious, cast and who liked to express himself in metaphors, vivid and compelling, did see, I believe, mathematics as mediating between man and what one can only call God. Occasionally, on a stroll after a seminar, usually towards evening, he would express his feelings, his fine hands slightly upraised, his eyes intent on the distant sky; but 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.