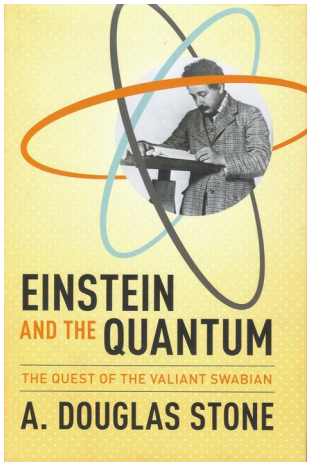

Einstein and the Quantum: The Quest of the Valiant Swabian. A. Douglas Stone. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2013. 344 pp. Price: US$ 29.95/£ 19.95.

Albert Einstein is one of the greatest scientists of all times, credited for bringing revolutionary concepts on space–time in special theory of relativity and formulating the general theory of relativity, claimed as 'the most beautiful theory in physics' by Landau and Lifshitz. In contrast to Einstein's unequivocal recognition to his contribution to relativity in the case of quantum theory his contribution in general perception is considered to be less original. This is despite the fact he got the Nobel Prize for his 'services to theoretical physics and especially for his discovery of the law of the Photoelectric effect'. His contributions both special and general relativity received immediate approval from his peers. Max Plank, the most influential and greatest theorist in Germany then, gave the first public lecture on relativity soon after it appeared in the year 1905. Immediately after, Arthur Eddington, British astronomer, announced the result of his famous expedition verifying general relativity. Einstein became an instant hero worldwide. In contrast, his contributions to quantum theory did not receive immediate acceptance. Einstein's stand on the development of quantum mechanics immortalized by his famous statement 'God does not play dice with man', has further added to the popular perception that his contribution to quantum theory was more of a critic rather than a pioneer in that field.

The book under review eloquently argues against this popular misconception. The author Douglas Stone lucidly weaves the story of the state of physics of that era, the contributions, triumphs and turmoil of the scientists of that period, in particular that of Einstein, to successfully bring out the thesis that Einstein's contribution to the development of quantum theory is no less original and path-breaking as his other well-known contributions.

The book starts with the circumstances under which Max Planck gave his distribution law as a 'desperate measure' in 1900. Though he stated 'energy to be composed of a definite number of equal parts', he was more apologetic about its implications. We learn that for five years since it appeared, there was no follow-up work by either Planck himself or by any other giants of that period. It was left to a clerk in a patent office, Albert Einstein, to take up the implication in his 1905 paper, that even energy of electromagnetic radiation in free space 'consists of a finite number of energy quanta that are localized in space, moving without dividing and can be absorbed or generated only as a whole'. We understand that prophetically he used to sign letters to his girlfriend (later wife for a brief period) Mileva Maric as a 'Valiant Swabian' after a crusader knight invented by a poet Ludwig Uhland, quoting 'valiant swabian is not afraid'.

Stone vividly brings before us the life and times of the period from late 19th century to the early 20th century with all the important players like Maxwell, Max Planck, Lorentz, Bohr, S. N. Bose, Nerst, Heisenberg, Sommerfeld and others. The book also contains some interesting vignettes about Einstein's student days. Since 1905, when Einstein wrote his epoch-making papers, Stone explains how much quantum theory had occupied his mind. Einstein's failed attempts to generalize Maxwell's equations for electromagnetism to include the Planck constant (though the details are not available) and his frustration shared with his friends are brought out well. His second great work on quantum theory, in the paper in 1906, states energy of vibrational states of matter to be quantized and explains the temperature variation of specific heat. This laid the foundation for the validity of Nernst theorem of entropy being zero at absolute zero. It is interesting to learn that until Nernst resurrected the paper in 1910, it was not noticed by anyone. There are some rather not so well-known facts about Einstein's contributions that were far ahead of his time. For example, Stone points out that in his contribution to Bohr–Sommerfield quantization condition, Einstein was careful to point out when it will fail; the condition which is now termed as dynamical chaos, and laying the seeds for quantum chaos. Also, Bose's derivation of Planck radiation formula had a seemingly innocent counting statistics that apparently Bose himself did not realize. It was Einstein who after extending the Bose method to quantum ideal gas understood its full implication that interchanging of role of two identical particles does not lead to a distinct physical state.

Albert Einstein in 1904 with his wife, Mileva Maric, and his young son, Hans Albert. ETH-Bibliothek Zurich, Image Archive.

The book traces the role of Einstein as an original contributor in the development of quantum theory until the start of wave mechanics. One wishes that he continued with the circumstance in which he wrote the famous paper with Padolsky and Rosen and its impact.

In summary, this book is written in a style which is easily accessible to any interested person wherein physics concepts are explained with vivid analogies. It has rare insights and information on the role of Einstein as a original contributor to quantum theory. I have no hesitation in recommending the book for anyone interested in the history of science in general and quantum theory in particular.

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