From Galileo to Einstein[1]

G S Ranganath

The desire to know the principles governing the physical universe is as old as man has been on this planet. The four little books under review are brief biographical sketches of four eminent scientists who have profoundly transformed our understanding of the physical world. In this review of these books I will draw attention to some unfamiliar facts of their lives and times.

An impression is created in popular literature that Galileo was the first to invent a telescope. The authors bring out the interesting fact that Leonard Digges had built both reflecting and refracting telescopes way back in 1550 more than a century before Galileo. Probably, Galileo was the first to make the best use of it. His discoveries concerning the phases of Venus established on a firm footing the heliocentric theory. As a result, he had to suffer years of persecution because this theory was in direct conflict with that held by the church. The authors makes a telling point when they write " The Pope, John Paul II, formally pardoned Galileo on 31st October 1992 ... "

The book has a graphic description of Galileo's family life. His father had promised, just before his death, a substantial dowry to Galileo's sister. Galileo had to give dowry to his second sister also. However, his financial status was so miserable that even to eke out a normal living he at times had to give private tuition. Thus he could not meet these social obligations in his entire life and to add insult to injury his brothers-in-laws sued him in a court for not settling their dowries. This left such a scar on him that he forced his two daughters, whom he loved very dearly, to be nuns for life.

No standard book on physics stresses the fact that Galileo was the first to introduce the concept of inertia. This point has been made out clearly by the Gribbins. He invented this principle to account for the eternal circular motions of planets round the sun. He believed that a circular motion is the natural motion due to inertia. It was Renee Descartes who realised that this concept of inertia applied only to motions in a straight line. But it was left to Newton to solve the problem of motion on a curve.

This brings us to Newton's biography. There is a general belief that Newton was born in 1642, the year Galileo died. But in reality Newton was born on 4th January 1643. This discrepancy is due to the fact that the British being mostly Protestants were naturally suspicious of the Pope and did not adopt the Gregorian calendar until 1752. This biography also tells us how Newton arrived at his law of gravitational attraction. The arguments found in the book look extremely plausible. Newton was aware of Kepler's discoveries about planetary motion. He had to reconcile them with his discovery of the centrifugal force. A planet moving in an orbit

[1] see pages 90, 91.

would experience a centrifugal force that would drive the planet away from the sun. To keep it in its stable orbit around the sun there must be an equal and opposite force of attraction tugging it towards the sun. Using Kepler's law about orbital periods he discovered that this force of attraction should fall inversely as the square of the distance from the sun. Thus Newton's universal law of gravitational attraction was born.

Edmund Halley is not as well known as Galileo or Newton. Thus his biography is very welcome. Though he is known for his work on comets, it is not generally recognised that Halley made a very significant discovery concerning stars. This came about after his friend Newton took over as the President of the Royal Society. The Royal Greenwich Observatory had been set up so that Flamsteed could prepare more accurate astronomical tables to improve navigation. But Flamsteed was extremely reluctant to part with his data since he had spent a lot of his own money in improving the telescope. When he became adamant the Queen stepped in and appointed Newton to get this data. Newton in turn assigned this job to Halley. Halley added a lot of his own data to the ones supplied by Flamsteed. While on this job he carefully compared the stellar co-ordinates he had on hand with similar data of Hipparchus of second century BC. He found to his amazement that the recently measured co-ordinates of most of the stars agreed with the ancient data. Halley boldly suggested that these stars had moved in the intervening centuries. Thus he shattered the myth that stars are fixed objects in the sky.

The biography of Albert Einstein has nothing new to recommend it. The little book dwells upon all the known facts. I wish the authors had been a little careful. They make two misleading statements. It has been stated that the Bose–Einstein statistics(BES) applies to particles whose number is not conserved and that when the particle number is conserved it is the Fermi–Dirac statistics (FDS)that will have to be used. The right statement would have been that BES applies to particles with integral spin while FDS applies to particles with half-integral spin. They end Einstein's biography with the statement:

"Number two to Newton in physics rankings is surely a position he would be proud to hold – though he may have to share that number two slot with Richard Feynman"

I think that many will not agree with this elevation of Feynman to the level of Einstein.

I would strongly recommend these books to every pre-college student. They will hopefully motivate and inspire our young students who of late have been opting out of basic sciences. The Universities Press has done a service to the student community publishing these books at such low prices.

G S Ranganath, Liquid Crystals Laboratory & Physics Group, Raman Research Institute, Bangalore 560 080, India.