

An Online Undergraduate Astronomy Lab Course

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Current on-campus astronomy lab course

- Satisfies core curriculum lab requirement.
- A separate lab course from the lecture.
- Fixed schedule.
- In-class spectroscopic, optics, parallax, computer exercises + paper and pencil.
- Group viewings at campus observatory.

On-line course

- Off-campus students wanting to complete degree requirements.
- Off campus lab courses are a challenge.
- Astronomy is well-suited. Same sky for all.
- Equipment can be constructed or quickly ordered.

Dept learner objectives used in writing on-line course .

- Utilize scholarly research methods.
- Apply the scientific method and critically evaluate scientific information.

Learner objectives continued (more astronomical)

- Share information and advise one another in obtaining and explaining observations
- Apply scholarly research methods to assist with understanding of astronomical processes and topics including visual phenomena in the sky, as well as distance, temperature, mass, elemental composition determination of stars and galaxies.
- Construct and use simple laboratory equipment in astronomical observations

New additional learner objectives for each module: Module 1 example

- Become familiar with scholarly research methods. In this case watch for cycles like the daily cycle of astronomical objects due to the Earth's rotation.
- Use simple laboratory equipment in astronomical observations, in this case, the “Star and Planet Locator” a modern version of the ancient astrolabe and/or the *Stellarium* PC planetarium. program.
- Recognize the scientific method and critically evaluate scientific information.
- Apply scholarly research methods to develop an understanding of astronomical observational processes and topics such as daily visual phenomena in the sky.

Graded Items in the Course

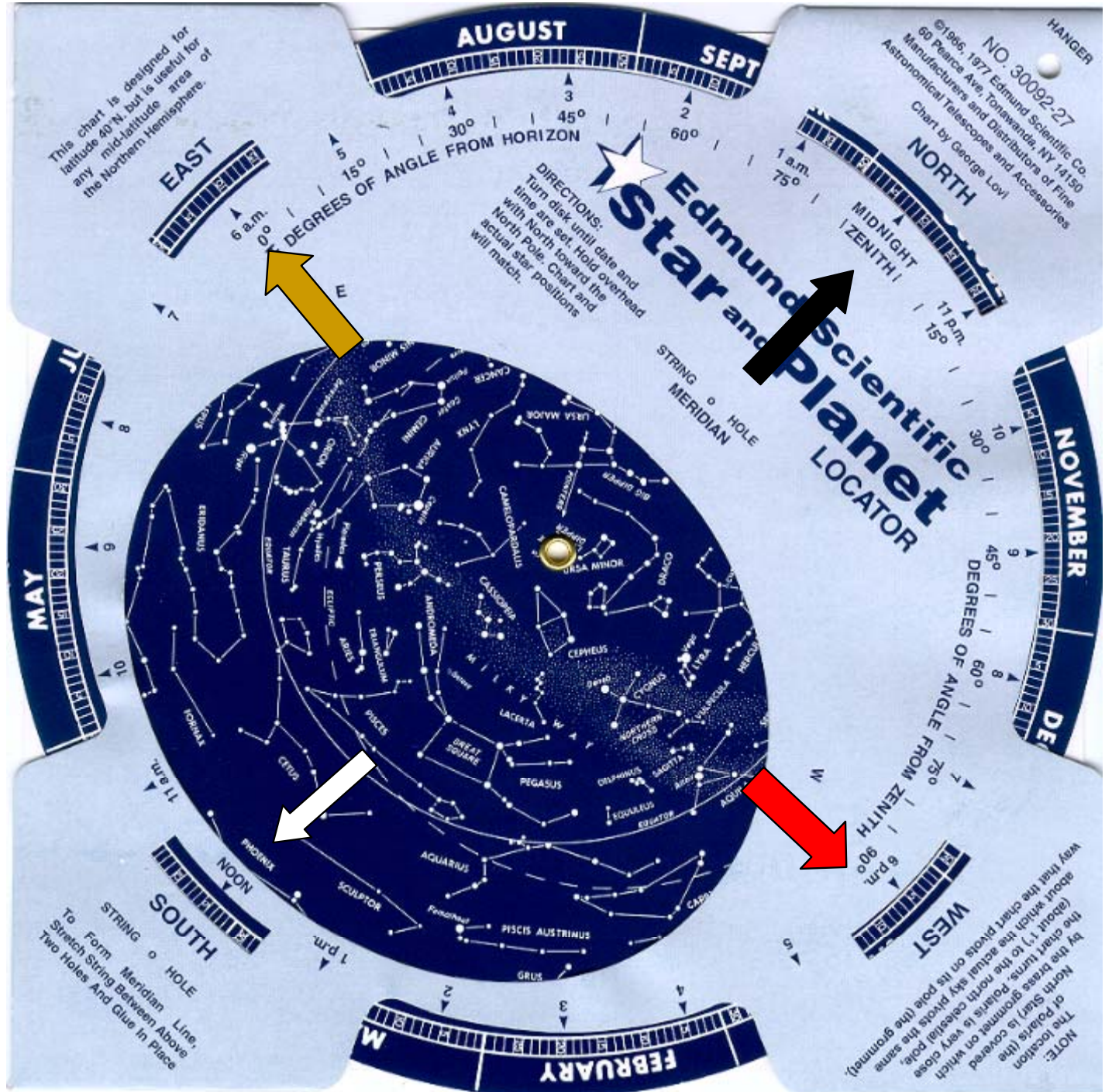
- Data calculations, drawings and photos in an “observational notebook”.
- Scanned drawings, plots, digital photos pasted in notebook for submission.
- Class discussion among students. Introductions, discussion about problems, online astronomical news items, questions asked.
- Open book multiple choice assessments on questions given in the 12 lab modules.
- Closed book proctored multiple choice final exam (similar to module questions). About 1/3 of the grade.

Aspire to a non-virtual lab course

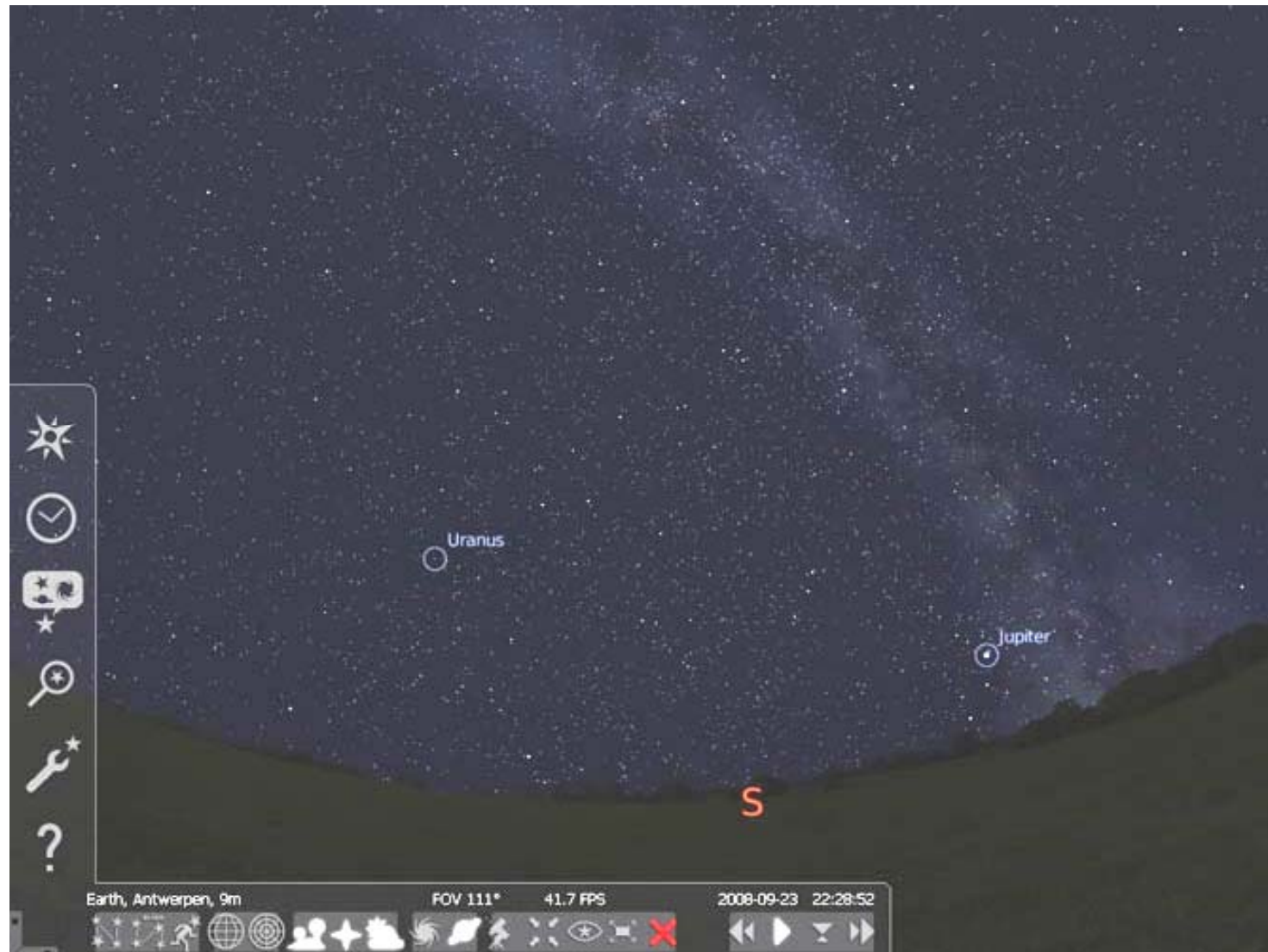
Real equipment, real sky

- To identify stars and planets in the sky, students use a “classic” Edmund Scientific Co. paper “star wheel” and/or the free Stellarium PC planetarium software.
- Some like the historically important star and planet finder. Some prefer pc planetarium or ipad.
- Document and submit photographs.

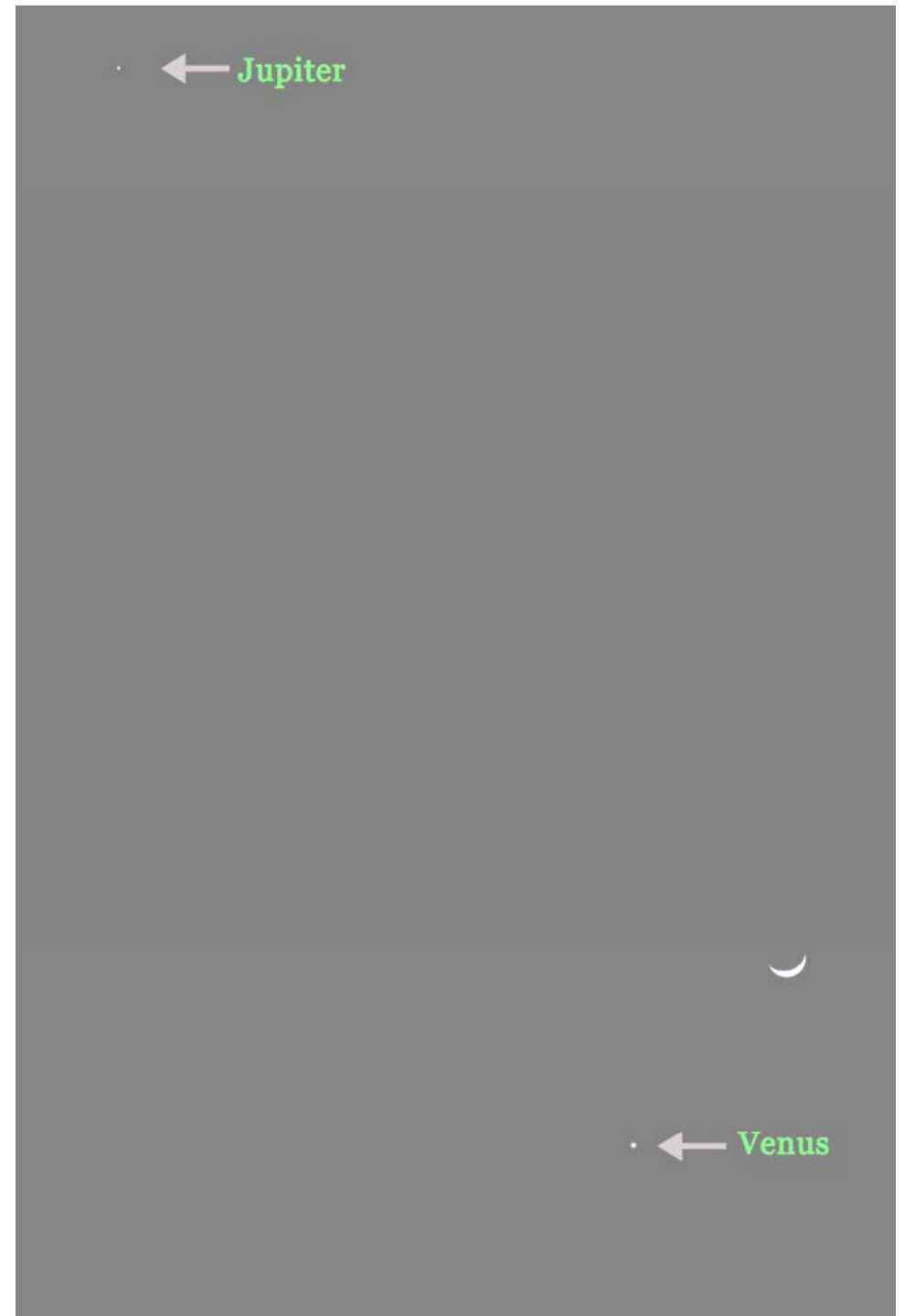
Star and planet locator.



Stellarium screen image.

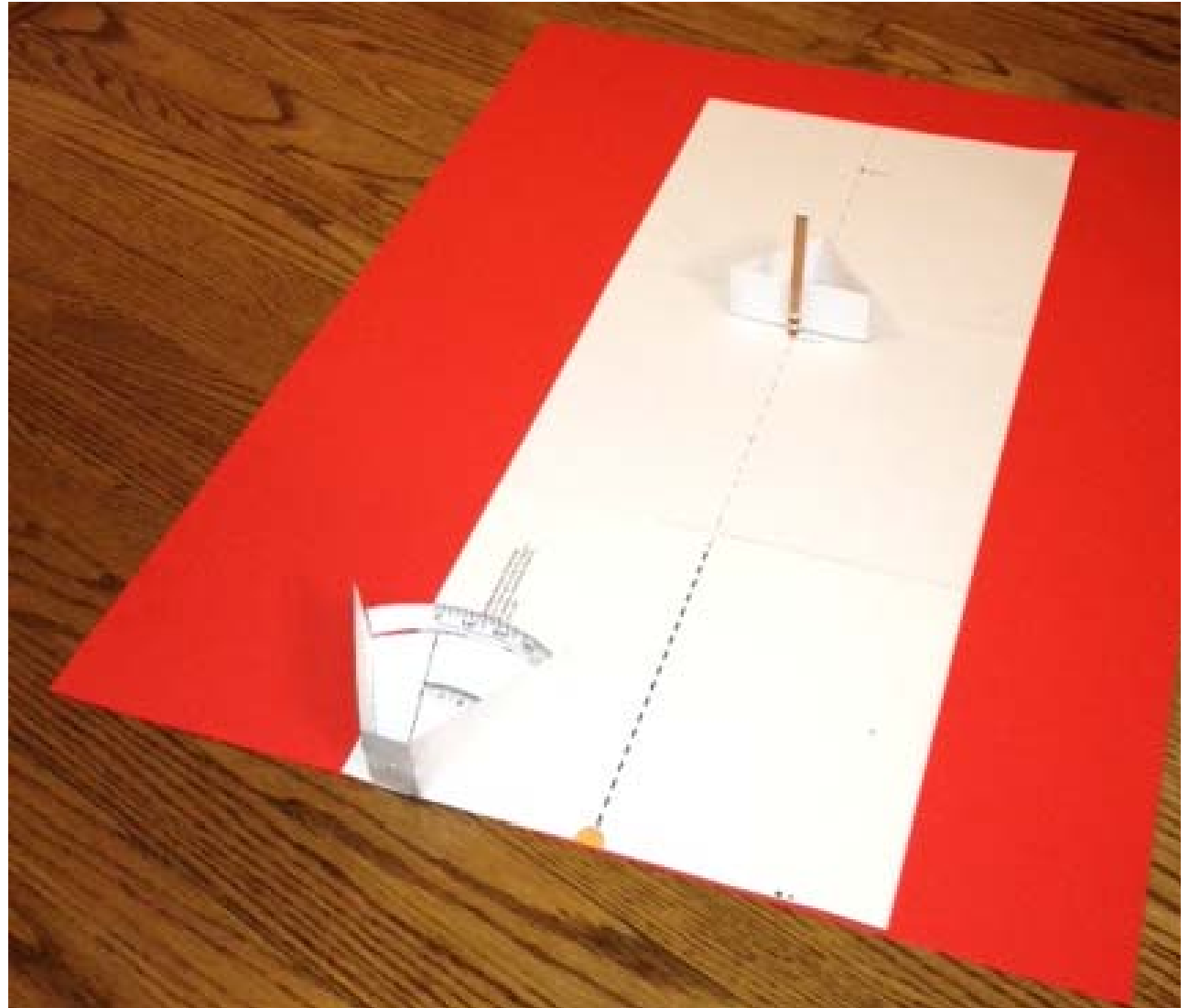


- February 25, 2012
- Moon, Jupiter, Venus
- By student
- Stephen Walker

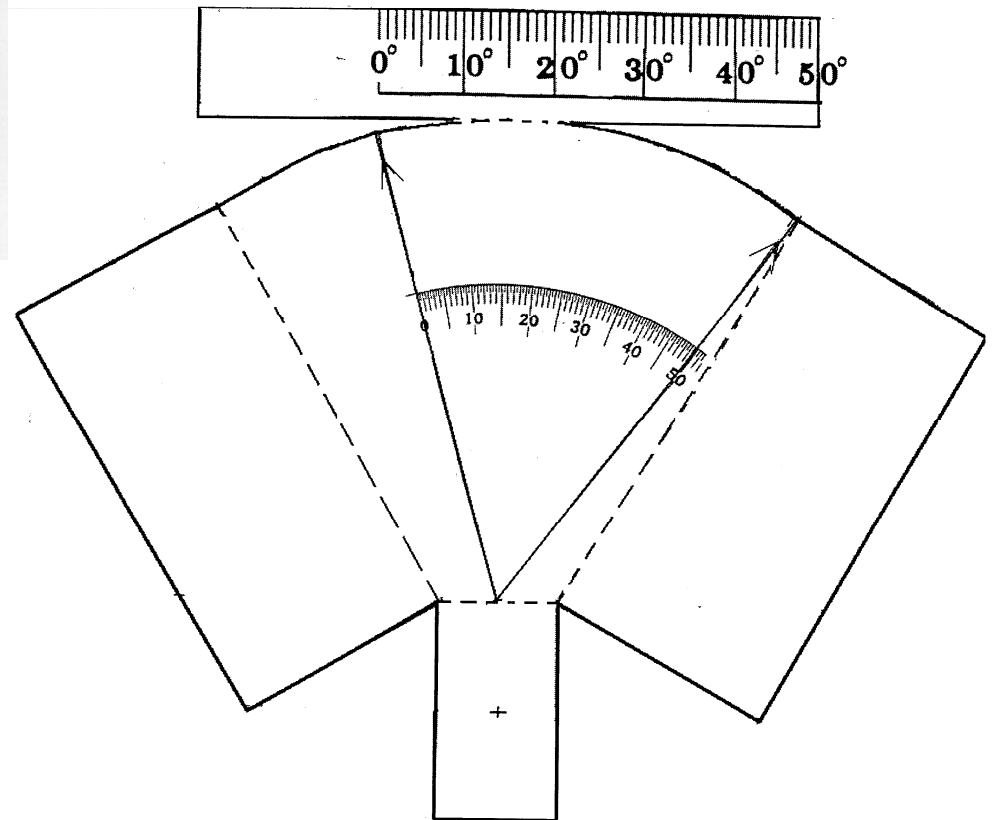
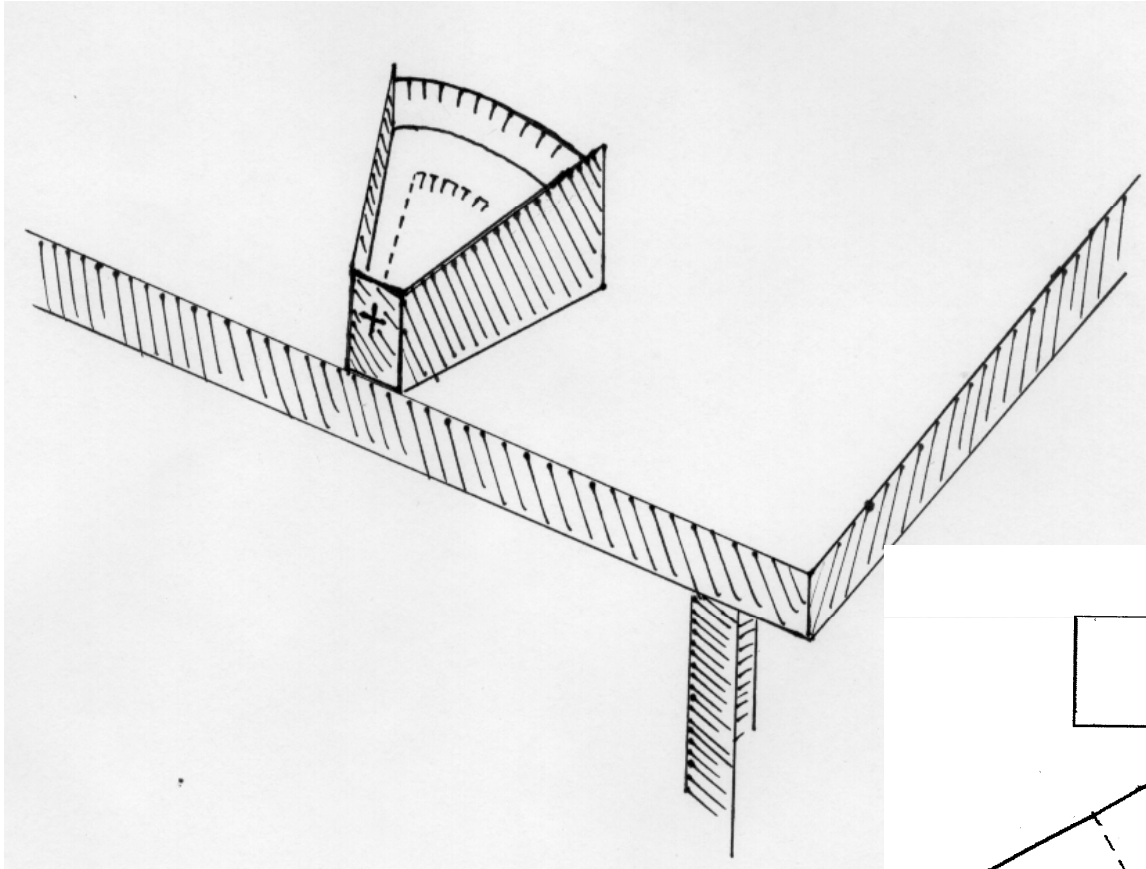


Angular size and parallax; Table top universe

- Pin-hole protractor
- “Pencil” star for parallax vs distance
- Paper base for angular size vs distance
- Earth orbit/Sun baseline
- Turn in photo of set-up, measurements.



Pin-hole Protractor



Lens and telescope kit: Large lenses for basic optics measurements.

Multiple choice questions.

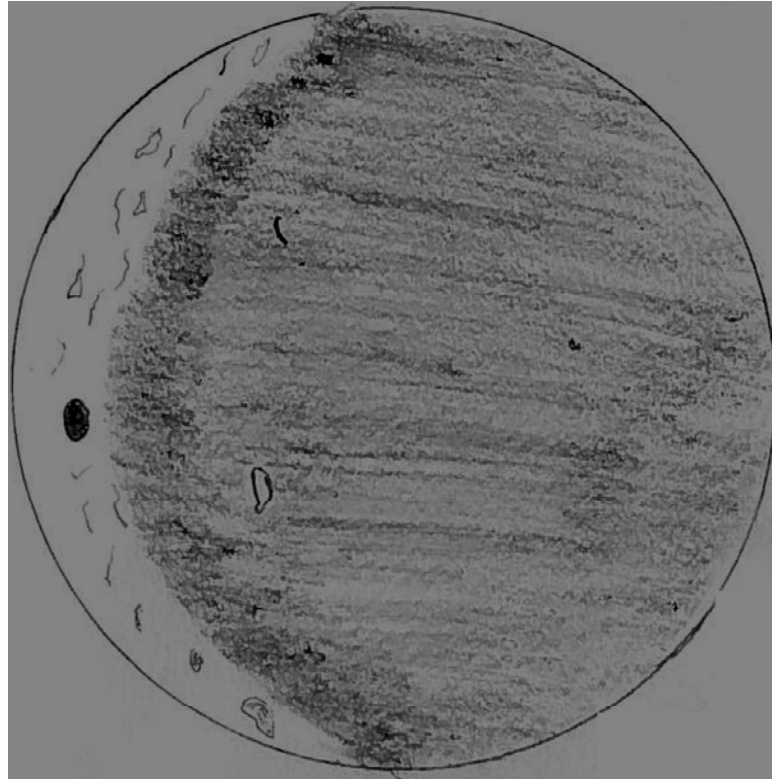


Assembled telescope + very steady homemade mount

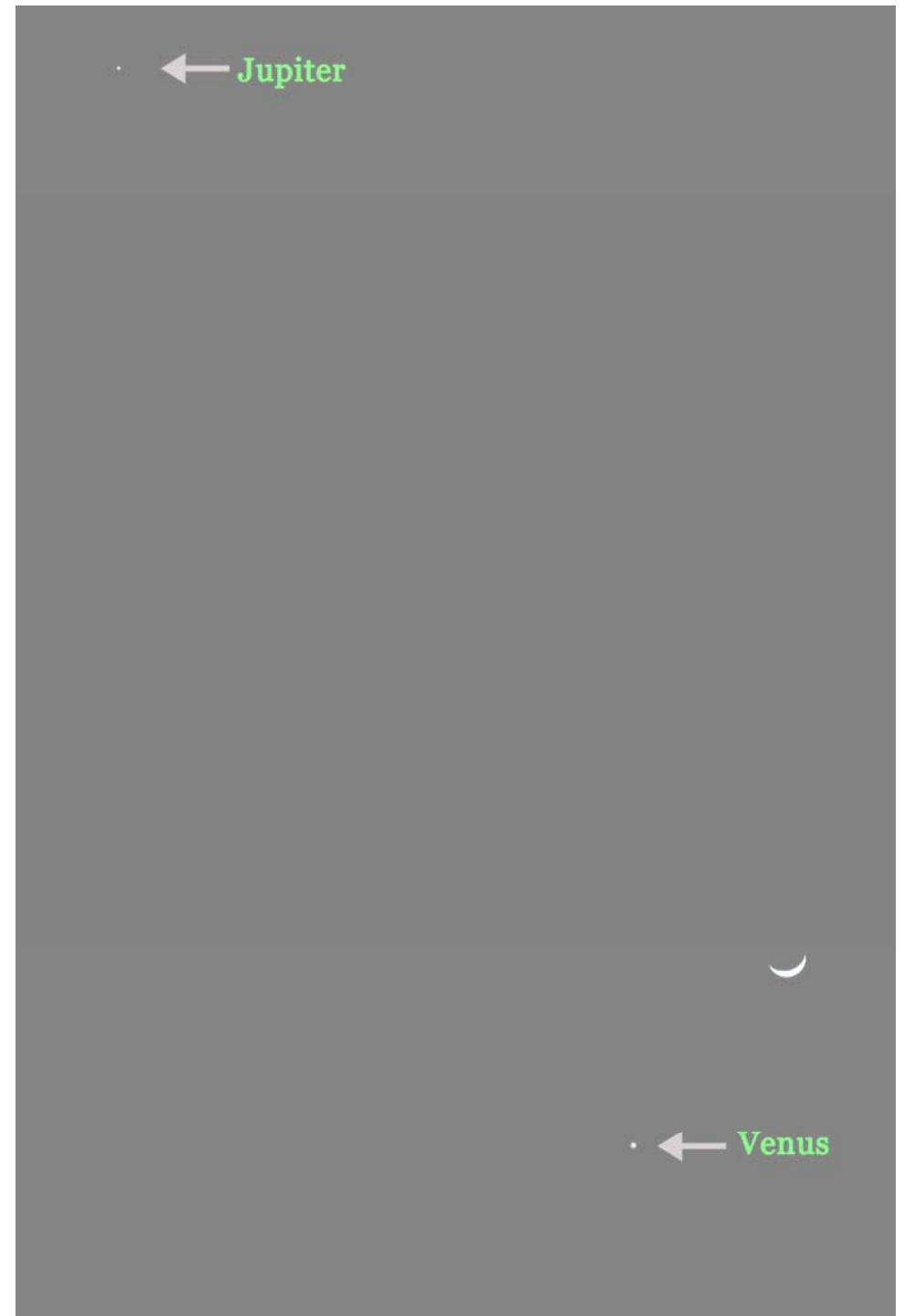
- Submit photo like this student's.



March 17, 2012 student sketch of evening
crescent Moon via kit telescope. 7 x.



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A more difficult
Observation.
Golf ball shading
matches 3rd quarter
moon.
Sunny clear morning
needed.
Extra credit.



Spectra

Spectrum
grating
glasses

Street light
(mercury vs
sodium)
spectra .

Photo via
grating
“glasses”.



Conclusions

Plus:

- University of Alabama online undergraduate astronomy lab course successfully taught since 2009.
- Enables students working full time off campus to complete the Natural Science core curriculum lab requirement.
- On-line self paced nature of the course permits a more active observational experience rather than the on-campus course.
- Photos, assessment and discussion documentation.

Conclusions

Minus:

- Some exercises are difficult without an instructor beside the student. Also as in all self-paced courses some students put off completing exercises until the end of the semester.
- The course is actually fairly difficult for some students. We are exploring other ways to help them understand the course material better.

- Thank you

Example: Learner Objectives and Discursive Questions

- **Module 01: The Daily Motion of the Sky – THE STAR AND PLANET LOCATOR**
- **Learner objective:** Students will: become familiar with scholarly and research methods; learn to use simple laboratory equipment in astronomical observations.
- **Learner Objective Question: What equipment did you use in this module?**
- **Learner Objective Question: What is its purpose?**

- **Learner Objective:** Scholarly and research methods will be applied to understanding astronomical observational processes and topics. In this module, the processes are visual phenomena in the sky, the daily motion of all objects in the sky due to rotation of the Earth and differing locations of the observer.
- **Learner Objective Question:** In your use of the Star and Planet Finder (or the supplemental Stellarium computer program), what daily motion is apparent over 24 hours for an observer in the mid-northern hemisphere of the Earth.
- **Learner Objective Question:** Explain how most stars move relative to the east and western points of the horizon. How are some stars in the sky perpetually even if the Sun prevents us from seeing them?