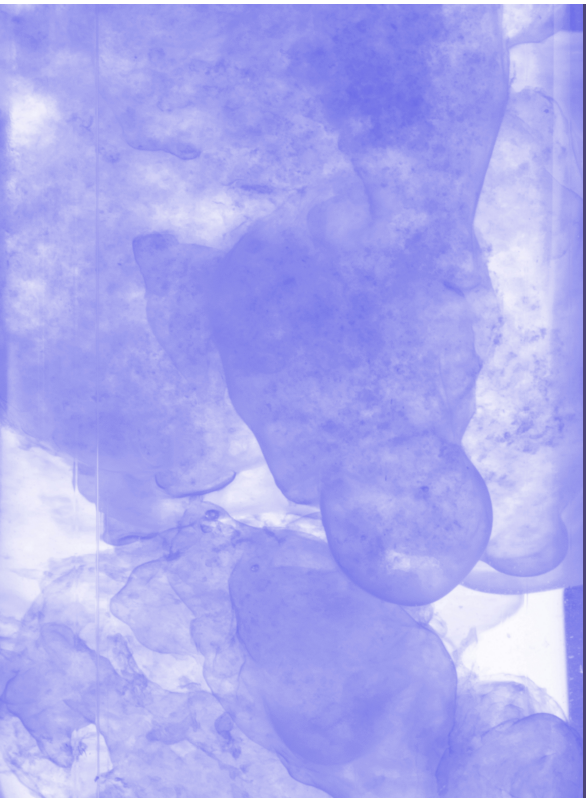
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Selected Papers



Photoconductive Semiconductor Switches: Materials, Physics, and Applications

Authors: Vincent Meyers, Lars Voss, Jack D. Flicker, Luciano Garcia Rodriguez, Harold P. Hjalmarson, Jane Lehr, Nicolas Gonzalez, Gregory Pickrell, Soroush Ghandiparsi and Robert Kaplar

Abstract: Photoconductive semiconductor switching (PCSS) devices have unique characteristics to address the growing need for electrically isolated, optically gated, picosecond-scale jitter devices capable of operating at high voltage, current, and frequency. The state of the art in material selection, doping, triggering, and system integration in PCSSs is presented. The material properties and doping considerations of GaN, GaAs, SiC, diamond, and β-Ga2O3 in the fabrication of PCSS devices are discussed. A review of the current understanding of the physics of the high-gain mode known as lock-on is presented.

https://doi.org/10.3390/app15020645



Optimization of Physics Learning Through Immersive Virtual Reality: A Study on the Efficacy of Serious Games

Authors: Julian Felipe Villada Castillo, Leonardo Bohorquez Santiago and Sebastian Martínez García

Abstract: Background: Integrating serious games in immersive virtual reality (IVR) enhances university physics education by addressing student motivation and engagement challenges. Traditional methods often fail to link abstract concepts with real-world applications, reducing interest. IVR and serious games create interactive environments that dynamically reinforce complex scientific principles, improving learning experiences. Methodology: A pre- and post-experimental design was conducted with 17 Physics 1 students from Universidad Tecnologica de Pereira (UTP). The participants were assessed before engaging with "Parabolic Basketball VR" to measure their initial understanding of projectile motion. After gameplay, post-intervention evaluations were conducted to analyze learning outcomes. Results: The intervention significantly improved students' understanding, with post-intervention scores notably higher. The Wilcoxon signed-rank test ($p = 0.007$, $Z = -2.687$) confirmed a substantial increase in scores, demonstrating the game's effectiveness in enhancing conceptual learning. Conclusions: "Parabolic Basketball VR" effectively enhances learning of projectile motion through immersive and interactive experiences. The significant improvements observed confirm the potential of integrating well-designed serious games into physics education, suggesting that these tools can significantly enhance both the theoretical understanding and practical application of complex scientific concepts. This study underscores the importance of aligning educational content with interactive gameplay to achieve learning objectives, providing a valuable approach for future educational strategies in scientific disciplines.

https://doi.org/10.3390/app15063405

Extension of the Discrete Electron Transport Capabilities of the Geant4-DNA Toolkit to MeV Energies

Authors: Ioanna Kyriakou, Hoang N. Tran, Laurent Desorgher, Vladimir Ivantchenko, Susanna Guatelli, Giovanni Santin, Petteri Nieminen, Sebastien Incerti and Dimitris Emfietzoglou

Abstract: The discrete physics models available in the Geant4-DNA Monte Carlo toolkit are a subject of continuous evolution and improvement in order to meet the needs of state-of-the-art radiobiological research for medical and space applications. The current capabilities of Geant4-DNA for event-by-event electron transport extend up to 1 MeV. In this work, Geant4-DNA's most accurate electron inelastic model for sub-keV energies is improved and extended up to 10 MeV via the Relativistic Plane Wave Born Approximation and other theoretical considerations. Benchmark simulations of the electronic stopping power and range of electrons in liquid water using the new model show almost excellent agreement (at the few % level) with the recommendations of the International Commission on Radiation Units and Measurements (ICRU) up to 10 MeV, offering notable improvement (by a factor of ~2) over the default Geant4-DNA inelastic model and an order-of-magnitude higher electron limit. The present development will allow Geant4-DNA users to perform electron track-structure simulations up to 10 MeV, thus, covering a wider range of radiotherapeutic applications (including FLASH-RT) as well as space applications involving MeV electrons which are not currently reachable.

https://doi.org/10.3390/app15031183

Evaluation of Radiation Doses Received by Physicians during Permanent ^{198}Au Grain Implant Brachytherapy for Oral Cancer

Authors: Yohei Inaba, Keiichi Jingu, Masaki Fujisawa, Kazuki Otomo, Hiroki Ishii, Toshiki Kato, Yuuki Murabayashi, Masatoshi Suzuki, Masayuki Zuguchi and Koichi Chida

Abstract: Brachytherapy is a practical, effective procedure for the local treatment of cancer; it delivers a high radiation dose to a limited tissue volume while sparing the surrounding normal tissues. Although the clinical benefit of brachytherapy is clear, there have been very few studies on the radiation dose received by physicians during the procedure. Furthermore, no study has investigated the eye radiation dose received by physicians performing ^{198}Au grain (seed) brachytherapy, using an eye dosimeter. Recently, the International Commission on Radiological Protection (ICRP) recommended significantly reducing the occupational lens dose limit, from 150 to 20 mSv/yr (100 mSv/5 years). Therefore, it has become essential to evaluate the eye radiation doses of medical workers. We evaluated the eye radiation dose of a brachytherapy physician performing ^{198}Au permanent grain implantation for tongue cancer; this is the first study on this topic....

https://doi.org/10.3390/app14146010

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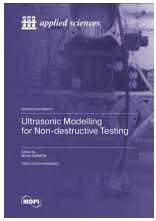
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