

## AN ALL-ROUNDER

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It was the spring of 1965. Delhi was getting hot but was not yet uncomfortably so. As a young researcher, I was looking forward to my return to the sedentary environment of King's College, Cambridge, after a marathon lecture tour of India. I had lectured on astronomy, gravitation and cosmology to mammoth audiences from university campuses to municipal receptions and other public forums, met the President of India, the Prime Minister, the Education Minister and other distinguished personalities. And I was fagged out at the fag end of my visit, when my local hosts said:

"Your visit will not be complete until you have met Professor D.S. Kothari."

My initial reaction would have been to say: "No more! I want to call it a day." However, I knew that Professor Kothari was different. He being the Chairman of the University Grants Commission, and intimately connected with the fabric of higher education in the country, I could think of no better person to talk to, especially since my long-term goal was to join that very fabric.

So a meeting with Professor Kothari was duly arranged and at the end of it I felt that it had been well worth it. For, in those fifteen to twenty minutes I could not only get a feel for the state of university education in the country but also catch glimpses of the warm personality underneath the formal cloak of the Chairmanship of the UGC.

It was said of Albert Einstein that in the course of a scientific discussion in English he would occasionally slip into his native German when he got excited or when he wished very much to convey his intuitive feelings on a scientific topic. Kothari would likewise slip into Hindi during discussions—even during formal lectures. This was probably why, talking to him, like I did that day in Delhi, one felt very much at ease.

Dault Singh Kothari was born in Udaipur, Rajasthan, on July 6, 1906 and graduated from the University of Allahabad. The astrophysicist, Meghnad Saha, was teaching at Allahabad then and

he encouraged this bright student to go to Cambridge which not only was then the Mecca for physicists but also had distinguished astrophysicists like Eddington, Larmour, Smart, Fowler etc. Kothari's fame as a bright young student had preceded him at Cambridge where he met another young Indian astrophysicist who was one day to become world famous: Subrahmanyan Chandrasekhar.

Chandrasekhar's seminal work on white dwarf stars—the derivation of the mass limit (which came to be known as the Chandrasekhar limit) up to which such stars can be supported through a quantum degenerate electron pressure—was well known in the early thirties but also considered controversial in view of Eddington's opposition to it. Nevertheless, Kothari and another young Indian R.C. Majumdar appreciated its significance and chose to work on quantum statistical mechanics and its applications to stars and planets.

Kothari therefore worked on the interiors of white dwarfs to estimate the march of temperature in a typical such star. He and Majumdar used rigorous quantum mechanical treatment for the interior of the white dwarf to compute its opacity coefficient so as to decide on how the energy flows outward from the centre to the surface. Their conclusion was that energy flows outwards through thermal *conduction* rather than by *radiation*. (For ordinary stars like the Sun, the energy transport is through convection and radiation.) Kothari was the first to give an approximate theory for thermal conductivity of the degenerate electron gas. He even went on to suggest the presence of neutrons at the centre of cold degenerate bodies like white dwarfs. His composite models of bodies with degenerate electron cores and perfect gas envelopes had anticipated the later work of the 1960s on black and brown dwarfs. His other work of the late 1930s relates to pressure ionization in dense stars and the maximum radius of a cold degenerate electron body.

Those were the days of early germination of theoretical astrophysics in India and Kothari and Majumdar were the torch bearers of the flame lit by Meghnad Saha in the early 1920s.

D.S. Kothari was the first head of the newly set up Department of Physics and Astrophysics in the University of Delhi. The Physics Lecture Theatre in the University Department carries the following message from Eddington:

With especial pleasure I send my good wishes for the prosperity of the new Physical laboratory of the University of Delhi. It may be that at present it does not go beyond the modest aim of

taking some small part in the world-wide activity of physical science. But great things come from small beginnings and nowhere are the prospects more fair than in your country. With its ancient traditions of scientific learning now awakening again into an intellectual revival gaining momentum year by year the words used by Clark Maxwell at the foundation of the Cavendish Laboratory come to my mind: 'And with faith in the unsearchable riches of creation and of the untried fertility of the fresh minds into which these riches will continue to be poured, I wish you success.'

From Maxwell to Eddington, physics and astrophysics had been the strongholds at Cambridge from the mid-nineteenth century to the late 1930s. Kothari carried that inspiration to the new Department at Delhi. And his association with the University and the Department continued even after he was drawn into several national projects and important executive roles.

For example, he continued to reside in the campus and draw his salary equal to that of a university professor on being called to the Ministry of Defence where, as the Defence Science Advisor to the Government of India, he was entitled to higher pay. He continued to teach while treading the corridors of power in Delhi, first regularly but later, once a week.

The 'teacher' in him has been appreciated not just by his students but even by others (like myself) who came in occasional contact with him—at private discussions or public lectures. One always felt that there was some point or other he wished to convey, sometimes very intensely. This is where he would switch gears and start talking in Hindi!

At the helm of the University Grants Commission, Kothari left his stamp not only on the university and higher educational system but also on education in general. The Kothari Commission of 1964 on Education was a remarkable combination of educationists of different backgrounds. As the Chairman, Kothari demonstrated his skills in producing a cohesive report with several practical recommendations which subsequently were incorporated in the national policy on education in 1968 by the Parliament. The 10 + 2 + 3 system that we follow today had its origin in the Kothari Commission Report. Another, more important recommendation of the Report to be implemented was to make science compulsory up to standard X.

The Report also made other useful recommendations some of which have proved difficult to implement for various reasons. For example, universal primary education is still an unattained goal

largely for socio-economic reasons. The use of mother tongue for higher education has proved somewhat controversial. For example, comprehension demands that science is best taught in the mother-tongue—for the emphasis should be on grasping the basic facts and on ability to reason. On the other hand, can we afford to let go English which has become the international language for science?

Kothari was himself concerned with the language problem for technical and scientific technology. He chaired the Commission for making this terminology during 1961-64. Likewise he was interested in the programme of writing text-books on science at school level, undertaken by the National Council of Educational Research and Training. Here too the question of standardising Hindi terminology came up frequently.

In the late seventies, several of us wrote to the then Chairman, UGC, stressing the need to revitalize and systematize the teaching and research in the general relativity theory, within the university sector. The Chairman responded by constituting a national committee with Professor Kothari as the Chairman. The Committee was provided with financial support for the various programmes it recommended. Although with advancing age Professor Kothari later withdrew from the Committee, its programmes are still continuing.

In 1979 the relativists in India organized an international meeting to celebrate Einstein's birth centenary. More than 200 participants took part with about fifteen from abroad. Two evening lectures were arranged as part of the programme, one by Professor Phillip Morrison of M.I.T. and the other by Professor D.S. Kothari.

Professor Kothari spoke on 'Einstein, Physics and Beyond'. It was beyond that took up most of his talk where he regaled the audience (—and also occasionally left them confused!) with sudden transitions between relativity, philosophy, quantum mechanics and religion, with quotations from Einstein, Schrödinger, Heisenberg and other scientists mixed with those from the *Upanishads*, the *Gita* and other religious/philosophical texts.

This was perhaps the beginning of a new phase in his life when he became a seeker for synthesis of science and religion/philosophy. But his approach was scientific and analytical: not born out of superstitions. The following story about him told by a fellow scientist may or may not be true, but it *could have been* true:

Once DSK was visiting a distinguished godman. Knowing that a famous scientist was visiting him, the godman produced a

watch 'out of nowhere' and laid it in front of DSK as a present. How did DSK react? Was he impressed by his 'miracle'—impressed enough to abandon his faith in the law of conservation of energy? Not a bit. He replied "Sir, you have brought this watch from infinity to this place. If you can arrange for it to move towards me by another six inches purely by your will power, I will become your disciple."

Needless to say, the godman did not make him a disciple!