

BOOK REVIEWS

moves around earth, bending of light. What bends is space not light, light freely floats on it and hence we measure bending of space by means of light. Though wrong, it has got currency and so we carry on with it.

Another misconception is that in a strong gravitational field light slows down. That too is utterly wrong. What slows down is the clock in strong gravity and that would result in increasing light frequency and thereby energy but its speed remains the same universal constant. When light is tunnelling out of a strong gravitational field, it loses energy through decrease in its frequency or increase in wavelength. This is the phenomenon of gravitational red-shift.

This otherwise excellent book, I have to say, suffers from this misconception.

Let me also underline one of the profound statements the author makes: light travels as a wave but arrives as a particle. It should rather be enlarged to say that not only does it arrive but it also departs as a particle. It is a wave through the journey while it is a particle at both ends.

At first sight, I must confess I was a bit taken aback, why should such a fascinating book end with such a speculative note? What the author is seeking is further synthesis between gravity and quantum theory. We are again faced with the wave-particle like duality. Gravity is described by curvature of space-time which is a continuum while the basic elements of quantum theory are discrete. How to make the two compatible is the most challenging question over half a century discrete/digital nature of events induces non-locality and acausal transmission of information. What is hinted at is that new synthesis would arise as and when we have quantum theory of gravity or space-time.

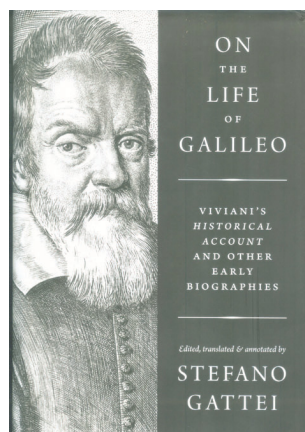
In other words, how do we synthesize Planck's constant, which is universal like velocity of light, with space-time? All universal entities must be related and synthesized. This is the most profound open problem over half a century, and we are nowhere near the solution.

As I said in the beginning, it is a fascinating and engaging story of one of the most exciting and challenging feats of observation and experiment. It is being told with a lot of feeling, insight and care, and it is indeed a must read for not only physicists but scientists in general as well as curious audience at large.

Let me close with an apology. I have taken liberty in discoursing on some issues of concepts and principles (enclosed in parentheses) that could though be construed as transgressions but at the same time that may perhaps be illuminating.

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On the Life of Galileo: Viviani's Historical Account and Other Early Biographies. Edited, translated and annotated by Stefano Gattei. Princeton University Press, 41 William Street, Princeton, New Jersey 08540. 2019. lxviii + 348 pages. Price: US\$ 49.95/£42.00.

Galileo Galilei (1564–1642) is one of the most well-known scientists as the father of mechanics and dynamics; however a commoner would identify him as an 'eye-opener' for astronomy by the introduction of telescope. It provided a turning point for the observations of the night sky, and for a strong foundation for a heliocentric planetary model. His biography is so well publicised that we imagine that his life story was created rather easily as he left behind his own works. Some documents (for example, letters) would have supplemented the write ups with many ifs, buts and may be's, providing scope to classify some anecdotes to 'hero worship' category. Thus it becomes all the more important to know what his contemporaries felt

about him and their reactions to the good and the bad events of his life. However, as we see in this latest compilation, the contemporary biographies unfold his potential as an untiring seeker of truth; his mind and hands worked brilliantly leaving us wonder if some unpublished material may still be hiding somewhere escaping the eyes of historians.

Stefano Gattei is a well-known name among the historians. The book was eagerly awaited by historians as the publications of a series of papers on Galileo, especially the one¹ in 2017. This critical edition comprises the biographical sketches of Galileo during his life time or just after his death by people within his circles. Some of them are translated into English for the first time opening up our views on his public image – his life which was entangled in controversies of science and religion.

Stefano Gattei gives a detailed introduction clearing our blurred views of the contemporary society. The original Italian, French and Latin texts follow with a very faithful translation and abundant notes. The resources available (in English) hitherto, were mainly based on the book by Viviani Vincenzo, the last student of Galileo. Thus historians were longing for access to other original resources providing the historical context of the making of Galileo.

The introduction titled 'Shaping the myth' begins with the poem by Primo Levi in 1984, with '*Before the Sun burned my eyes/I had to yield and say/I did not see what I saw*', a very concise picture we have of Galileo. The 'Galileo affair'² gained enough publicity especially after the church vindicated him in 1992. He was well respected for his engaging thoughts on the experiments with the inclined plane, the introduction of the ideas on gravity, the analysis of tidal motions. His books on physics were popular all over Europe and therefore, one would be curious to know how this 'affair' was treated. Segre³ made an effort on these lines to analyse the context in light of limited tools accessible to Galileo.

Gattei narrates the individual texts of this volume, fourteen in all. Viviani's original biography (1654), the 'Letter to the Prince Leopoldo de Medici on the Application of the Pendulum Clock' (1659) and 'Report on Galileo's Later Works' (1674) are reproduced with translations and comparison of the style of writing with other contemporary

biographers, Gherardini and Vasari (who sketched the life of Michelangelo). It is important to note that many biographers followed this style as a formality.

The complete text on the pendulum clock and related drawings has been made available. Galileo was aware that this would be of great help for navigators which turned out to be true. He also mentions about the application of the ‘Medician stars’ (satellites of Jupiter) for the determination of longitude as a very apt alternative to eclipses. About 40 years of observational data on these satellites were lost as reported here. The method indeed gained the confidence of navigators. Many explorers used his idea of the timings of the eclipses of the satellites of Jupiter for longitude estimates till late 18th century. He was the first to toy with the idea of a magnifying glass – the microscope – and succeeded.

Girolamo Ghilani wrote the first traceable biography in 1632 probably prior to the trial. He gives an elaborate discussion on the science of Galileo and declares ‘As these most learned works are of the highest value to scholars and teachers in that science, they are very highly praised and offer me the opportunity to honor Galileo’s precious merits by giving him a central place in my Theatre.’ Leo Allatius has included Galileo’s sketch for a compilation and Gattei opines that he probably did not have a first-hand information on the work of Galileo. Gian Vittorio Rossi criticized the Pope Urbana VIII for the moral collapse. The biographical sketch by Vittorio Siri faithfully details the science but

avoids the trial completely. His emphasis is on the mathematical foundation laid to philosophy. Lorenzo Crasso writes a very brief essay and declares that the troubles were ‘self-invited’ by Galileo because of his reckless opinions. The writer from Germany Joachim von Sandrart is well recognized for his language, but more important is his description of a visit he paid when the Inquisition was in progress. He has specifically mentioned about the interest Galileo had in arts. While some essays like Leo Allatius are very passive, appreciation by most of the other scientists hint at a positive development. The ideas on mechanics, gravity and mass are well appreciated and had a wide range of audience. Galileo was indeed received whole heartedly by the scientific community in general and that speaks of his legacy.

The short essays by Paul Freher and the details of inscriptions engraved by Vincenzo Viviani in 1702 as ‘Testimony of a Grateful Soul’ complete the available sources in this volume. The poem by Maffeo Barberini, ‘*Adulatio perniciosa*’, in Latin is the best part of the book; written in 1620 by the same individual who, as Pope Urban VIII, became Galileo’s prosecutor, later. Ignoring all the politics, differences in ideologies and conversations leading to the Inquest, for a while, this poem can be enjoyed as a beautiful piece of literature. The transla-

tion has perhaps retained the emotions set in the original – here is one ‘*Some people look up at the rising evening star/And the dreadful star of Mars, and the track coloured with brightness of milk/Others look up at your light, Cynosura/Still others marvel at the Scorpion/or the brightest star of the Dog/or Jupiter’s attendants, or his father Saturn’s, which you discovered/through your telescope, learned Galileo.*’

There are some ‘failed’ biographical sketches as disclosed by correspondences. There are 24 illustrations very beautifully reproduced with utmost care. As can be expected, it has no place for the famous quote – ‘E pur si muove’ or ‘And yet it moves’, which has been traced to an artwork from Spain⁴.

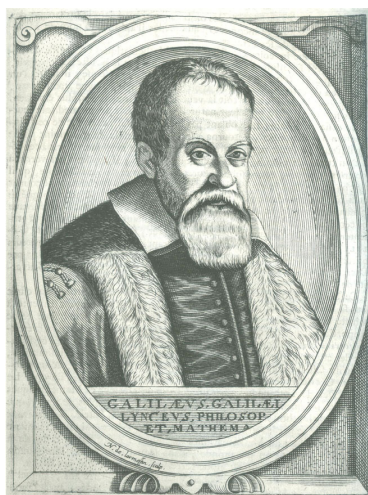
Stefano Gattei has compiled, translated and annotated all the fourteen works that were published in the seventeenth century with great care. With all the original languages occupying the left hand pages, reading in English is smooth.

This volume provides an inspiration for the beginners of the study on history of science and also for those aiming at understanding the legacy of Galileo, who shares the number of his biographers with Einstein.

1. Gattei, S., *Galileo’s Legacy: A Critical Edition and Translation of the Manuscript of Vincenzo Viviani: Grati Animi Monumenta*, BJHS, 2017, p. 1; doi:10.1017/S0007087417000073.
2. Finocchiaro, M., *The Galileo Affair: A Documentary History*, California Studies in the History of Science I, University of California Press, Los Angeles, Berkeley, 1989.
3. Segre, M., *In the Wake of Galileo*, Rutgers University Press, New Brunswick, NJ, 1991.
4. Drake, S., *Galileo at Work: His Scientific Biography*, The University of Chicago Press, Chicago-London, 1978.

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Portrait of Galileo; woodcut. Inscription



Close up of the bust of Galileo; right hand holding a telescope; left hand holding a compass, Below the statue a coloured marble and bronze representation of Jupiter and Medicean planets