

A sound introduction to the piano

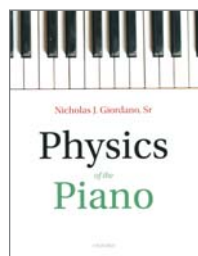
Physics of the Piano

Nicholas J. Giordano Sr
Oxford U. Press, New York, 2010.
\$59.95 (170 pp.).
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Reviewed by Uwe J. Hansen

In just over 150 pages, *Physics of the Piano* manages to deliver remarkable depth for a text aimed at a broad audience—anyone who is interested in understanding how and why the piano was invented, how it evolved, and how different parts of the instrument contribute to the sound it produces. Like many of us musical-acoustics researchers, author Nicholas J. Giordano Sr—the Hubert James Distinguished Professor of Physics at Purdue University—came to the field rather late. But since his arrival, he has made significant contributions as evidenced by a number of his publications in the *Journal of the Acoustical Society of America* and invited presentations at that society's conferences.

Giordano offers in-depth discussions of fundamental physics principles relevant to music production, amplification, and propagation. In doing so, he follows in the tradition of Neville Fletcher and Thomas Rossing in *The Physics of Musical Instruments* (Springer, 1998) and Jürgen Meyer in *Acoustics and the Performance of Music: Manual for Acousticians, Audio Engineers, Musicians, Architects and Musical Instrument Makers* (Springer, 2009), which I translated. Giordano's accessible presentation also addresses topics not ordinarily considered by readers who are neither scientists nor musicians. Among those topics are nonlinearities



in the hammer-string interaction, longitudinal string vibrations, and “stretch” tuning due to the stiffness of piano strings (see John Bryner’s article about Richard Feynman’s letter to his piano tuner in *PHYSICS TODAY*, December 2009, page 46). Each is discussed within the broader context of musical scales, piano history, the vibrating string, the soundboard, psychoacoustics, and the magic of Steinway pianos.

Omitted are some important details such as practical effects of longitudinal-wave propagation in strings and effects of string scaling on the inharmonicities of higher partials. The author’s understandable love affair with the Steinway brand is evident throughout the book, and it serves well to illustrate details in piano development and technology. Unfortunately, Bösendorfer and Yamaha pianos are consequently relegated to mere parenthetical comments; other high-quality brands are totally ignored. Although additional low-register strings in the Bösendorfer might be rarely used, the increased size of the soundboard does affect the piano’s tone.

Also, both Bösendorfer and Yamaha manufacture electromechanical systems that are used extensively for training young virtuoso performers in developing performance techniques. The author mentions the Yamaha system but dismisses its value. And he ignores the Bösendorfer system that senses and records hammer velocity and key position, and uses those recorded parameters to drive solenoids behind the key pivot points to reproduce performance dynamics.

Anyone desiring additional scientific details should consult the extensive listing of references, which include a truly masterful list of historic and contemporary researchers. Three notable works are missing, however. The first, edited by Anders Askenfelt, is *Five Lectures on the Acoustics of the Piano* (Royal Swedish Academy of Music, 1990); the lectures were presented during a 1988 conference at the Royal Institute of Technology in Stockholm that also

included intensive discussions among piano researchers, performers, and manufacturers. A CD of performances at that conference is included with the lectures. The second missing publication is a December 1995 *Scientific American* article by E. Donnell Blackham that provides a wonderful lay-language introduction to the physics of the piano; the third is Meyer’s *Acoustics and the Performance of Music*, mentioned earlier, which includes a chapter on tonal characteristics of the piano and another on directional characteristics of piano sound.

In summary, I highly recommend *Physics of the Piano*. It is an accessible introduction to many standard and some esoteric principles involved in creating the piano sound. I intend to use it as a reference for my general-education class offered in the honors program at Indiana State University.

Neutrino

Frank Close
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In 2006 Oxford University physics professor and accomplished popularizer of science Frank Close was invited to write an obituary of nuclear chemist and physics Nobel laureate Raymond (Ray) Davis Jr. When that obituary won the UK Science Writer’s Prize for the “Best Science Writing in a Non-Scientific Context,” Close decided to expand it into a popular book.

Neutrino is the story of the elusive particle conjured by Wolfgang Pauli as a “desperate remedy” to save the law of conservation of energy. Pauli was hesitant about publishing his idea; he even turned down an invitation to present it at a conference in Tübingen, Germany. Instead, in a famous open letter to the conference attendees, addressed to the “Dear Radioactive Ladies and Gentle-



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