Preface

The idea of this special issue of *Pramana – Journal of Physics* on Vortex State Studies originated during the time the commemorative Tenth International Vortex Workshop (IVW-10) was being planned to be held at the Tata Institute of Fundamental Research (TIFR), Mumbai, India, during January 9–14, 2005. Considering that there are usually no formal proceedings of such workshops, it was felt that it would benefit the scientific community a great deal, if eminent research workers were requested to contribute an article each on a contemporary subject of their choice in the area of Vortex Physics for inclusion in a special issue of *Pramana – J. Physics*. There was an enthusiastic response to this idea, which has resulted in the emergence of this issue which we hope is timely and useful to the scientific community at large, specially the young researchers.

The vortex state refers to the mixed phase of superconductors, where the magnetic field permeates and microscopically sub-divides the specimen into normal cylindrical regions surrounded by circulating supercurrents in the form of vortices. A superconductor in a magnetic field can sustain large current density without dissipation of heat only if the vortices do not move around and/or start flowing. Though the vortex state studies have been going on for a long time, it was the discovery of high temperature superconductivity which gave a fresh impetus to this field. This discovery in metallic copper oxide systems in 1987 had raised the hope that these materials would transform the electrical power and the microelectronics industry. However, the insurmountable difficulties in devising innovative ways to prevent the movement of vortices at boiling point of liquid nitrogen in the high temperature superconductors has slowed down their development for novel applications.

The discovery of high temperature superconductivity gave an opportunity to a large section of the community of condensed matter physicists, statistical physicists, material scientists and engineers to study the vortex state in a variety of materials. The appearance of a very comprehensive and timely article in *Reviews of Modern Physics* in 1994 further attracted the attention of researchers in this area of physics. This also culminated in the holding of Workshops on Vortex Dynamics. The number of researchers working in this area has steadily increased as gauged by the number of prospective participants in such workshops. The Nobel prize in Physics for the year 2003 was awarded to A A Abrikosov, who had pioneered the idea of vortex state in superconductors.

Several groups in India have been actively engaged in the research on Vortex Physics and have contributed a good deal. It was only fitting that the 10th International Workshop was finally held in TIFR, Mumbai, India. This gave an opportunity to numerous young researchers in India to listen to the talks presented by eminent scientists, to interact with them and to highlight their work and achievements. This year also happens to be the birth centenary year of J R D Tata, who played a leading role in the setting up of the Tata Institute of Fundamental Research. The year 2005 is incidentally also the World Year of Physics.

A notable feature of the present issue is a review article on Experimental Results in Vortices in Dilute Bose–Einstein Condensates. This is a new topic, which was added to the deliberations of the Tenth Vortex Workshop.

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Last but not the least, we thank the editorial board of *Pramana* for agreeing to publish this in *Pramana – J. Phys.* and the staff of *Pramana* office for their help.

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