Contribution ID: **867** Type: **Talk**

Development of a Smartphone-Based Radiation Detection App and Its Application to Science Education Outreach –New Possibilities for Science Education Through a Cosmic Ray Detection App

Friday 18 July 2025 15:20 (15 minutes)

Cosmic rays provide crucial insights into astrophysical phenomena and fundamental physics. However, their detection traditionally requires specialized, costly equipment, limiting accessibility for education. This study explores the potential of using commercially available smartphones and tablets equipped with CMOS image sensors for cosmic ray detection. We developed the "Soramame"app (https://soramame.n.kanagawa-u.ac.jp/en/), enabling users to detect cosmic rays by leveraging the charge generation properties of CMOS sensors when exposed to high-energy particles. This study evaluates the app's reliability, educational impact, and potential for citizen science. CMOS image sensors, made of silicon semiconductors, detect electrical charges generated by charged particle interactions and convert them into digital images. "Soramame"visualizes cosmic ray events in real-time without specialized equipment, lowering barriers to participation in cosmic ray research. Its low-cost, accessible, and user-friendly design matches students, educators, and the general public. To assess its practicality, we conducted controlled experiments in various environments. The first experiment, conducted on commercial flights, demonstrated an increased cosmic ray flux at high altitudes compared to ground levels. The second experiment tested the app's response to controlled radiation sources, confirming that the CMOS sensor effectively detects charged particle interactions. These results demonstrate that consumer-grade CMOS sensors can be repurposed for cosmic ray detection, offering a valuable tool for scientific and educational applications. Beyond its scientific capabilities, we examined educational applications. Traditional science education struggles to engage students with abstract concepts like astrophysics and radiation physics. "Soramame"enhances hands-on learning by allowing students to use their devices to detect and analyze cosmic rays. By making invisible cosmic interactions visible, students develop a deeper understanding of physical phenomena, fostering curiosity and engagement. The app supports inquiry-based learning, encouraging students to collect and analyze data under different conditions (e.g., altitude, shielding, time of day) and discuss findings.

Additionally, its data-sharing feature enables users worldwide to contribute and compare results, promoting collaborative learning and citizen science. This study also highlights the potential for a global cosmic ray observation network, where participants collect and share real-time data on cosmic ray flux. Such a network could provide valuable insights into cosmic ray variations while fostering public engagement in scientific research. Future improvements will focus on enhancing detection accuracy, expanding educational integration, and refining data processing capabilities. By incorporating "Soramame"into formal and informal education, we aim to bridge the gap between research and public understanding, advancing scientific literacy and encouraging broader engagement with astrophysics. Our findings demonstrate that a smartphone-based cosmic ray detection system can be a powerful tool for science education and outreach. The development of accessible, interactive scientific tools like "Soramame"has the potential to revolutionize STEM education by making complex physical phenomena more tangible. Through this initiative, we seek to inspire future scientists, expand citizen science in astrophysical research, and create new opportunities for interdisciplinary learning.

Collaboration(s)

Author: TAKANO, Wakiko (Kanagawa University Research Institute for Engineering)

Co-authors: HIBINO, Kinya (Kanagawa University); UDO, Shigeharu (Kanagawa University); SHIOMI, Atsushi (Nihon University)

Presenter: TAKANO, Wakiko (Kanagawa University Research Institute for Engineering)

Session Classification: OE

Track Classification: Outreach & Education