K. Porsezian (1963–2018)

On 11 August 2018, the country lost one of the most promising and dynamic upcoming researchers. Kuppuswamy Porsezian, Professor of Physics, Pondicherry Central University, breathed his last at Apollo Hospitals, Chennai due to an unexpected and sudden liver condition at the rather young age of 55. He was destined to achieve greater heights in science but nature snatched him quite unexpectedly leaving his loving family, colleagues, students and a large circle of friends in India and abroad in great despair.

Porsezian was born on 5 June 1963 in an agricultural family as the youngest among five brothers and a sister at the village Kallur near Gudiyatham town in the present Vellore district of Tamil Nadu. After schooling at Municipal Higher Secondary School, Gudiyatham, he had his undergraduate study at Government Thirumagal Mill's College, Gudiyatham, and M Sc Physics course at Government Arts College, Tiruvannamalai. He joined my group as a Ph D research scholar in 1985 at Bharathidasan University (then Autonomous Postgraduate Centre of University of Madras at Tiruchirappalli) and studied the soliton spin structures underlying ferromagnetic nonlinear dynamical systems and obtained his Ph D degree in Physics in 1991. He continued as a Postdoctoral Research Scientist during 1991–1993 and then joined Anna University in April 1993 as a Lecturer in Physics. Here he started working on optical solitons, forming an active group of young people. He became an Assistant Professor in May 2001 and then moved to Pondicherry Central University in November 2002 as a Reader in Physics where he became a Professor of Physics in March 2006. He also headed the Department during June 2006 to March 2009. He expanded his field of interest to solitons and modulational stability in nonlinear fiber optics, rogue waves, Fibre Bragg gratings, photonic fibres, Bose–Einstein condensates and self-induced transparency, besides solitons in magnetic systems and integrability aspects of nonlinear partial differential equations.

At Pondicherry, he developed a fine School of Nonlinear Optics, attracting a large number of young people and visitors from all over the country and abroad. He guided about 16 students towards their Ph D degrees, while 8 students are registered during his demise. He had also trained several post-doctoral students from India and abroad. He had run numerous sponsored research projects funded by agencies like DST, CSIR, DAE, NBHM, INSA, Indo-French Centre (IFCPAR), and so on, and also participated in several committees of these agencies as an active member and was the Chairman of SERB School on Nonlinear Dynamics during 2012–2016. He organized numerous seminars, meetings, conferences and schools for the benefit of young people at Pondicherry University and elsewhere. He visited the University of Hannover, Germany to

work with H. J. Mikeska as a DAAD Postdoctoral Fellow during 1995–1997 and later travelled to many countries in Europe, Japan and China for collaborative research and to France, particularly to University of Bourgogne, Dijon, several times on extended periods for collaborative research.

Porsezian received numerous awards and honours during his research career. He has been a recipient of INSA Gold Medal for Young Scientists (1995), Sathya Murthy Memorial Award (1997) of Indian Physics Association, Anil Kumar Bose Memorial Award of INSA (1998), ICTP Associate, Trieste (1997–2004), INSA International Exchange Fellowship (5 times) and Incoming Fellowship of European Union (2010). He was also a recipient of UGC Research Award (2004–2007) and DST Ramanna Fellowship (2006–2009). He was elected to the Fellowships of Indian Academy of Sciences (FASc) in 2012 and to the National Academy of Sciences India (FNASc) in 2013. He published more than 225 articles in reputed journals, edited 6 books and contributed to numerous conference proceedings.

Porsezian early in his career had investigated the nonlinear dynamics aspects of Heisenberg ferromagnetic spin chain by including the effect of discreteness of lattice in the classical continuum limit and showed that this effect at higher orders destroyed lower order coherent structures and demonstrated that solitons are possible only for specific choices of biquadratic parameters. He improved upon the earlier models with a new soliton possessing discrete magnetic system and showed that site-dependent and spherically symmetric magnetic systems with suitable inhomogeneities admitted solitons. This work is widely cited as Lakshmanan–Porsezian–Daniel equation in the literature.

Considering different linear and nonlinear higher order optical effects, Porsezian explored the soliton propagation and modulational instability (MI) in nonlinear birefringent fibers, wavelength division multiplexing systems, dispersion managed fibers, fiber Bragg grating structures, photonic crystal fibers, nonlinear bulk media, directional couplers, negative refractive index materials and Bose–Einstein condensates and proposed several soliton models and new novel ideas in MI, which find applications in optical communication and other related areas in nonlinear science. Using the projection operator method, he investigated the dynamics of femtosecond pulse propagation through the birefringent fibre and observed that the impact of scattering on chirp of the pulses decreases/increases in anomalous dispersion (AD)/normal dispersion (ND) regime. His most noteworthy contributions are the prediction of suitable dispersion map forms under the complete suppression of soliton–soliton interaction scenario and demonstration of novel pulse amplification and compression technique. He also obtained a new type of dark-in-the-bright soliton, also called dipole soliton with non-Kerr nonlinearity. He also investigated the exact analytical self-similar bright and dark

optical solitary wave solutions of the NLS equation with localized inhomogeneous cubic-quintic (CQ) nonlinearity where one can compress to a desired width and amplitude in a controllable manner.

Porsezian along with his students and collaborators obtained the MI conditions required for the evolution of ultrashort pulses in an asymmetric dual-core fibre and also investigated the ensuing nonlinear evolution of pulses in the ND regime and a regular chain of stable bright solitons in the AD regime which can be used as a source for optical telecommunications. He investigated the MI of two linearly coupled complex Ginzburg–Landau equations, which explains a laser based on a dual-core fibre. He studied the dynamics and steering characteristics of optical pulse propagation at 850 nm through photonic crystal fibre (PCF) using the projection operator method. The efficient optical switching by filling different liquids has also been analysed. By considering the influence of dispersion up to the sixth order on the scalar MI process, he elucidated the dichotomy between the odd order and even order dispersion terms in their influence on the MI. He demonstrated that a fibre with periodically varying dispersion can substantially improve the power gain of nonconventional sidebands. He investigated the unconventional MI process like the generation of new MI bands under the impact of higher order dispersion. He proved that the imaginary part of the nonlinear response models the Raman-like process and leads to Raman self-matched instability, while the real part accounts for the conventional parametric MI process through phase matching. He pioneered the studies on saturable nonlinearity and explored the results like suppression of MI with the existence of two-state behaviour and suppression of the frequency drift of MI sidebands by means of a fibre system associated with a photon reservoir.

Porsezian also studied the existence of bright and dark solitons in photorefractive media. The existence of stable light bullets in a medium with CQ nonlinearity and selfdefocusing effect of free electrons due to plasma formation has been proved. He demonstrated that the three-dimensional spinning solitons are unstable and the multi-photon ionization effect may stabilize the spinning light bullets in the CQ model. Considering pulse propagation in fibre Bragg grating, he explained the symmetry-breaking instability and optical switching. In the field of Bose–Einstein condensates (BECs), he investigated MI in single and multicomponent systems. Also, he has studied the transverse instability associated with the higher dimensional system when both cubic and quintic interactions are present. His studies of vortices in BEC produced various interesting results like pinning of hidden and visible vortices, the role of three-body interaction on critical rotational frequency and on the number of vortices, vortex lattice melting as a result of impurities, giant hole formation in the presence of cluster of impurities, etc. He explored the unique properties of spin–orbit coupling in the dynamics of MI in single and multi-component BECs.

Porsezian has significantly contributed in the context of rogue waves. He along with his collaborators proposed the novel generating mechanism for higher order rogue waves and studied various types of rogue wave solutions of different nonlinear models in nonlinear fibre optics, as well as multicomponent (2+1) dimensional long wave–short wave system. He has also significantly contributed in the context of nonlinear directional couplers. He investigated that the triangular configuration of liquid core chloroform PCF is found to exhibit the best figure of merit with minimum input power for logic gates application. Furthermore, he reported the robust coupling in the presence of asymmetry at linear regime and the high impact of geometrical asymmetry on pulse steering characteristics at nonlinear regime. His noteworthy contribution in the case of directional coupler is the novel observation of optical bistability in oppositely directed coupler. He further studied the stability of solitons and MI in negative index materials and the impact of the incorporation of such materials in the coupler system, and demonstrated many interesting features which could not be realized in conventional materials. He also studied the MI scenario in PIM-NIM coupler and reported new ways to generate and manipulate MI and soliton in two and three core directional couplers with negative index channel.

In the field of photonic crystals, Porsezian investigated the influence of linear and nonlinear effects for different air hole size and successfully demonstrated the generation of higher order solitons near the visible wavelength regime. In addition, he analysed supercontinuum generation (SCG) using soliton fission and MI. Another significant aspect of his investigations is the study of instability induced SCG in saturable nonlinear media with saturable nonlinearity where he also observed a novel behaviour of MI and SCG. His research findings in the context of SCG were helpful and can serve as a guideline for the design of supercontinuum sources for future applications.

Porsezian has been highly endearing, affable and liked by all. He was always cheerful, modest and ever helpful to anyone approaching him with a request. He will be missed by everyone. He leaves behind his affectionate family consisting of his wife (Selvi) and two young sons (Gokul and Ragul).

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