Poster at Splinter Meeting

Splinter C

Astronomy Project for 8^{th} and 9^{th} grade students at the Alfried-Krupp-Schülerlabor

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During the spring and autumn school break we offer 8^{th} and 9^{th} grade students to come to the Ruhr-University Bochum. During one week they can experience everyday life at university and can do research on one of our projects at the *Alfried-Krupp-Schülerlabor* and the Department of Physics and Astronomy.
One of these projects has the topic "Astronomy - how we get to know whats out there" (*Astronomie - woher wir wissen, was da draußen ist*). We want to spark their interest in astronomy and physics and be sure that their fascination lasts. With the materials we provide they can continue performing their own experiments at home. Our central theme is to discover how much different information astronomers can get from only light. We want them to find answers through their own experimentation.
One topic is telescopes, how they work and what kind of telescopes are needed for the observation of different wavelengths. We give the students the opportunity to observe the nightsky with our roof-top observatory. Through experimentation with spectrographs they examine the composition of light and its application in astronomy. They also use the freeware program "Aladin Sky Atlas" and different archiv data in order to create their own color images of astronomical objects. By creating them they learn how to interpret such images. Furthermore, the students learn how to orientate oneself in the nightsky. For this purpose they construct star maps, learn how to use them, how the celestial coordinates work, and which constellations are typical for the seasons. Additionally, the students study the sun and observe it with our solar telescopes.
Up to now the project has taken place five times with a total of 68 participants. 94% answered "How did you like your project?"with very good or good.

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"Black Holes" - An E-Learning-Course for arguing in modern cosmology

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A main aim of physics lessons is to support students in their development to become mature citizens. Especially in the natural science, it is important that students learn how to examine and create scienctific arguments in order to make reflected decision. This is for pupils easier with everyday phenomena than with issues that affect the modern worldview. An attractive possibility to support pupils and teachers to achieve this aim is proposed by an E-Learning-Course. The E-Learning-Course was developed by a collaboration between teachers and researchers. It combines the subject of black holes with a scientific argument training. The course supports secondary school students to develop their reasoning ability and their interest for scientific contents. Teachers can use the E-Learning-Course in in physics classes and in German classes too.

The Kelvin-Helmholtz Instability at school

Lenka Bzduskova, Siegen

The Kelvin-Helmholtz Instability appears on layer flows at the shear layer. When two fluids with different densities and velocities flow past each other, they will develop waves, respectively turbulent flows. The best known example of this phenomenon is the ocean wave; resulting of the air and the water moving with different velocities. A similar observation can be made in the sky, too: wavy clouds might develop through different speed of moving air layers next to each other. Even in the atmosphere of Saturn it is commonly to be observed.

Illustration 1: The Kelvin-Helmholtz Instability at the atmosphere of the earth

(Source: http://de.wikipedia.org/w/index.php?oldid=130464126)

The presentation shows, how to build a model of the Kelvin-Helmholtz Instability for use at school.

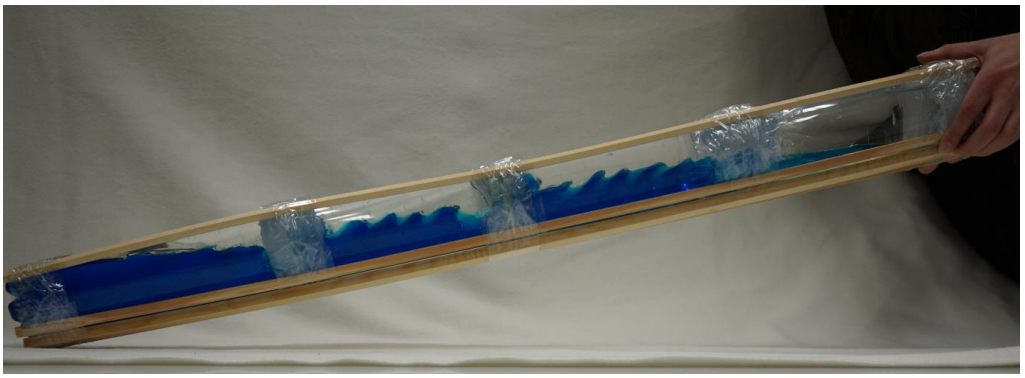

Illustration 2: The model of the Kelvin-Helmholtz Instability

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Magic Moments in Astronomy – Witness and comprehend the World

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Astronomy can be considered as the history of constant exploration and development of new horizons. As the main idea for a professional as well as a student-oriented education we recommend a procedure in line with the chronological exploration of new horizons. At the beginning of what we nowadays regard as the exact natural sciences lies the visual astronomy and especially the genuine experience of astronomy. The silent and plain observation of a sunrise or the starry sky are both fascinating spectacles of a world full of experience which still constitute along with wide-open glances and looks of inquiry an entryway for the pupils to distant celestial objects. Since the natural desire to understand the new and unknown leads inevitably to the reflection and pondering, the comparison, the observation and experimentation as well as to the first theories, it is imperative to provide enough science-promoting free space for the idea and theory generation of the eager learners and to seriously discuss their responses and suggestions.

Such a subject-didactic approach is underpinned by the findings of cognitive psychology – Parallelism of phylogeny and ontogeny (Parallelität von Phylo- und Ontogenese) – as well as by well-known school practitioners such as Martin Wagenschein To understand is to right on the phenomena (Verstehen heißt stehen auf den Phänomenen) or Christoph Berg Worldview needs world-view (Weltanschauung braucht Welt-Anschauung).

It becomes apparent that with our approach – which looks back on a long tradition at the Department of Physics at the University of Siegen – not only geeks but also several common boys and girls find their own way into the eminently important field of astrophysics.

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Zeitreisen und Zeitmaschinen – Science und Fiction im Unterricht

Andreas Müller[1]

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Passend zum Einsteinjahr 2015 wird vorgestellt, wie das Thema Zeitreisen im Schulunterricht eingesetzt werden kann. In den Schulfächern Physik, Astronomie und Mathematik kann die Physik von Zeitmaschinen behandelt werden, die auf der speziell und allgemein relativistischen Zeitdilatation sowie auf (spekulativen) Wurmlöchern beruht. Fachübergreifend können die Lehrerkollegen in den Fächern Geschichte und Deutsch diskutieren, was den Zeitreisenden in der Vergangenheit und Zukunft erwarten würde und welche gesellschaftlichen Folgen Zeitreisen hätten. Zur Ausgestaltung der Unterrichtseinheiten wird eine Fülle an Materialien (Vortragsfolien und Rechenaufgaben) angeboten.
Referenz: Andreas Müller, *Zeitreisen und Zeitmaschinen – Heute morgen war ich noch gestern* (Springer 2015)

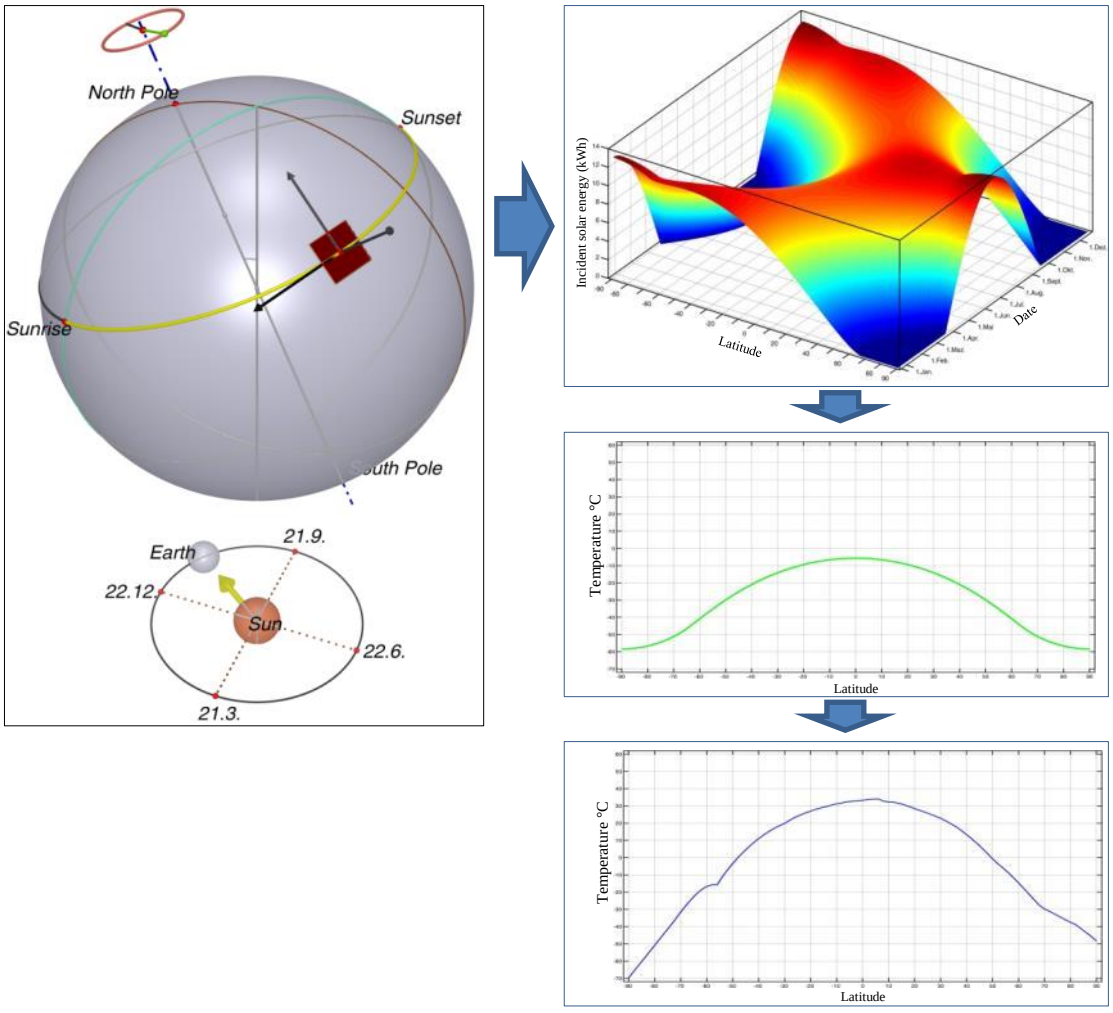
Influencing factors on surface temperature, a step-by-step analysis and illustration

Chat Tran (Universität Siegen, Didaktik der Physik, E-Mail: tran@physik.uni-siegen.de)

Abstract

Investigations of the balance of radiation on planet earth and the determination of resulting surface temperatures are initial points for various following discussions both for planar physics and investigations on the limits of renewable energies. Therefore, this basic knowledge has to be taught at school.

The surface temperature of planet earth depends on different factors: time of radiation, degree of latitude, optical depth through the planet´s atmosphere, distribution of air density, absorption and the scattering, such as clouds and earth surface albedo. Within this talk it will be shown, how these impacts can be simplified through step-by-step assumptions and how they can be calculated and displayed graphically by using computer simulations (see graphics and pictures).



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Radioastronomy for the Classroom

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Inquiry-based approaches to teaching astronomy in schools are in most cases limited to the optical range of the electromagnetic spectrum. Regarding celestial observations, the optical telescope is still the tool of choice for teachers and students. But scientific breakthroughs are to be expected (also) in different wavelengths. The first results of ALMA show new and fascinating discoveries. With the installation of other ground based instruments like LOFAR and SKA, we are at the dawn of a new era in radio astronomy. In order to let the pupils participate in the coming research results, it is necessary to develop new educational concepts to boil down the principles of radio telescopes, discuss the technical challenges and analyze the astronomical data in the classroom. In this talk I will present a successful approach to radio astronomy using low-cost everyday items connected with an USB-Stick for Software Defined Radio. The incoming signal is then visualized by freeware computer programs. By changing the setup of the antenna from a simple wire-loop to a parabolic dish and varying the filters/amplifiers, different wavelength ranges could be covered. Whereas low frequency signals only reveal temporal variations of the signal strength without giving too much information about the direction, signals in the GHz-Range could easily be spatially resolved. Scanning the sky in the GHz-Band leads therefore to an intensity-coded celestial map at the chosen wavelength - for example in the light of the 21cm line of hydrogen. The resolution in frequency is accurate enough to distinguish different velocities of the hydrogen gas due to the Doppler-effect. Regarding the electronic parts of the radio telescope as a black box, this concept could easily be used at school starting at grade nine. A more sophisticated description of the electronics is reserved for students of grade eleven.