

The Atom and the Apple: Twelve Tales from Contemporary Physics.

Sébastien Balibar. 200 pp. Princeton U.P., Princeton, NJ, 2008. Price: \$24.95. ISBN 978-0-691-13108-5. (Roger Balian, Reviewer)

Although the French version of this book has been widely praised, I discovered it only now in its recent English version. I should say that I have been captivated and delighted by this reading. Sébastien Balibar is not only an outstanding experimenter in the field of low temperature physics (he was awarded the Fritz London memorial prize in 2005)—he also has a taste and a gift for popularizing science, which is an integral part of human culture for him as for me. Significantly, the text opens by quoting Marie Curie: “I am among those who think that science is a thing of great beauty. A scientist in his laboratory is not just a technician: he is also a child confronted with natural phenomena which dazzle him like a fairy tale.” In this deeply original book, the author succeeds in conveying this curiosity and this sense of wonder of the true scientist. He convinces us that “Really, there is only one step from science to dreams, or vice versa.”

I have been unable to solve a small mystery: Why has the order of words in the French title “La Pomme et l’Atome” been switched to “The Atom and the Apple”? Anyhow, this “Apple” does not refer to Newton, but to the thriving tree of knowledge. Sébastien Balibar invites us to “bite into a few of the ripe and delicious fruits of the tree of contemporary research”. In fact, the book, though thin, covers a large number of phenomena that were elucidated during recent decades. Each topic is dealt with swiftly, but never superficially. Through a seemingly whimsical but controlled path, starting from daily observations, the reader is initiated to deep concepts of modern physics, including chaos, symmetries of matter and of living beings, universality, and the uncertainty principle. Several discoveries to which Balibar himself contributed, including facets of crystals, quantum evaporation, superfluidity, and cavitation, are explained in simple terms. Exciting, sometimes surprising answers are provided to many questions, such as Why is it dark at night? How did dinosaurs disappear? Why is a table a quantum object? How does the sap rise in trees? Can one understand financial markets? Why are Fibonacci numbers exhibited in sunflowers and pineapples?

A distinctive charm of the book lies in the constant presence of the author throughout its pages. Addressing us directly in a conversational tone, he confides his personal memories, feelings and hobbies as clues to introduce scientific themes. The reader will thus be led from the miniature cars of Sébastien’s childhood to the Doppler effect, from his youthful vacations in Provence to cosmology, from his literary emotions to helium, from his taste for burgundy to glass, from his distaste for military marches at Ecole Poytechnique

to crystals, from his passion for cycling to turbulence, from his favourite pastry recipe to meteorology, from his love of music to the explanation of Bose–Einstein condensation and of chaos. (These allusions to music remind me of his joyful four-hand piano performances with his brother, at the 1973 Summer School at Les Houches where he was a student; both used to begin the score solemnly, but we all burst out laughing when one of them succeeded in ending his part three bars ahead.) Sébastien Balibar relates with passion how his vocation for physics grew. He evokes his everyday life at his laboratory with a list of key words, *garden, green, helium, coffee, diagonals, bicycle, cold, cosmonauts, vacuum, leaks, e-mail*, which he explains with humour. For instance, the entry “coffee” begins with remembrances of the tiny dark room at the Kapitza Institute in Moscow, where endless and fruitful exchanges on the latest advances in physics arose from the daily coffee.

Actually, the book not only presents and explains physical phenomena, it also enlightens the process of their discovery through numerous historic digressions and anecdotes. Original testimonies are included about physicists whom Balibar has known, such as Laszlo Tisza, Alexei Abrikosov and Stephen Hawking. We reach a better understanding of science when we discover the men behind the searchers, when we become aware of their controversies, of the interplay between fierce competition and friendly collaborations. Science is a collective and international adventure, and the author analyzes the many factors that condition its progress: publications, language difficulties, stimulation of the intuition by images, patient and unimpressive daily tasks leading to rare illuminations. He also touches on philosophical issues from the viewpoint of a researcher. I deeply appreciate his discussions on the meaning and value of scientific truth, the existence of progress in spite of renewed questioning, the relation between aesthetics and physics, and the strengths and weaknesses of reductionism.

Far from being confined in an ivory tower, Sébastien Balibar is concerned with problems of society, on which he casts a physicist’s eye. He stresses the limits of science, fighting both its “worship” and the misuse of scientific language as an abusive instrument of power. At the same time, he advocates the spread of a true scientific culture, which would help the general public not to be fooled by demagogues manipulating irrational hopes and fears. While explaining what radioactivity is and presenting its applications, he relates a press campaign about fallout from Chernobyl. The media reported measurements of contaminations in some parts of France rising up to 5000 becquerels per square meter. However, the becquerel is such a small unit that this figure of 5000, which seemed frightening, is lower than the natural radioactivity of the person who performed the measurement, and comparable to that of a pebble of granite

weighing 500 g.... How many newspaper readers (and journalists) were aware of that?

One among the twelve chapters (or “tales” as the author calls them) is curiously entitled “From Pianos to the Sun”. It shows how a scientific attitude may improve our grasp of a major problem of our time, energy supply versus greenhouse effect. Sébastien Balibar starts with Fermi’s query about the number of piano tuners in Chicago to explain what an order of magnitude is and how one may estimate it. He then demonstrates how considering orders of magnitude may help to compare the possibilities opened by the various sources of energy. He wishes that every politician and environmental activist would have “the political and scientific courage to identify the real problems and to see how we might solve them without too many prejudices”. This requires such a scientific type of reasoning, where the advantages of each possible action are weighed against its disadvantages.

I have alluded above to numerous topics; the author has succeeded to tackle many more, since his index lists 427 entries (for 200 pages). While rereading my account, I fear that my attempt to convey this richness and variety might give the impression of a medley. In reality, Sébastien has carefully mastered his composition; the many, apparently dissimilar themes are nicely harmonized and intertwined, so that the book can be read with much pleasure and benefit by all kinds of readers. It has been written “for those who think that science is incomprehensible, that things are either true or false—and are so now and forever, for those who don’t dare to ask naïve questions”. The author hopes that his readers “might understand why scientific research is his passion and perhaps even share it.”

Indeed, his essay is attractive and accessible to the general public. It discloses fascinating phenomena, provides a deeper understanding of Nature and of our place within it, and shows how physics underlies technological objects of daily use. By setting up science as a source of reflection, it may also help the layman to behave as an enlightened citizen and to reason soundly about societal issues. More specialized audiences will equally enjoy the reading. Scientists will appreciate how nicely the concepts that underlie the frontiers of physics are explained with simple words and adequate images. Teachers will find many hints for making their physics courses more attractive. Finally, I wish to recommend the book to young people. Through his communicative enthusiasm, Sébastien Balibar sows many seeds that should encourage scientific vocations. With a thrilling and refreshing style, he not only tells exciting stories about what science has achieved, but also stresses the continuous birth of new questions. His contribution can thus be a valuable aid in the fight against the disaffection of our students from physics.

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