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O14 - Enhancing STEM Engagement at the High School Level: A Pedagogical Framework for Optics and Waves Instruction via Astronomical Instrumentation

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Astronomy serves as a potent catalyst for advancing Science, Technology, Engineering, and Mathematics (STEM) education, leveraging its inherent visual appeal to stimulate intellectual curiosity regarding the cosmos. Within the context of secondary education in Indonesia, however, physics is frequently delivered through a predominantly theoretical lens, often lacking clear links to practical applications. This abstraction can lead to significant conceptual disconnects and a subsequent decline in student engagement. To address this pedagogical challenge, the Bosscha Observatory, acting as an academic laboratory under the Bandung Institute of Technology (ITB), has developed a strategic framework designed to bridge the gap between theoretical physics and experiential application.

This framework integrates astronomical principles into the high school physics curriculum, specifically targeting the domains of optics and waves. By utilizing astronomical observing instruments as primary didactic tools, the program transforms abstract physical laws into observable, tangible phenomena. The initiative involves the systematic development of hands-on modular activities and workshops that are rigorously aligned with the Indonesian National Physics Curriculum. These modules not only reinforce mandatory learning objectives but also introduce supplementary content, thereby extending the students' knowledge base beyond standardized requirements. Through this inquiry-based approach, students are encouraged to explore the functional relevance of physics in both scientific research and daily life.

The program is projected to yield substantial improvements in scientific literacy and foster a sustained vocational interest in STEM disciplines. By reinforcing the nexus between classroom instruction and real-world application, this initiative highlights the observatory's critical role in demonstrating how fundamental physics principles underpin modern technology and our understanding of the universe.

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