

S. Chandrasekhar (1930–2004): Discotic Liquid Crystals

Sivaramakrishna Chandrasekhar, inventor and discoverer of discotic liquid crystals, renowned educator and tireless

advocate, for over four decades, of liquid-crystal sciences and technologies, died March 8, 2004 in Bangalore, India. He was born 73 years earlier to a large family distinguished in both science and public service. Convinced that major research advances arise from interactions among scientists

from many different cultures, he organized several Liquid Crystal Conferences in Bangalore, chaired four biennial International Liquid Crystal Conferences and set up bilateral scientific collaborations between India and many countries. In 1992, he co-founded the International Liquid Crystal Society and was its first president. In 1998, along with George W. Gray, Nobel Laureate Pierre-Gilles de Gennes, and Alfred Saupe, he was elected one of its first Honored Members.

Chandrasekhar is best known for his prediction, discovery, and elucidation of a new class of liquid crystals where disc-shaped molecules stack in liquid columns.^[1] This discovery opened an entirely new area of research, which has since led to a host of applications ranging from legibility films for giant LCDs, clearly legible in large public spaces, to hybrid nano-chips. Research interest in discotics has recently surged with the recognition that some liquid-crystal phases exhibited by bent-core molecules (banana liquid crystals) could be columnar and polar.^[2] Chandrasekhar's book, *Liquid Crystals*, a universally acclaimed classic,^[3] elegantly presents the beautiful and complex world of liquid crystals to all students, beginning and "experienced".

We are grateful to Professor Chandrasekhar's widow, Ila, for the following biographical details. While many of us knew him as Chandra, Ila called him Chander: "Chander was born in Calcutta, India, on August 6, 1930. His father, R. B. S. Sivaramakrishnan, was Accountant General in both colonial and independent India. His mother, Sitalakshmi, a beautiful woman, was the younger sister of Nobel Laureate C. V. Raman. Chander was the fourth of five brothers. Only the oldest is alive today. His second brother, A. S. Natarajan, worked for Tatas, a well-known industrial house. The third brother was S. Ramaseshan, a widely known crystallographer and materials scientist. The fifth, S. Pancharatnam^[4] died young while at Oxford. The 1983 Nobel Laureate, astrophysicist Subrahmanyan Chandrasekhar, was a first cousin.

Chander was educated at a well-known Catholic institution, Loyola College, Madras. He received a D.Sc. from Nagpur University while working with C. V. Raman at the Raman Research Institute. He obtained a second Ph.D. from Cambridge University. Post-doctoral work was with Kathleen Lonsdale at University College, London, and Lawrence Bragg at the Royal Institution, London. He returned to India in 1961 as the first Head of the Department of Physics of the University of Mysore. There, on the heels of Charles Frank's seminal paper,^[5] he began working on liquid crystals.

Chander was deeply interested in classical Indian as well as western music and sang well, a talent inherited from his mother. He was also interested in theater, painting, and sculpture. But he always put his research before anything else in life."

In 1971, Chandra moved his group from Mysore to found the liquid-crystal laboratory at the Raman Research Institute, Bangalore, soon recognized as a world-class research center. In 1991, to help build the high-tech enterprises emerging from India's important research base, he founded a new Center for Liquid Crystal Research in Bangalore. Chandra was proud of the pioneering work of his group, especially on pressure effects on liquid-crystal

phase transitions^[6] and their discovery of the optical analogue of the Borrmann effect.^[7]

Just as his research contributions are too numerous to mention here, so are the many honors conferred on him for his research and teaching. Most recent of these include the Royal Medal of the Royal Society of London for his discovery of discotics and his book, and the Niels Bohr UNESCO Gold Medal for his outstanding contributions to the development of liquid crystals, the advancement of science in developing countries, and the teaching of physics (1998). Chandra was a gentle, friendly, and caring man devoted to his family, friends and fellow researchers. Our hearts go out to his wife, two children, and two grand-children. He will be remembered with great affection and respect well into the future as his rich legacy to liquid-crystal research continues to flourish. Life is the word.

Patricia E. Cladis

Advanced Liquid Crystal Technologies, Summit, NJ (USA)

Banahalli R. Ratna

Naval Res. Labs, Washington, DC (USA)

Ranganathan Shashidar

GEO-CENTERS, Washington, DC (USA)

Photo by Ila Chandrasekhar

[1] S. Chandrasekhar, B. K. Sadashiva, K. A. Suresh, *Pramana* **1977**, *9*, 471.

[2] See for example: H. Pleiner, H. R. Brand, P. E. Cladis, *Mol. Cryst. Liq. Cryst.* **2003**, *396*, 169.

[3] S. Chandrasekhar, *Liquid Crystals*, Cambridge University Press, **1977/1992/1994**.

[4] S. Pancharatnam, *Proc. Indian Acad. Sci. A* **1956**, *44*, 247.

[5] F. C. Frank, *Discuss. Faraday Soc.* **1958**, *25*, 19. Much later, F. C. Frank, S. Chandrasekhar, *J. Phys. (Paris)* **1980**, *41*, 1285 deduced tilted columns from their study of discotic defects.

[6] S. Chandrasekhar, S. Ramaseshan, A. S. Reshamwala, B. K. Sadashiva, R. Shashidar, V. Surendranath, *Pramana* **1975**, *Suppl. 1*, 117.

[7] R. Nityananda, U. D. Kini, S. Chandrasekhar, K. A. Suresh, *Pramana* **1975**, *Suppl. 1*, 325.