

Preface

E. C. G. Sudarshan

In this Special Section of *Current Science* we celebrate the scientific contributions by one of the brightest theoretical physicists of the latter part of the 20th century, E. C. G. Sudarshan. Prof. Sudarshan who made path-breaking contributions to many areas of theoretical physics passed away in Austin, Texas on 13 May 2018. He was 86 years old. The wide variety of the articles in this Special Section reflects the broad range of physics topics to which Sudarshan has made seminal contributions.

The four editors of this Special Section have had different levels of interaction with the physics and the person of Sudarshan. N. Mukunda has been a student, a long time collaborator and a close colleague for many decades; S. Pakvasa was a long time friend who has shared the excitement of the physics and times of Sudarshan; X. Tata was a graduate student and post-doc at University of Texas at Austin and did some of his early research with ECG; R. Godbole, the one who has, perhaps, had the least overlap with ECG, took her first steps in physics in the days of establishment of the Standard Model as ‘the theory of weak interactions’ in which the V – A theory of Marshak and Sudarshan played a key role. We felt that a record of the intellectual legacy of this brilliant, innovative Indian theoretical physicist, in an Indian journal like *Current Science* would serve as an inspiration to future generations, as well as a tribute to a great scientist.

The three of us (SP, XT and RG) thank NM for agreeing to allow us to include his article (page 179), which describes the life and work of Sudarshan and ends with a few remarks on his personality as well as his views on life and philosophy, as the lead article in this special section.

This is followed by the written version of the talk by ECG’s colleague at University of Texas at Austin, Nobel Laureate Steven Weinberg (page 193), on the occasion of ECG’s 75th birthday, reproduced here with permission from *Journal of Physics*. In this talk titled ‘V – A was The Key’, Weinberg explains how Sudarshan’s seminal work on V – A theory of weak interactions was essential for the development of the unified model of electro-weak interactions. This very clear exposition is followed by a tribute by Nobel Laureate Sheldon Glashow (page 199) who was a student at Harvard when ECG was a post-doctoral fellow with Julian Schwinger. He writes about the memories of the shared time and physics as well as about the two occasions where ‘for sensible reasons, Sudarshan felt himself unjustly deprived of a well-deserved Nobel Prize’. Glashow and Weinberg shared the 1979 Nobel Prize for physics with Abdus Salam for the synthesis of the electromagnetic and weak interactions into what is known today as the electro-weak interaction.

Next is an article by Wayne Itano (page 201) who was involved in an experiment which established, in 1986, the existence of the quantum Zeno effect put forward by Misra and Sudarshan in 1977. He gives a very nice description of the effect, the experiment as well as the reaction from other physicists to both the effect and the experiment. He also

points out how this work by ECG might now find applications in quantum information processing.

The write-up by Girish Agarwal (page 205), an expert in quantum optics, describes the impact of ECG’s work on modern quantum optics. Agarwal points out how ECG’s abstract ideas and thought experiments are now being increasingly followed up by experimentalists due to developments in experimental techniques. He also points out the great utility of the diagonal representation for constructing quantitative measures of quantum-ness of a state. This is just one of the important scientific legacies of ECG.

This is followed by an article by Samir Bose (page 207) who shared an advisor with ECG and who began his days at Rochester in 1958 by compiling the notes of lectures given by ECG at Rochester. He writes about his memories of working with ECG and discusses his work on tachyons as well as the spin statistics connection and further some important formal contributions to quantum field theory.

This is then followed by an article by Austin Gleeson (page 211), a long-time colleague of ECG at the Centre for Particle Theory (now the Centre for Particle Physics) where Sudarshan spent a major part of his scientific career. Gleeson describes ECG’s move to Texas, his life and science in Texas and briefly also touching on his life before Texas.

These articles show us how multifaceted the science and the life of E. C. George Sudarshan was. A significant omission is a write-up on the theory of open quantum systems to which Sudarshan has also made important contributions.

K. R. Sreenivasan (page 216), the former Director of the Abdus Salam International Centre for Theoretical Physics (ASICTP) at Trieste, gives us a ‘stroboscopic view of Prof. E. C. G. Sudarshan’ which does full justice to the multifaceted character of, not just the science but also the personality in addition. As somebody who interacted with him from time to time in various capacities, first as a Ph D student in IISc, Bangalore and then as a part of the US physics community of Indian origin and then as the Director of ASICTP, he gives a picture of ECG through the eyes of a theoretical physicist from a distance, and truly brings out the multiple facets of his personality and physics in a delightful manner.

The essays by Anil Shaji (page 227) and Urjit Yajnik (page 229), both of whom had the good fortune to be ECG’s Ph D students, reminisce about the physics and the times with him. That brings out the human face of ECG along with his wit and humour.

We are grateful to all the authors for freely giving their time and energy in preparing this tribute to E.C. George Sudarshan. Thanks are due to the *Current Science* office for efficiently managing the Special Section in spite of some tardiness from some of us.

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– Guest Editors



E. C. G. Sudarshan (1931–2018)