# Pierre-Gilles de Gennes (1932–2007)

Pierre-Gilles de Gennes, the famous condensed matter theorist, died on 18 May 2007 at Orsay, a southern suburb of Paris. He was 74. He is survived by his wife Anne-Marie and three children.

de Gennes was born in Paris on 24 October 1932. His father was a doctor, and his mother, a nurse by profession, tutored him at home for some years. He later joined the elite Ecole Normale Superieure and graduated in 1955. He joined the Atomic Energy Center at Saclay as a research engineer and started research work on neutron scattering and magnetism under the guidance of A. Abragam and J. Friedel. After obtaining his doctorate degree in 1957, de Gennes pursued post-doctoral work with C. Kittel in the University of California, Berkeley, USA. He later served in the French navy for a couple of years before being appointed as an assistant professor in the Universite Paris-Sud at Orsay in 1961. He started working on superconductors, and organized a group with some experimentalists to study several impurity and surface effects. Based on a course of lectures that he gave on the topic, de Gennes wrote a book, a pattern to be repeated later on several other topics. de Gennes changed his research area to liquid crystals in 1968, and the Orsay Liquid Crystal Group quickly became the most active group in the world. Thermotropic liquid crystals were discovered in rod-like molecules in 1888, and the subject was just reviving due to the contributions from Maier, Saupe, Leslie, and the synthetic work of Gray. Liquid crystals have one or more broken symmetries compared to the isotropic liquid phase. The Landau theory had been successfully used to describe phase transitions in relatively simpler systems like magnets. de Gennes showed that the phenomenology can be extended to describe the seemingly more complex phase transitions in liquid crystals. The Landau–de Gennes theory, as it is now known, was used by him (i) to account for the weak, first-order nematic to isotropic transition on the basis of the second rank tensor nature of the order parameter, and (ii) to find a close analogy between the smecticA-to-nematic transition and the well-studied superconductor-to-normal metal transition, and predict that in type-II materials the analogue of the Abrikosov mixed state should be observed. This and other predictions made by him on the basis of continuum models (like that of the light scattering spectrum from nematics) led to intense experimental activity in many laboratories in the world. He wrote a book on the subject, and became a professor in College de France in 1971.

de Gennes again changed his field around 1974 to polymers, and brought out the connection between polymer statistics and phase transitions, and argued that a polymer with a large polymerization index ($\sim 10^5$) is like a system close to a critical phase transition temperature, to derive several scaling relations. He also proposed a simple explanation based on reptation, of the experimentally measured dependence on the polymerization index of the crossover frequency from liquid-like to rubber-like response. de Gennes was named the Director of the Ecole Superieure de Physique et de Chimie Industrielle de la Ville de Paris in 1976, a position he occupied till his seventieth year. In the mean time, after writing his book on polymers, de Gennes started to work on the dynamics of wetting in 1984, and showed the importance of the precursor film on the dissipation of the spreading liquid. Subsequently (around 1989) he turned his attention to the adhesion phenomenon, and hence to problems like welding in polymers which form glues. More recently, he was interested in granular materials and some biological problems, like the possibility of creating artificial muscles using cross-linked nematic polymers, functioning of the brain, etc. During the past few years, he was associated with the Institute Curie in Paris. In addition to his deep involvement in condensed matter physics, de Gennes had an interest in drawing and painting.

He had the uncanny ability to intuitively grasp the essential features of a given problem and use physical approximations, which led to new physics, often with surprisingly simple mathematical apparatus. This approach allowed him to tackle a wide variety of problems, and bring out analogies between different physical systems. de Gennes was indeed a prolific author. His first paper was written in 1956, and he remained active in research till the end. He has penned eight books, and about 530 research papers and review articles, averaging more than ten papers per year. A rather remarkable feature is that in well over 300 of the publications, he is the sole author. His publications are highly cited, Hirsch Index being about 83.

de Gennes received numerous awards in recognition of his scientific contributions. The more important ones are: the Holweck Prize from the joint British and French Physical Society, the Ampere Prize from the French Academy of Sciences, a gold medal from CNRS, the Metteuci medal from the Italian Academy, the Harvey Prize and the Wolf Prize from Israel, the Lorentz medal from the Dutch Academy of Arts and Sciences, and Polymer Awards from both the American Physical and Chemical Societies. The crowning recognition was of course the award of the Nobel Prize for Physics for the year 1991, for his contributions to the physics of liquid crystals and polymers. He was also an elected fellow of the following academies: the French Academy of Sciences, the French Academy of Technologies, the Dutch Academy of Arts and Sciences, the Royal Society, the American Academy of Arts and Sciences, and the National Academy of Sciences, USA, the Australian Academy of Sciences, the Ukrainian Academy of Sciences, the Russian Academy of Sciences, and the Brazilian Academy of Sciences. The Nobel Committee called him the 'Isaac Newton of our times', but he was somewhat embarrassed by the comparison, and signed as 'nano-Newton', while responding to an article that I had written in this journal on the occasion of his winning the Nobel Prize.

After he received the Nobel Prize, de Gennes decided to talk to high-school students about the way scientific research, mainly of the soft condensed matter variety, is conducted. He was a charismatic speaker, and could convey the background and the essential physical arguments leading to new knowledge, in simple language. He also discussed about education of the young, and encouraged students to ask questions. After visiting more than 200 high schools, he did not accept any more invitations. He has however summarized the main topics in a delightful book entitled '*Fragile Objects*', with J. Badoz as co-author. He emphasizes the importance of practical learning by experimentation, and deplores the excessive 'mathematization of subjects', in the courses taught to students. He also emphasizes the desirability of a marriage between fundamental and applied research. (He was himself a consultant to a few polymer and petrochemical industries.)

A collection of his papers (which were selected by himself) accompanied by some 'afterthoughts', was also published under the title *Simple Views on Condensed Matter* in 1992. Interestingly, the cover of the book has the sketch of a 'Flying Apsara' by the author.

de Gennes visited India twice. The first was to give a series of lectures in a school, which was followed by an International Conference on Liquid Crystals organized at the Raman Research Institute, Bangalore during 1973. The second visit was in 1996. Large audiences had the pleasure of listening to his inspiring talks, and to interact with him on both occasions.

In the passing away of de Gennes, the international condensed matter physics community has lost a pioneering theorist, and indeed the most illustrious researcher and teacher of soft condensed matter science.

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# A. K. Tiwari (1960–2006)

Anil Kumar Tiwari, a space scientist who worked in the field of forestry, passed away on 12 November 2006 at CMI Hospital, Dehradun. Born on 5 January 1960 into a forest officer's family in Nishini, a village in Almora District, Uttarakhand, Tiwari had his early education mostly in Nainital, Uttarakhand and did his B Sc in 1977 from H.N.B. Garhwal University, Uttarakhand. He started his career in the field of forest ecology in 1979 after obtaining his M Sc degree in botany. He worked in a project integrated study of the natural resources and environment of parts of the Kumaun Himalaya through remote sensing under the supervision of the ecologist J. S. Singh in Kumaun University, Nainital. During this time span, Tiwari was responsible for a number of ecological studies using aerial photographs and Landsat MSS images. He was awarded the Ph D in 1985 and he served as Assistant Director at the Wildlife Institute of India (WII), Dehradun for one year. Later he moved to the Department of Space in 1986.

Tiwari visited RESTEC, Tokyo, Japan in 1987 for an advanced course in remote sensing technology. He had carried out a number of studies in various aspects of forest ecology using remote sensing techniques at WII and the Regional Remote Sensing Service Centre. He had about 27 years of experience in the use of remote sensing and GIS techniques for natural resources studies in the Uttarakhand region. His major research contribution was on regional-level biomass estimation; evaluation of net flux of carbon at regional scale; geo-vegetation analysis in landslide-affected areas; wildlife habitat evaluation; sediment yield and soil erosion; biodiversity studies with reference to climate change; biodiversity studies with reference to bioprospecting; modelling landscape nutrient dynamics; integrated studies

for sustainable development. Tiwari has published his research results in both national and international journals of forestry and environment.

His special interest was on biomass and productivity studies, besides biodiversity studies for the Himalayan region. One of his works on component-wise biomass models for trees using non-harvest techniques, published in the year 1992, is used as reference even today for biomass studies due to its applicability in the present scenario of environmental degradation. Regional level forest biomass mapping using remote sensing techniques is the first study of its kind in India in which an original technique was developed for forest biomass mapping, based on four major assumptions: (i) major quantitative parameters of vegetation expression are interrelated and one can be used to predict the other; (ii) using allometric biomass estimation equations, mean tree basal cover and density, it is possible to compute stand biomass; (iii) generalized species and interspecies biomass estimation equations can be used for dominant and subordinate species respectively; (iv) reduction of vegetation variable into discrete classes will not materially affect the quality of information. The crown cover of forests estimated through aerial photographs was related with the stand biomass estimated for reference sites to develop cover-biomass models. The study was carried out over ten sub-catchments of the Central Himalaya and was extended with minor modifications to estimate the total forest biomass in the entire Indian Central Himalaya. In order to obtain the biomass estimates at much finer level, the digital image processing technique was combined with the cover biomass models to demonstrate the use of digital image processing for forest biomass mapping. Forest biomass estimated through remote sens-