



# Dr. Chanchal Uberoi

(1939–2019)

Prof. Chanchal Uberoi came from a Punjabi business family of Quetta in Baluchistan, of pre-Independence India. Her family was engaged in retail business that was devastated by an earthquake in 1929. With sheer resilience and toiling, the family re-established their business in the next decade. Once again it was destroyed to ashes during the post partition events. The entire family with their tiny tots was forced to flee when their home was set on fire at night. Little girl Chanchal was only 8 years old then. Being chased out of their own land and settling elsewhere was not easy for any of those families. Life was not at all easy on them, as they had to wander in different parts of India as refugees. Her *appa* started his business again in Hyderabad and tried settling there. While Chanchal found learning mathematics very interesting, her four siblings found

their interest in diverse areas. When she wanted to pursue research after her master's from Osmania University, her parents supported her choice, though it was not common then.

In the 1960s, Applied Mathematics department at Indian Institute of Science, IISc, Bengaluru was a “service department” to equip researchers from various disciplines with mathematical tools which could be applied to their fields of study. Young Chanchal got accepted for PhD there, after hours of rigorous interview. **Years later, she climbed up the ladder as the first woman mathematician to adorn the position of Dean.**

Soon after joining as a research scholar, Chanchal was asked to take up teaching mathematics to students from the departments of metallurgy, chemical engineering and management studies. “I began

preparing notes for teaching. Looking back, it was fun teaching. Most students had little or no training in mathematics beyond high school. To get them interested in mathematics, I began emulating a kind schoolteacher by sharing anecdotes about the lives of mathematicians!” recalled Prof. Chanchal.

Chanchal was working on her thesis on the propagation of waves, their characteristic instabilities in plasma media and their applications to astrophysical problems. She had to burn the midnight oil, even thousands of integrals and calculating machine. This was not an easy task in that decade before the dawn of personal computers. To describe the behaviour of gases of neutral particles, she successfully employed what is known as the **Bhatnagar-Gross-Krook Model (BGK Model)**, named after Prof. Shanti Swarup Bhatnagar and

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others. After obtaining PhD, Dr. Chanchal started working as a lecturer at IISc.

Two years later, she was granted leave to pursue research at the University of Cardiff and then at the Harvard Observatory. On her return to India, she was appointed as Assistant Professor and over the years, she became Professor in the Department of Applied Mathematics, later renamed as Department of Mathematics.

She married Dr. S.N. Balasubrahmanyam who was a researcher in organic chemistry at IISc. He was a great supporter of his wife's career. Together they performed the duties of raising a family while having fulfilling careers. As a couple and as a family, they indulged in their mutual love for Indian classical music, Indology and research.

With the dawn of the space age, astrophysics gained great importance in the early 1960s. Chanchal applied her expertise in mathematics and plasma physics to understand problems in the near-earth space environment. In 1972, Hannes Alfvén received the Nobel Prize in physics for the discovery of a new type of wave (later named as Alfvén waves) in natural plasma.

This kind of plasma constitutes a major part of ionised matter prevalent in space. **Incidentally, in the same year, she established a very important physical process that is prevalent in plasmas, described as resonant absorption of Alfvén waves in inhomogeneous magnetic fields.** This work helped us understand the various physical processes in natural plasmas. She could trace the origin of this work back to her PhD thesis, where she wrote a small chapter on Alfvén waves. **The work has also become**

**substantially important in the study of heating of laboratory plasmas in fusion research.**

Her work in collaboration with Akira Hasegawa of Bell Laboratories resulted in a monograph titled *The Alfvén Wave*, published by the US government's Department of Energy. She was awarded by the Society for Technical Communication, Tennessee. **Her work has had applications in both space and laboratory plasmas.** She has contributed research articles in internationally reputed journals on the chromosphere of the sun, behaviour of sunspots and magnetic fields in space.

Chanchal Uberoi authored many popular articles on topics like women in science, famines due to solar activity during Mughal rule and on connections between Indian music and monsoon. She had undergone training as a vocalist in North Indian classical music.

Combining her scientific interest, she created musical pieces using audio frequency radiation produced by ionised entities surrounding and interacting with magnetically active planets (Saturn, Jupiter, Earth), then recently transmitted by Voyagers I and II and converted to sounds audible to the human ear. She prefaced each sound profile by a short rendering of a subjectively chosen musical piece, instrumental and vocal. She believed that this effort would interest young people in taking up research in topics related to ionised media. She was always amused by the contrast of elaborate ensembles used in western harmonic music and the simplicity of Indian melodic music. She wrote essays on how *ragas* and *taala/laya* of our music beautifully create intended effects on the listener.

She travelled extensively, for her academic work to Australia, Sweden, Japan, Brazil, Nigeria, England, USA and many other places for collaborative research and for transaction of knowledge. She was also engaged in year-long periods as visiting professor at Institute of Physics, Puebla, Mexico, research consultant at AT&T Bell Laboratories, and later, at Lucent Technologies, NJ, USA, Research Associate at International Centre of Theoretical Physics, Italy and at Indian Institute of Astrophysics, Bengaluru.

Till today, Joint Astronomy Programme (JAP), an initiative of IISc trains PhD students in astrophysics, jointly run with several collaborating institutes Raman Research Institute (RRI), Indian Institute of Astrophysics (IIA) and Indian Space Research Organisation (ISRO).

This programme was established in 1982, in which Prof. Uberoi was a founder member and played a key role. **She was a great teacher, mentor, researcher and an able administrator who was at IISc for more than four decades.**

Remembering her long satisfying association with her institute, she said, "I strongly believe that the vision of our founder, JN Tata, has largely fulfilled. The Institute is a scientific environment, producing highly trained teachers, scientists, engineers and scientific administrators, which is reflected in the atmosphere of the Institute. Though I think this might change with time, I assure myself that it could only happen superficially – the quest for knowledge and learning that the Institute inculcates in its students will last for ages."

