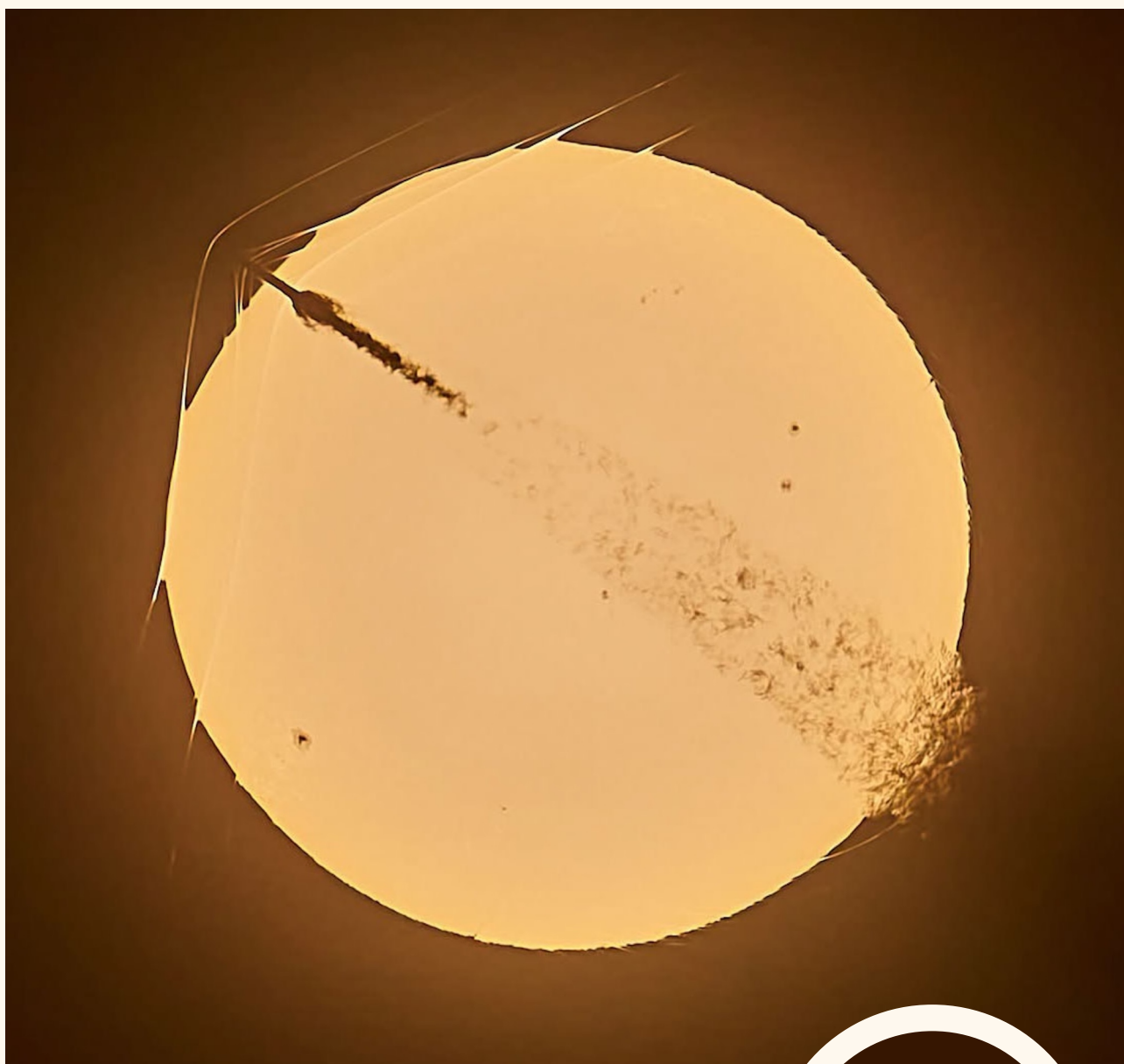




Astronomy Education

Journal



2026

Nº 2

Contents



Astronomy Education

2026, № 2

Opening Address 3

Astronomy and School Education

Dmitry Klykov. **Playing with Big Data: Working with Astronomical Catalogs in Upper Secondary Computer Science Classes** 4

This paper describes how real astronomical data can bring upper secondary computer science lessons to life. The author compiled an instructional dataset containing the properties of the brightest stars in the sky and developed scenarios for practical lessons. Using Python with the Pandas, Matplotlib, and Plotly libraries, students learn to filter, process, and visualize data, including recreating the famous Hertzsprung – Russell diagram. The materials can be integrated into computer science and physics courses and used to foster cross-curricular connections. The dataset, source code, and instructional guides are openly available and intended for classroom lessons, project and club activities, as well as independent student research. This approach helps demonstrate to students that big data is a tool for exploring the world – even the stellar world.

Astronomical Etudes

Nikolay Kondratiev. **Two-Faced Janus: On the Motion of Janus and Epimetheus** 11

The solution to an olympiad problem often hinges on one or more key ideas, without which further calculations are impossible. This article examines Problem 11.6 from the final round of the 2026 Russian National Astronomy Olympiad, concerning the motion of Saturn's moons Janus and Epimetheus. Several methods are presented for estimating the satellites' semimajor axes and orbital periods, as well as the minimum distance between them: expansion in a small parameter, binary search, direct integration of the forces, and application of conservation laws in inertial and non-inertial reference frames. The article shows which approximations allow the orbits to be regarded as nearly coincident and why Saturn's influence cannot be neglected when estimating the close approach. A comparison of the solutions demonstrates the importance of checking orders of magnitude and the range of validity of the chosen physical model.

Student Research Activity

Aleksandr Efimkin, Vladislav Glazunov, Mikhail Kachay, Porfiry Petrov
EDUSat: An Educational Platform for Studying Satellite Attitude Control Systems 19

This article presents the EDUSat educational platform in the 2U CubeSat form factor, designed for studying spacecraft architecture and attitude control algorithms. It describes the mechanical structure and reaction wheels, the electronic subsystem based on ESP32 and RP2040 microcontrollers, the quaternion-based mathematical framework, and the test rigs. The results of testing a prototype with one degree of freedom and the experience of using the platform in workshops and summer practical training for school students are discussed. An outline curriculum combining 3D modeling, programming, and analysis of the attitude control system is proposed. The platform enables a transition from simulations to experiments with real sensors and actuators and can serve as a basis for school and university projects. Typical difficulties encountered when transferring algorithms from a model to a prototype are noted.

Mikhail Rudomanov, Igor Bulygin
Mass Segregation in Open Clusters 26

This paper presents a student research project in astrophysics completed by a Grade 10 student. It demonstrates the feasibility of advanced research project work for upper secondary students and identifies communication tools and principles for structuring a student's work. The research component focuses on assessing mass segregation in 12 open clusters using data from the SAI Open Clusters Catalog. Segregation is quantified using the minimum spanning tree (MST) method, which compares the MST length for a sample of the most massive stars with the distribution of MST lengths for random subsamples of the same size. Stellar masses are estimated from photometric data using an approximate mass – luminosity relation, while a simple model of changes in the number of stars is based on the initial mass function. A characteristic relaxation time is also estimated for each cluster using formulas from stellar dynamics. The results indicate a possible relationship between the dynamical age of a cluster and the value of Δ_{MSR} ; however, because of the small sample, approximate mass estimates, and simplified cluster membership selection, the conclusions should be regarded as qualitative estimates obtained within a student research project.

About

Project of the Coaching Staff
of the Russian National Team
in Astronomy and Astrophysics

Editorial Board

I. A. Uteshev – Acting Editor-in-Chief
M. I. Volobuyeva – Executive Secretary
A. V. Veselova
B. B. Eskin

Editorial Council

Currently being formed

Reviewers of the articles in this issue

F. A. Belov, PhD (Pedagog. Sci.)
I. I. Bulygin
K. I. Vasilyev
V. V. Grigoryev
E. V. Zhabrunova
S. G. Zheltoukhov, PhD (Phys. & Math. Sci.)
M. V. Kuznetsov
S. V. Kuzmin
E. I. Ledenev
I. O. Orlov
S. V. Pilipenko, PhD (Phys. & Math. Sci.)
O. L. Starinova, DSc (Engineering)
V. S. Fedorov

Online mass media outlet
registered with Roskomnadzor,
No. FS77-91030 dated 10.03.2026.
No age restrictions

Founder & publisher: I. A. Uteshev.
Contacts: journal@astroedu.ru;
+7 (921) 920-04-58

Cover image:
Triple Shockwave from Sun Crossing Rocket.
John Winkopp, WAI Media (29.05.2026)

ISSN 3033-7917
journal.astroedu.ru

Ivan Alekseev, Angelina Veselova

**Analysis of Galactic Cepheid Kinematics
and Modeling of the Galactic Stellar Disk 35**

This article describes a student research project analyzing the kinematics of the Milky Way disk using a catalog of classical Cepheids. The Sun's displacement relative to the mean plane of the disk is estimated as $z_{00} = -37.4 \pm 0.7$ pc. The motions of Cepheids are modeled numerically in an axisymmetric Galactic potential comprising a Plummer sphere potential (bulge), a Miyamoto – Nagai disk potential (stellar and gaseous disk), and a Navarro – Frenk – White halo potential (dark halo). No significant evolution of the disk warp is found on a timescale of ~ 100 million years. The interdisciplinary and career-guidance value of the project is also discussed.

Aleksandr Mokhov. **Modeling Radial Oscillations of the Sun 43**

This student research project develops a discrete one-dimensional model of the Sun's radial oscillations: a radial sector of the star is divided into blocks, and the gas pressure between adjacent blocks is represented by nonlinear "gas springs." The frequencies and shapes of free oscillations are obtained as eigenvalues and eigenvectors of a matrix problem. For the lowest-frequency mode, a period of approximately $4.3 \cdot 10^3$ s is obtained; the largest displacements in this mode occur in the outer layers of the model. The results of the modal analysis are additionally verified by direct integration of the equations of motion using the Leapfrog method.

Astronomy Olympiads

Filipp Belov, Irina Kozlova

**Problem Sequences in Municipal-Round Problem Sets
of the Russian National Astronomy Olympiad 50**

The article briefly analyzes shortcomings in the work of a regional subject-methodological committee and proposes a way to address the shortage of creative ideas when developing a problem set for the municipal round of the Russian National Astronomy Olympiad. The approach is based on using differentiated sequences of problems sharing a common context and is illustrated with the 2025 municipal round of the Russian National Astronomy Olympiad in Saratov Oblast.

Andrey Azhakin, Maria Izmailova

**Methodological Risks of Using Official Solutions
to Astronomy Olympiad Problems for Self-Study 54**

Official solutions to olympiad problems are prepared for jury members, but after publication they are used by students and teachers to prepare for olympiads. Using materials from the regional round of the Russian National Astronomy Olympiad and the Saint Petersburg Astronomy Olympiad, the article examines four types of methodological risk: implicit choice of a model, terminological ambiguity, inconsistency between scoring criteria and admissible solution methods, and errors in published solutions. The pedagogical consequences of such shortcomings are discussed. Measures are proposed to improve the quality of olympiad materials, including after their publication.

Education and Technology

Dmitry Morozov, Konstantin Sevastyanov, Egor Gorodov

Experience in Developing a Computerized Telescope Pointing System 63

This article describes the experience of developing a computerized telescope pointing system by members of the astronomy club at the Sergiev Posad Physics and Mathematics Lyceum. The system was developed for a reflecting telescope on an equatorial mount. The article demonstrates that a relatively inexpensive system can be built with all the functionality required for educational astronomical observations.