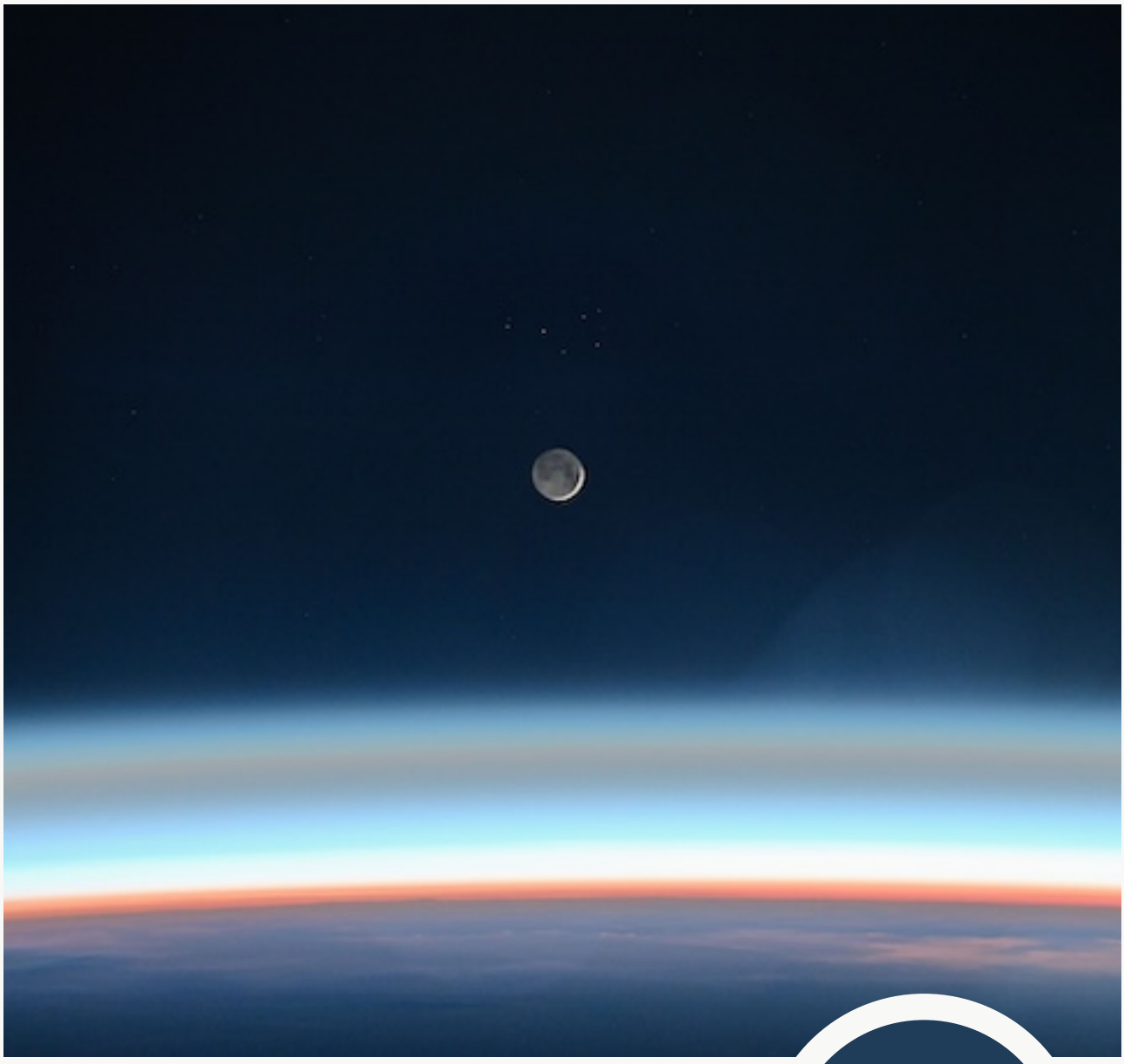
Astronomy Education

Journal



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Contents

Events, Reviews, and Commentary

The article examines the experience of implementing the professional development program for physics teachers, *Integrating Astronomy into the School Physics Curriculum,* conducted at the Sirius Educational Center in October 2025. It substantiates the relevance of searching for realistic forms of astronomy's presence in mainstream schooling under conditions where there is no stable standalone course. The concept of integrating astronomical content as a means of substantively enriching school physics is described. The article characterizes the logic underlying the program design, its main content, practical and methodological modules, as well as the format of the participants' final projects. It is shown that the combination of subject-matter training, observations, practical workshops, and independent methodological development contributes to the formation of teachers' readiness to incorporate astronomical topics into both classroom instruction and extracurricular activities.

Astronomy and School Education

The paper describes an unusual model of integrating astronomy with physics implemented at School No. 179 in Moscow, Russia. Within a specialized physics-and-mathematics course, students study not only astronomy proper but also selected topics from the school physics curriculum.

The paper proposes a set of criteria for distinguishing levels of integration between Physics and Astronomy in school education. While Astronomy is not currently taught as a compulsory subject, it is often offered through extracurricular activities and elective courses. Embedding astronomical contexts into physics instruction is a natural and pedagogically sound approach that can reinforce students' understanding of the astronomical picture of the world by graduation.

Although astronomy is not included in the list of school subjects, building students' understanding of it and teaching its basic concepts is quite feasible for teachers, especially physics teachers. The article presents examples of acquiring and applying elements of astronomical knowledge in physics lessons. Using a problem on tides and a problem on calculating molecular speeds as examples, it is shown how physics problems help reveal interdisciplinary links between astronomy and other sciences.

The article addresses the problem of insufficient attention to astronomical content in the modern school curriculum. As a solution, it proposes the author's original instructional design for a 9th-grade physics lesson aimed at integrating key astronomical concepts into the topic of "Harmonic Oscillations." Using the annual variation of the Sun's declination as an example, the article demonstrates how an abstract physical model finds its manifestation in cosmic processes that determine the смену seasons. The lesson design includes a step-by-step transition from everyday observations to the construction of a celestial-sphere model and далее to the identification of the harmonic law. The article is intended for physics and astronomy teachers interested in strengthening the worldview-building and motivational components of their lessons.

The article summarizes the author's experience of reintroducing astronomy as a separate school subject in the 2019/20 academic year, coordinating this course with the main physics curriculum, and, after astronomy was discontinued as a separate subject at the end of the 2023/24 academic year, transferring part of its content into the physics course. Astronomy was taught in the spring semester of Grade 11, which made it possible to build on knowledge that had either already been acquired in the physics course or was being learned in parallel. A number of astrophysics problems are presented, aimed primarily at finding non-standard, intuitive, and approximate solutions.

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About

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Astronomical Etudes

This article presents an educational and methodological review of model gravitational potentials used to describe mass distributions in galaxies. Classical spherically symmetric models are considered, including the Plummer, isochrone, power-law, Jaffe, Hernquist, and Navarro–Frenk–White models, as well as the axisymmetric Miyamoto–Nagai model for disk components. Particular attention is paid to the relationship between the potential, the density distribution, and the circular velocity curve. The practical part discusses Olympiad-style problems on the motion of bodies in non-Keplerian potentials, making the material useful for teachers, senior secondary school students, and university students interested in astrophysics and celestial mechanics.

An analysis is carried out of methods for solving a certain class of problems in spherical astronomy related to calculating the altitudes of celestial bodies at culmination. An original method for solving problems of this type using the construction of a “latitude–declination” diagram is presented. Examples of problem solutions are considered.

Student Research Activity

The article is devoted to a methodological, psychological, and pedagogical interpretation of practical problems in astronomy olympiads. We proceed from the premise that a practical problem should be regarded not as a supplement to the theoretical content of the discipline and not as a set of technical operations, but as a distinct form of learning activity. The aim of the article is to propose a conceptual framework for the analysis and design of practical problems. From a theoretical and methodological perspective, the paper examines the concept of a practical problem and its place among instructional formats, the role of uncertainty as a key characteristic of its content, the methodological principle of the priority of hypothesis over algorithm, as well as the psychological and pedagogical foundations of learning through inquiry-based activity. The proposed approach is aimed at identifying invariant elements of research thinking that retain their significance when the content of problems and the techniques of solution change.

An inquiry-based laboratory module in wave optics was implemented during training camps for candidates for the Russian national team in astronomy and astrophysics (grades 10–11). For the extended version, elements of statistical data analysis are included. A sample of an additional research question is discussed separately: testing whether hair thickness depends on a person’s height using a small participant sample.

Astronomy Olympiads

The article describes the experience of developing and using astronomy olympiad problems related to the geographical features of Sakhalin Oblast. It shows how regional context can be incorporated into olympiad tasks to increase students’ motivation to study astronomy and the natural sciences. Examples of different types of problems (engaging, problem-based, and estimation tasks) are provided; they require the application of basic astronomical concepts and skills: estimating speeds and angles, working with coordinates, accounting for the Earth’s daily rotation, and using the geometry of the celestial sphere. The proposed approach can be used by teachers and subject-methodological committees when preparing sets of tasks.