



LATIN AMERICAN JOURNAL OF PHYSICS EDUCATION

www.lajpe.org

Volume 7

Number 2

June 2013



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

Daniel Sánchez Guzmán
dsanchez@ipn.mx
Rocío Bonilla Castelán
chio@lapen.org.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 cmoral@ipn.mx 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: Cesar Mora, Editor in Chief, CICATA-IPN Av. Legaria 694, Col Irrigación, Del. Miguel Hidalgo, CP 11500 México D. F.

Copyright © 2011 César Eduardo Mora Ley, *Latin American Physics Education Network*. (www.lapen.org.mx)
ISSN 1870-9095

INTERNATIONAL ADVISORY COMMITTEE

Ann-Marie Pendrill, Göteborgs University (Sweden)
Bayram Akarsu, Erciyes University (Turkey)
Carl Wenning, Illinois State University (USA)
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)
Elena Sassi, University of Naples (Italy)
Freidrich Herrmann, University of Karlsruhe (Germany)
Gordon Aubrecht II, Ohio State University (USA)
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 Michelini, University of Udine (Italy)
Marco Antonio Moreira, Universidade Federal do Rio Grande do Sul (Brazil)
Minella Alarcón, UNESCO (France)
Orhan Karamustafaoğlu, Amasya University, (Turkey)
Pratibha Jolly, University of Delhi (India)
Priscilla Laws, Dickinson College (USA)
Ton Ellermeijer, AMSTEL Institute University of Amsterdam (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)
Eduardo Montero, Escuela Superior Politécnica del Litoral (Ecuador)
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)
Manuel Reyes, Universidad Pedagógica Experimental Libertador (Venezuela)
Mauricio Pietrocola Universidad de Sao Paulo (Brasil)
Nelson Arias Ávila, Universidad Distrital, Bogotá (Colombia)
Octavio Calzadilla, Universidad de la Habana (Cuba)
Ricardo Buzzo Garrao, Pontificia Universidad Católica de Valparaíso (Chile)
Zulma Gangoso, Universidad Nacional de Córdoba (Argentina)

EDITOR-IN-CHIEF

César Mora, Instituto Politécnico Nacional (México)

ASSOCIATED EDITOR

Josip Slisko, Benemérita Universidad Autónoma de Puebla (México)