Astronomy and Education

Die App AudioHimmelsführungen

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[1] *Obercunnersdorf*

Was für die anderen Naturwissenschaften das Experiment bedeutet, ist in der Astronomie die Beobachtung: Erkenntnisgewinnung und Lernmotivation. Deshalb sollte sie eine tragende Säule eines jeden Astronomieunterrichts sein, unabhängig von seiner Organisationsform. Nachts eine Schulklasse an einem günstigen Beobachtungsplatz zu versammeln, um ihr den Sternhimmel näher zu bringen, ist allerdings nicht so einfach. Mit der Applikation AudioHimmelsführungen können Lehrer und Dozenten junge Menschen nun beauftragen, ihn an einem für sie geeigneten Ort mit ihrem Smartphone selbst zu erkunden. Das bringt sogar den Vorteil, dass sie die Audiodateien jederzeit unterbrechen, zurückspulen und wieder fortsetzen, und so die Aneignungsgeschwindigkeit selbst bestimmen können. Auch für die in den Führungen 2 bis 5 besprochenen Fernglasobjekte können sie sich die individuell erforderliche Zeit nehmen. Die 20-minütigen Himmelsführungen vermitteln in ihrer Gesamtheit einen grundlegenden, allgemein bildenden Einblick in die Astronomie. Die Zusatzfolge 6 setzt sich mit der Astrologie auseinander und soll insbesondere Lehrern behilflich sein, eine heikle, aber nicht ganz unwichtige Aufgabe zu erfüllen. Im Vortrag wird ein Smartphone an einen Beamer angeschlossen und die Handhabung der App live demonstriert. Das Konzept und der didaktische Einsatz der Führungen werden diskutiert und die zur App entwickelten Arbeitsblätter vorgestellt.
Web: http://www.lutz-clausnitzer.de/AudioGuideSky/audioguidesky.html

Astronomy and Education

Astronomisches Beobachten: Ein Schlüssel zur Faszination an Naturwissenschaften

Andreas Müller[1]

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Die Beobachtung des klaren Nachthimmels unter optimalen Bedingungen ist ein intensives Erlebnis. Noch schöner und lehrreicher ist es, wenn man diese Erfahrung mit astronomischem Hintergrundwissen macht oder die Beobachtung unter Anleitung eines Astronomiekundigen erfährt. Dazu ist nicht unbedingt ein Teleskop erforderlich, weil vieles schon mit bloßem Auge zugänglich und erfahrbar ist. Die Sternbilder erzählen uns die Geschichten und Mythen des Himmels und verbinden uns auf wundersame Weise mit unseren Vorfahren und deren Erkenntnissen (z. B. Kalender und Ursprung der Wochentage). Das Beobachtungserlebnis ist jedem zugänglich: Schon mit Grundschulkindern kann man sich auf Sternschnuppenjagd im August machen oder die Strukturen der Mondoberfläche betrachten und erklären. Selbst am unbewölkten Tag lassen sich Sonnenbeobachtungen durchführen und so die Sonnenflecken, der Sonnenzyklus und die Physik der Sonne studieren. Der Astrophysiker Andreas Müller stellt Best-Practise-Beispiele für den Schulunterricht und die gemeinsame Beobachtung vor. Die Astronomie stellt somit eine Eintrittskarte in die moderne Naturwissenschaft dar, die schon in frühem Lebensalter gelöst werden kann.

The solar impact on renewable energy on planet earth

Christian Deitersen (University Siegen, Department of Physics, Observatory)

In media the energy turnaround is a widespread topic. It is mainly discussed under economic or social issues. For a deeper understanding it is important to consider this topic both from physical and astronomical perspectives.

All renewable energy carriers are fed by solar energy. By using thermodynamics to determine limits on energy conversion rates and considering the natural devaluation of solar energy (shown in figure 1) one can estimate the maximum possible efficiency of renewable energy power plants. It is especially possible to calculate the required surface area to satisfy a certain energy demand. Using these results to estimate the area needed to supply a country entirely by renewable energy it is obvious that there is a direct conflict between the area needed for different purposes such as e.g. food production, living spaces and the providing of energy.

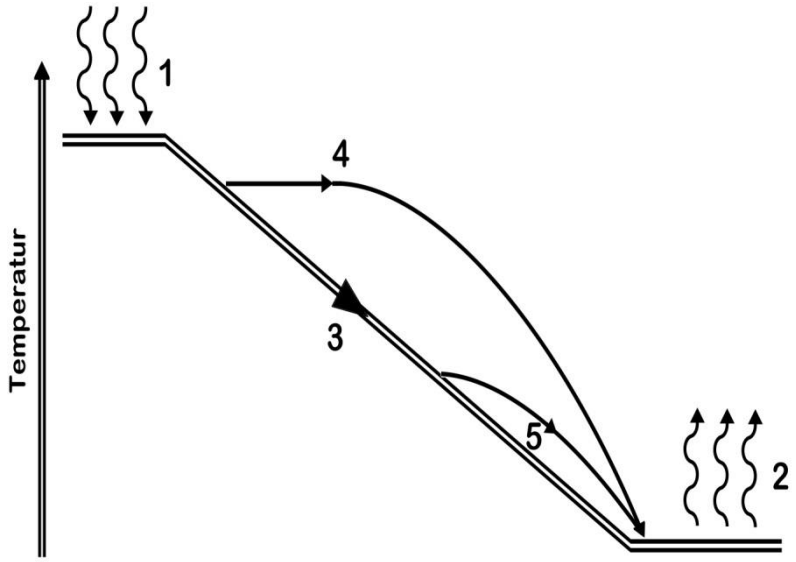

Figure 1: The natural devaluation of energy in geosystems and the using of renewable energy within the chain of debasement (graphic by Christoph Springob)

1) solar irradiation (T=6000K)
2) Thermal radiation of earth into space (T=288K)
3) Natural thermal devaluation of energy in geosphere
4) Technical usage and devaluation of solar energy
5) Technical usage and devaluation of wind and water power

Astronomy for blind and visually impaired students

Simon Kraus, Eduard Krause (University Siegen, Department of Physics, Observatory)

In the public opinion astronomical and astrophysical topics are perceived both as significant and attractive. Because of their importance they should be part of our general knowledge. Therefore these topics have to be integrated to school education. At the same time it should be considered to make these contents accessible for every student. This includes also blind students and those who are visually impaired, which is a major challenge.

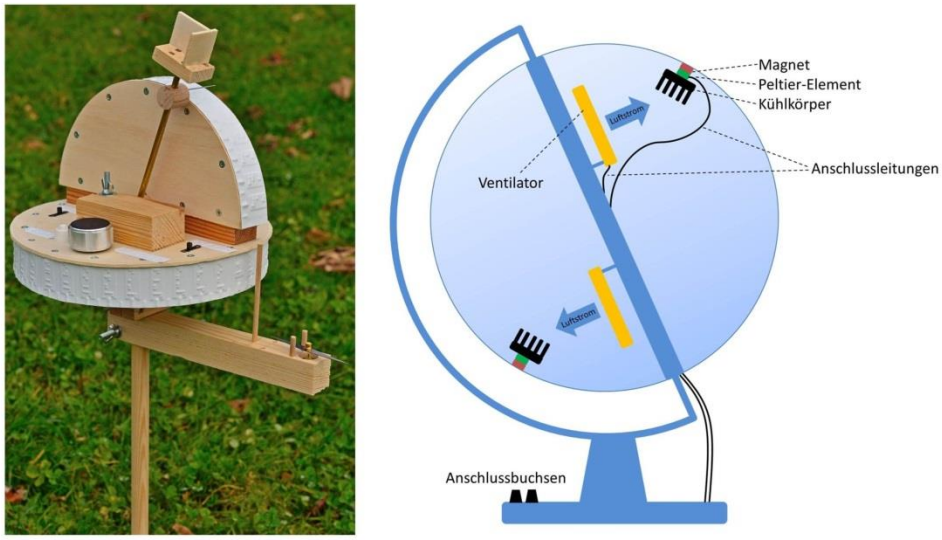

Figure 1: Goniometer for the measurement of the sun` position (left) and a schematic sketch of a model showing sunspots with their low temperature and magnetic characteristic.

It is desirable that these approaches exceed simple mechanical models and use the full spectrum of human perception. For example such models can make use of the thermoreception to illustrate lower temperatures as one of the fundamental properties of a sunspot. Another objective was the development of an instrument, which allows blind people to determinate the position of the sun on their own. This talk will give a short overview on some astronomical models and instruments for blind and visual impaired students.

Astrophysics in the Classroom

Ulrich v. Kusserow (Olbers-Gesellschaft e. V. Bremen)

There emanates a great fascination from a variety of astronomical phenomena as well for younger people. It is therefore tempting to integrate the debate about appropriate topics into motivating school teaching. Thermodynamics, electromagnetism, atomic and nuclear physics as well as Special Relativity are the desired teaching contents set out in the curricula for the high school physics classes. In this lecture it will be demonstrated how appropriate and interesting astrophysical processes in the field of Heliophysics can be introduced profitably as a motivation base in these classrooms.

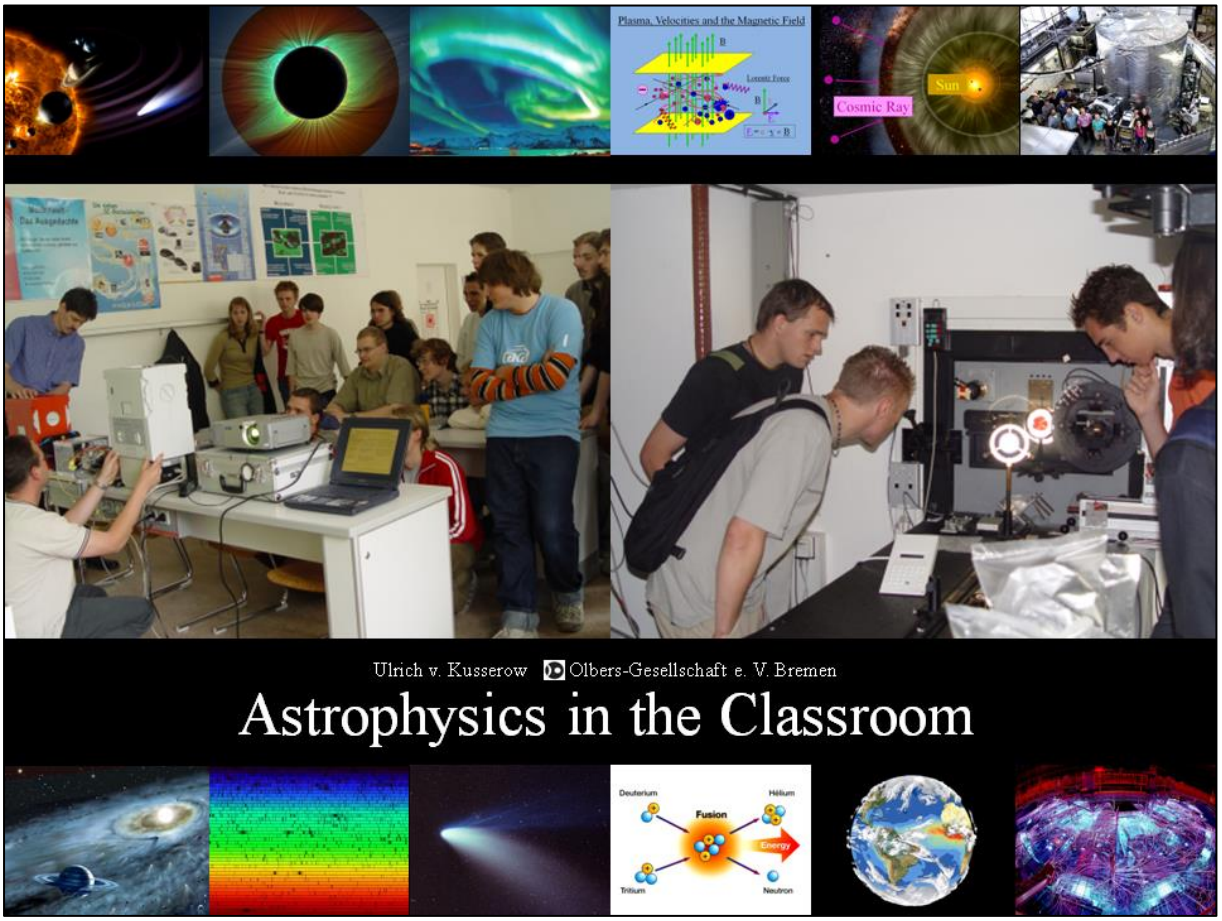

Figure 1: © U. v. Kusserow (2), NASA, M. Druckmüller et al., PALAZZI publish. comp., U. v. Kusserow, NASA, CLOUD/CERN, D. A. Hardy/NASA, N. Sharp/NOAO , H. Leue, ITER, NASA, Sandia National Laboratories

Models for teaching planetary science

Ina Militschenko, Lenka Bzduskova (University Siegen, Department of Physics, Observatory)

Models often play a significant role, when dealing with astronomical and astrophysical contents. They visualize exemplary circumstances and situations that are generally not directly observable. Moreover, they have the important feature to facilitate an active examination of specific topics and subjects.

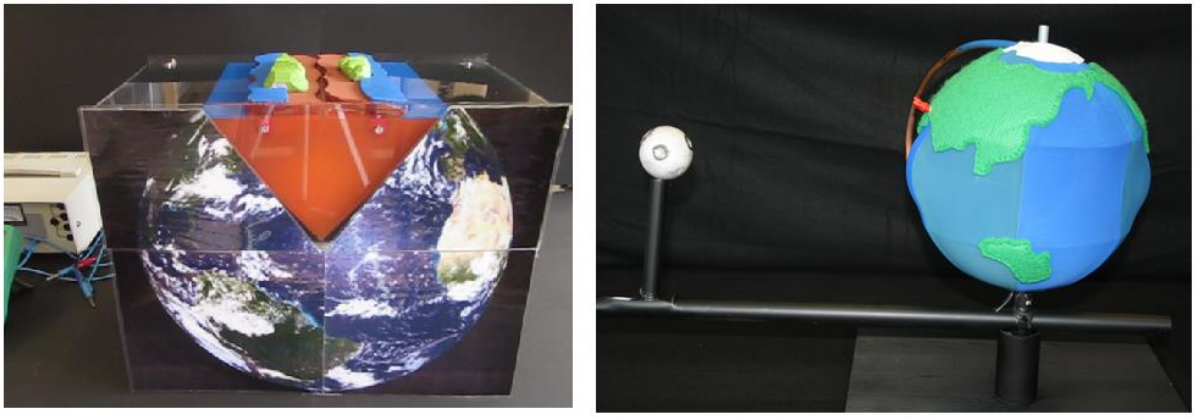

Figure 1: Experimental setup of the models concerning seafloor spreading (left) and tides (right).

Therefore, vividness and the individual initiative are equally essential and vital for the successful learning of younger students. Additionally the procedure of exemplary illustrating of certain selected contents from the field of planetary science is introduced. Models of differentiation, mantle convection, seafloor spreading and also of the tides are demonstrated.

How to weigh a star in the classroom - mass determination of the visual binary 70 Ophiuchi

Stefan Völker (Friedrich-Schiller-Universität Jena)

In common textbooks about astronomy one can find schemes like the one shown in figure 1 together with pictures of the true absolute orbit of visual binaries. This kind of schemes and such pictures are too much simplified, so that students get the impression that determining stellar masses is as easy as measuring the two semi-major axes in a picture.

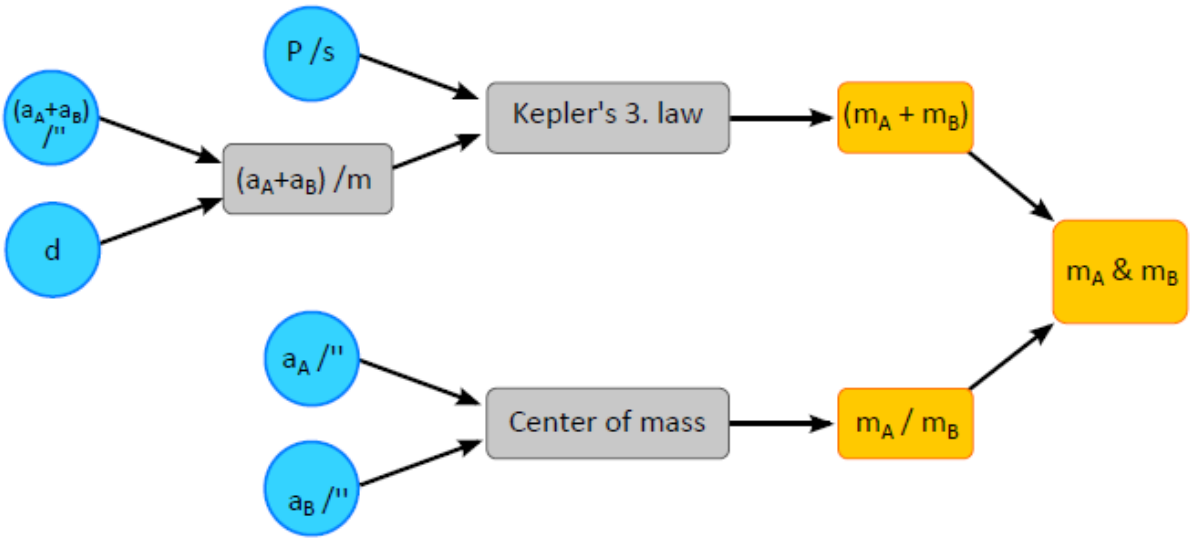

Figure 2: mass determination; measured quantities in full circles

In this talk I will present a project for students on mass determination of the visual binary 70Ophiuchi, taking into account that the movement of the binary is superposed by its proper motion and the stellar parallax. Furthermore the difference between the apparent and the true orbit is discussed. The project uses real astronomical observation data. One data set was collected with the 40-inch refractor at Lick Observatory and the other is listed in the Washington Double Star Catalog.

Beside the astronomical knowledge students get an insight into the scientific method. This means, for example, the method of least squares and not the use of complicated professional software. Every step of the analysis can be done with common software like Microsoft Excel or GeoGebra and the students CAS calculator.

Computing stellar structure with widespread software

Adrian Weber (University Siegen, Department of Physics, Observatory)

In order to understand the physics of stars it is necessary to study the stellar structure which is described by a system of partial differential equations. These equations can only be solved analytically in certain very simple cases, generally there are only numerical solutions. It is necessary to calculate any of these equations with the help of a computer. Without the knowledge of how to produce these solutions it is difficult to get a deeper understanding of this topic.

Within this talk I will show how to solve these equations of stellar structure by widespread software which would not require high programming skills. It is sufficient to use table calculation software (e.g. Microsoft Excel, Open Office Calc...) or modelling software which can be downloaded for free from the internet (e.g. Coach, Dynasys...).

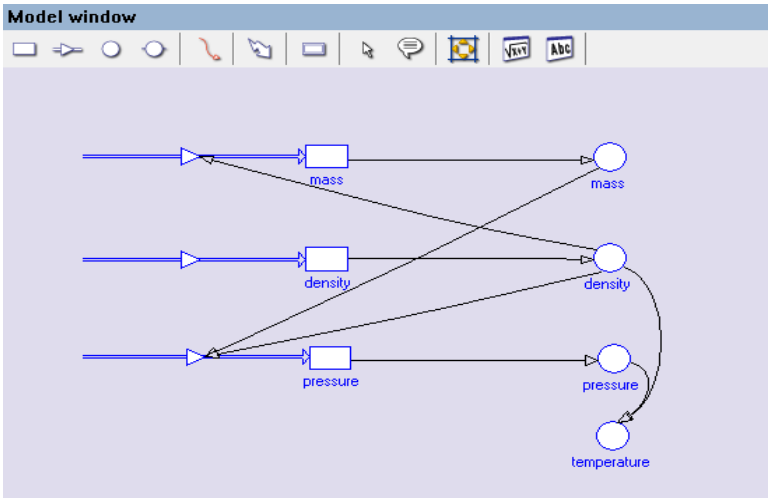

Figure 2: Polytrope stellar model in Coach 6.0

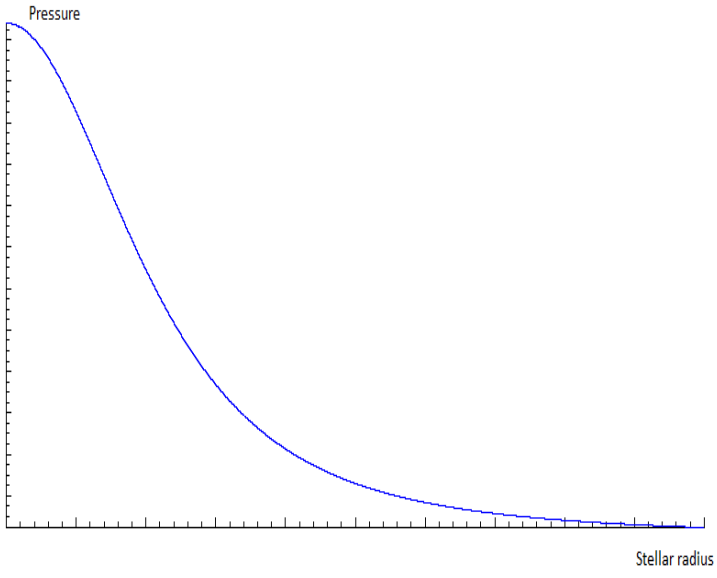

Figure 3: Pressure in a polytrope stellar model