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Beth Parks

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Beth Parks, *Editor*

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These brief summaries are designed to help readers easily see which articles will be most valuable to them. The online version contains links to the articles.

Regular readers will note the temporary increase in the length of the journal as we try to decrease the backlog of manuscripts.

Online administration of research-based assessments

Ben Van Dusen, Mollee Shultz, Jayson M. Nissen, Bethany R. Wilcox, N. G. Holmes, Manher Jariwala, Eleanor W. Close, H. J. Lewandowski, and Steven Pollock
89(1) p. 7
https://doi.org/10.1119/10.0002888
This guest editorial informs readers that using online versions of research-based assessments removes many of the administrative barriers associated with paper-based versions.

Letters to the editor

Alexander R. Klotz, B. H. Suits, Rod Cross, and Seán M. Stewart
89(1) p. 9
The letters-to-the-editor section returns after a too-long absence. Readers: keep sending contributions!

An optical *n*-body gravitational lens analogy

Markus Selmke
89(1) p. 11
https://doi.org/10.1119/10.0002117
A scheme is presented to use lensing by liquid menisci around small objects as an analog of gravitational lensing by multiple objects. The article is at the level of 2nd year physics and can be used for labs, outreach, or teaching optics.

Sun glints and luminous wriggles by the seashore

R. De Luca
89(1) p. 21
https://doi.org/10.1119/10.0001882
The seashore observations of wriggles and dancing spots of light are used as illustrations of the application of undergraduate-level optics. The link above will also take the reader to the article's video abstract.

Rabi oscillations, Floquet states, Fermi's golden rule, and all that: Insights from an exactly solvable two-level model

R. Merlin
89(1) p. 26
https://doi.org/10.1119/10.0001897
Rabi oscillations occur when a few-level quantum system is submitted to a periodically time-varying field. Floquet states are stationary solutions of a quantum system subjected to a periodic time-dependent perturbation. This paper discusses the connection between the two problems through the study of a two-level quantum system coupled to both a continuum and a periodically oscillating external field. The comparison between the exact solutions and those from perturbation theory leads to an in-depth discussion of the subtleties of these phenomena, including their relation with Fermi's golden rule. Appropriate for advanced undergraduate or graduate students.

Calculating spin correlations with a quantum computer

Jed Brody and Gavin Guzman
89(1) p. 35
https://doi.org/10.1119/10.0001967
The basics of two-state systems and correlations of two-particle and three-particle combinations of such systems. The paper includes specific examples and exercises that use the IBM Quantum Experience. The material is best suited for undergraduates who have some experience with quantum spin.

Equilibrium probability distribution for number of bound receptor-ligand

Tuhin Chakrabortty and Manoj M. Varma
89(1) p. 41
https://doi.org/10.1119/10.0001898
The equilibrium probability distribution for the number of bound receptor-ligand complexes is derived using a partition function obtained from the Gibbs-Boltzmann distribution. This allows one to calculate the fluctuation in the number of bound molecules, which cannot be obtained from the standard rate balance equation. A nice application of statistical physics to a biological problem.

Six textbook mistakes in computational physics

Alexandros Gezerlis and Martin Williams
89(1) p. 51
https://doi.org/10.1119/10.0001945
An effort to correct common mistakes: This paper identifies and corrects errors that have been propagating in computational physics textbooks. Essential reading for instructors in this field, but surprisingly readable to anyone who even occasionally uses computations.

Teaching college writing from a physicist's perspective

Kristen L. Thompson, Anthony N. Kuchera, and John N. Yukich
89(1) p. 61
https://doi.org/10.1119/10.0002179
The authors share experiences teaching in their college writing program for first-year students. Their courses emphasize critical thinking and sound argumentation, and also review basic writing skills. The course topics focus on

particular areas of physics such as astrobiology, but no physics background is required, and students with a wide variety of academic interests enroll in them.

A vertical race up and back down with and without drag

Carl E. Mungan, Seth T. Rittenhouse, and Trevor C. Lipscombe
89(1) p. 67
https://doi.org/10.1119/10.0001893

Two balls are thrown straight up, with one subject to a drag force proportional to the *n*th power of the instantaneous speed, and the other not subject to any drag. Which one will return to the starting point first? This paper, which is appropriate for discussion in both introductory and more advanced mechanics classes, analyzes this question as a function of the power *n*. The answer may surprise you.

High-speed escape from a circular orbit

Philip R. Blanco and Carl E. Mungan
89(1) p. 72
https://doi.org/10.1119/10.0001956

A rocket in a circular orbit can escape to infinity by ejecting fuel in just one impulsive thrust, or in two or three. The resulting saving in fuel and influence on the travel time to a distant location is an example for students of unexpected outcomes in introductory mechanics. The link above will also take the reader to the article's video abstract.

Of balls, bladders, and balloons: The time required to deflate an elastic sphere

Don S. Lemons and Trevor C. Lipscombe
89(1) p. 80
https://doi.org/10.1119/10.0001998

How long does it take for a party balloon to deflate? A straightforward analysis is presented and verified by a simple experiment employing a smartphone app. The topic is relevant to medical physics, and the approach is suitable for introductory students.

Chaos in the monopole ion trap

Edgar Perez and John Essick
89(1) p. 84
https://doi.org/10.1119/10.0001958

The monopole ion trap described can give undergraduates direct laboratory experience with simple electrically driven motion of a charged particle, and also introduces the onset of period doubling and chaos in that motion.

Modeling and measuring the non-ideal characteristics of transmission lines

J. S. Bobowski
89(1) p. 96
https://doi.org/10.1119/10.0001896

The frequency response of a transmission line is studied from 1 to 2000 MHz to determine not only its characteristic impedance but also its losses. This study nicely complements traditional undergraduate labs on the subject, which usually focus on ideal (lossless) lines.

Standing waves in a coaxial cable: A simple and low-cost experiment for an instructional wave laboratory

Vinícius M. Lenart, Romeu M. Szmoski, Rozane F. Turchiello, and Sergio L. Gómez
89(1) p. 105
https://doi.org/10.1119/10.0001927

Theory and experimental details are given for experiments that teach about electrical standing waves with MHz waves in a coaxial cable. The theory is well suited for students beyond the first year.

A demonstration of quantum key distribution with entangled photons for the undergraduate laboratory

Aayam Bista, Baibhav Sharma, and Enrique J. Galvez
89(1) p. 111
https://doi.org/10.1119/10.0002169

The theory is sketched of quantum communication with detection of eavesdropping, along with instructions of how to build a relatively inexpensive laboratory realization.

Exploring Black Holes. 2nd ed. Edwin F. Taylor. John Archibald Wheeler, Edmund Bertschinger. Electronic version only; freely downloadable at http://www.spacetimephysics.org

David Derbes, Reviewer
89(1) p. 121
https://doi.org/10.1119/10.0002493

Quantum Legacies: Dispatches from an Uncertain World. David Kaiser. 360 pp. University of Chicago Press, Chicago, IL, 2020. Price: $26 (hardcover). ISBN 978-0-22-669805-2

Cameron Reed, Reviewer
89 (1) p. 123
https://doi.org/10.1119/10.0002365