

ISSN 1870-9095



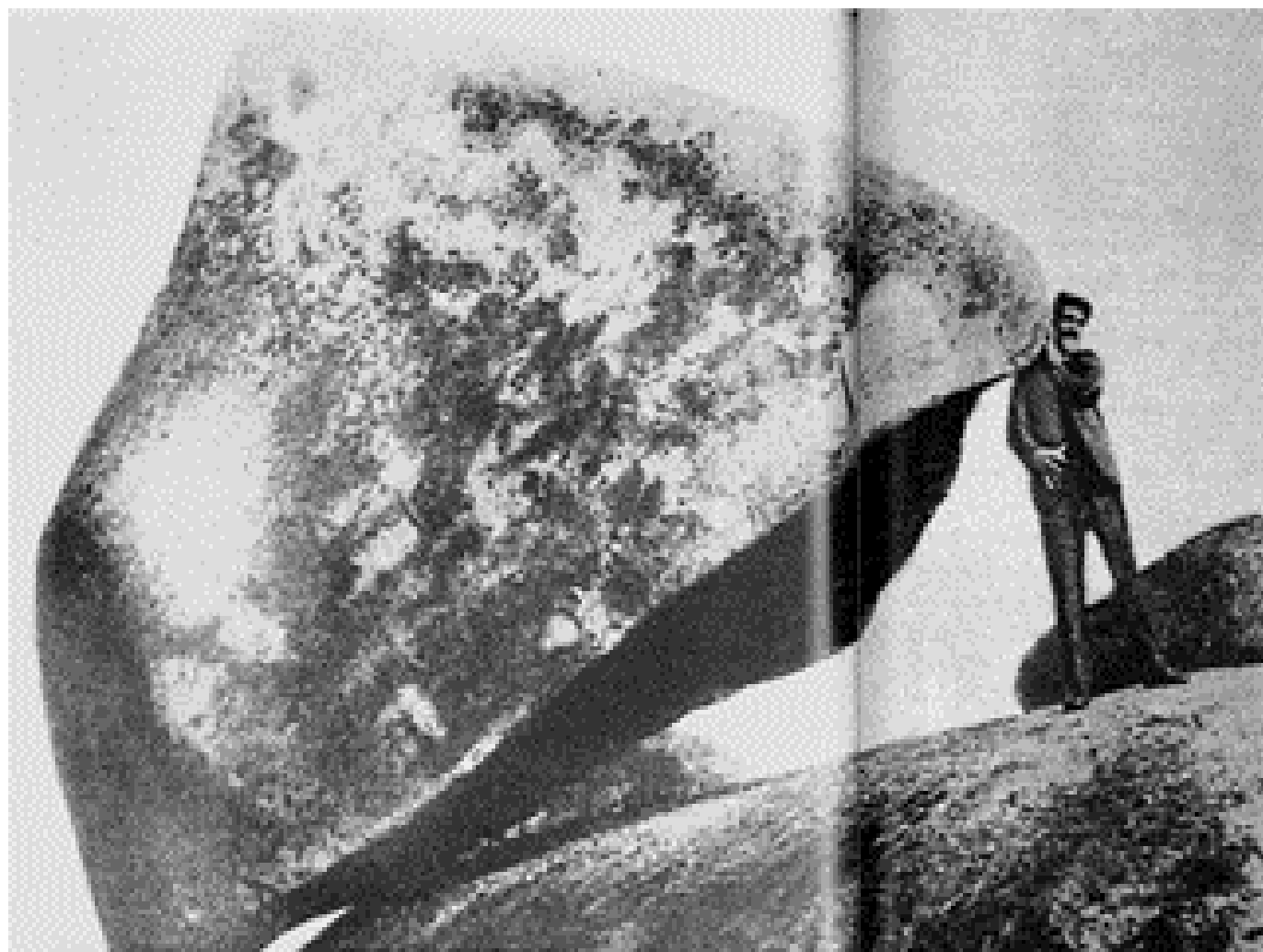
LATIN AMERICAN JOURNAL OF PHYSICS EDUCATION

www.lajpe.org

Volume 12

Number 4

December 2018



A publication sponsored by the Latin American Physics Education Network
and the Institute of Science Education



LATIN AMERICAN JOURNAL OF PHYSICS EDUCATION

Electronic version of this journal can be downloaded free of charge from the web-resource:

<http://www.lajpe.org>

Production and technical support

Rubpen Sánchez Sánchez
rbnsnchz@yahoo.com.mx
Isabel Contreras Arredondo
isaconarr1@yahoo.com.mx

Latin American Journal of Physics
Education is indexed in:

DOAJ

Dialnet

latindex

EBSCO
PUBLISHING

INDEX COPERNICUS
INTERNATIONAL

EDITORIAL POLICY

Latin American Journal of Physics Education (LAJPE) is a peer-reviewed, electronic international journal for the publication of papers of instructional and cultural aspects of physics. Articles are chosen to support those involved with physics courses from introductory up to postgraduate levels.

Papers may be comprehensive reviews or reports of original investigations that make a definitive contribution to existing knowledge. The content must not have been published or accepted for publication elsewhere, and papers must not be under consideration by another journal.

This journal is published quarterly (March, June, September and December), by the Latin American Physics Education Network (LAPEN) and the Institute of Science Education. Manuscripts should be submitted to boubarkic@gmail.com or lajpe@lapen.org.mx. Further information is provided in the "Instructions to Authors" on www.lajpe.org

Direct inquiries on editorial policy and the review process to: C. Bourbaki, Editor in Chief, Instituto Pedagógico Latinoamericano y Caribeño (Cuba), calle 154 No. 12906 entre 129 y 133 Reparto Reynold Garcia, Matanzas, Cuba CP 40100. Phone: 53 45 265794

ISSN 1870-9095

Copyright © 2018 Latin American Physics Education Network. (www.lajpe.org)

INTERNATIONAL ADVISORY COMMITTEE

Ann-Marie Pendrill, Göteborgs University (Sweden)
Bayram Akarsu, Erciyes University (Turkey)
Carl Wenning, Illinois State University (USA)
Cécille de Hosson, Université Paris Diderot (France)
Diane Grayson, Andromeda Science Education (South Africa)
David Sokoloff, University of Oregon (USA)
Dean Zollman, Kansas State University (USA)
Edward Redish, University of Maryland (USA)
Freidrich Herrmann, University of Karlsruhe (Germany)
Hiroshi Kawakatsu, Kagawa University (Japan)
Jorge Barojas Weber, Universidad Nacional Autónoma de México (México)
Jorge Valadares, Universidade Aberta de Lisboa, (Portugal)
Laurence Viennot, Université Paris 7 (France)
Lillian C. McDermott, University of Washington (USA)
Marisa Micheleni, University of Udine (Italy)
Marco Antonio Moreira, Universidade Federal do Rio Grande do Sul (Brazil)
Orhan Karamustafaoğlu, Amasya University, (Turkey)
Pratibha Jolly, University of Delhi (India)
Priscilla Laws, Dickinson College (USA)
Ton Ellermeijer, (Netherlands)
Verónica Tricio, University of Burgos (Spain)
Vivien Talisayon, University of the Philippines (Philippines)

EDITORIAL BOARD

Deise Miranda, Universidade Federal do Rio de Janeiro (Brasil)
Eduardo Moltó, Instituto Superior Pedagógico José Varona (Cuba)
Josefina Barrera, Universidade do Estado do Amazonas (Brasil)
Julio Benegas, Universidad Nacional de San Luis (Argentina)
Leda Roldán, Universidad de Costa Rica (Costa Rica)
Celso Ladera, Universidad Simón Bolívar (Venezuela)
Nelson Arias Ávila, Universidad Distrital, Bogotá (Colombia)
Octavio Calzadilla, Universidad de la Habana (Cuba)

EDITOR-IN-CHIEF

C. Bourbaki, Instituto Pedagógico Latinoamericano y Caribeño (Cuba)
Cesar Mora, Instituto Politécnico Nacional (México)

ASSOCIATED EDITOR

Josip Slisko, Benemérita Universidad Autónoma de Puebla (México)