NASA Exploring Space Challenges, where today's students are tomorrow's explorers.
Encourage students to create, design, research and use technology at
**http://esc.nasa.gov**.

# MISSION: MOON MATH CHALLENGE

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# Mission: Moon Math

**Grade Levels: 5-8**

**Focus Question:** What kind of measurement can you make of the Moon?
1. Example: What is the diameter of a crater on the Moon?
2. Example: How long does it take the Moon to rotate once on its axis?
3. Example: Does the Moon move at a constant speed in its orbit?

**Instructional Objectives:**
1. Students will acquire basic measurement skills.
2. Students will understand measurement uncertainty in scientific investigations.
3. Students will conduct a scientific investigation in the context of the Moon.
4. Students will research lunar geology, geography, topography and lunar cycles.
5. Students will provide an oral and written presentation summarizing the results of their experiment.

**National Standards**

*Science:*
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Earth in the solar system
- Understanding about science and technology

*Mathematics:*
- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Develop and evaluate inferences and predictions that are based on data
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and other

*Technology (from International Society for Technology in Education):*
- Students are proficient in the use of technology
- Students use technology tools to enhance learning, increase productivity and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications and produce other creative works.
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use technology tools to process data and report results.

# INTRODUCTION

NASA is returning humans to the Moon as early as 2020, with a robotics mission planned as early as 2015. Today's students will be our next generation of explorers and just may be the first people to live and work in a community on the Moon. Since measurement is a fundamental building block for science, technology and engineering, the **Moon Math Challenge** is an opportunity for students to conduct an experiment to enhance their measurement skills. Students can create a project on any aspect of the Moon and its relationship to the Earth and the Solar System. More importantly, during this Challenge, students must emulate the same procedures as NASA scientists and engineers when conducting a research project. Students must first propose a project to NASA, receive real-time feedback, and then conduct an investigation by collecting real data. Students can then "ground-truth" their results by researching data that may already exist in similar context. Finally, the students present their findings to a panel, just as a real scientist would at a professional conference.

What makes the **Moon Math Challenge** a unique activity is the interactivity between students and a NASA scientist or educator through NASA's Digital Learning Network**.** Short 30 minute lessons on parts of the Challenge are offered every 2-3 weeks by way of videoconferencing events through NASA's Digital Learning Network (DLN). Students participate in hands-on activities with the host to address skills students need to meet national education standards. Also, a Question-and-Answer session will be part of each videoconference to allow teachers and students to ask questions about their specific projects.

A standard component of the Exploring Space Challenges is for the teachers to host a local challenge within their own classroom. Each team gives an oral presentation on the research they accomplished. Students who scored highest in their local challenges then have the opportunity to present their projects to a NASA panel of judges through the DLN.

# CHALLENGE REQUIREMENTS

*Pre-Challenge Requirements*

1. **Online teacher and student registration.** Teachers must register for Moon Math by emailing nasa-esc@nasa.gov.
2. **Pre-assessment.** A brief assessment is required to be completed by students. This is for the ESC staff to acquire students' level of understanding prior to the Moon Math Challenge – for evaluation purposes only.

*Objective One*

- **DLN Event 1: Introduction to the Moon Math Challenge; Measurement tools and units.** During this event, the host introduces the Moon Math Challenge and converses with the students about pre-knowledge of the Moon. A short video on measurement skills is presented. The host then leads the class into a lesson about the use of appropriate measurement tools and measurement units corresponding to example scales.
- **Conduct background research.** Students should spend time in a library or computer lab to learn basic lunar characteristics and the history of lunar exploration.
- **Submit Proposals.** Student teams must send a brief proposal explaining their research question and how they plan to conduct their experiments.

*Objective Two*

- **DLN Event 2: Measurement Uncertainty.** This second event should occur two to three weeks after the first. A short video is presented on how to start a project for Moon Math. The host then conducts a hands-on activity with the students to demonstrate how a margin of error can exist when measuring quantities, emphasizing measurement uncertainty that occurs in real science investigations.
- **Collect data.** Student teams should begin their investigation and data collection.

*Objective Three*

- **DLN Event 3: Data analysis and presentation.** This event should occur two to three weeks after the second event, or about three to four weeks before projects are due. During this event, a third video is shown and the host demonstrates proper data recording technique and data presentation styles. Students learn about data tables and graphs and how to properly label them.
- **Complete experiment.** Student teams should finish their investigation, tabulate or graph their results, write a report and prepare an oral presentation.

*Objective Four*

- **Host a Local Challenge.** Teachers must arrange a local Moon Math Challenge in their class or school. Student teams give an oral presentation about their project to a panel of judges. Team with highest score is recommended to NASA ESC for participation of Regional/National Challenge.

*Post-Challenge Requirements*

1. **Online submission of students' reports and scores.** Teachers must submit scores for each student team from their local challenge and the winning team's written report and oral presentation.
2. **Post assessment.** A post-Challenge assessment must be completed by students who participated in the Challenge. Again, this is for the instructor to evaluate students' level of understanding.
3. **Regional/National Moon Math Challenge.** Winning teams of local challenges will then compete regionally or nationally through additional videoconferencing events.
4. **Certificate of participation.** Each student to successfully complete all requirements of the Moon Math Challenge (including both assessments) will receive a certificate of participation as submitted by registered teacher.

## 2007 MOON MATH SCHEDULE

| Event | Date | Notes |
|---|---|---|
| Registration | September 1-30 | Teachers must first register their class prior to student registration |
| DLN Event 1 | October 3-7 | Measurement Basics |
| Letter of intent and pre-assessment due | October 21 | Students can send their proposals as plain text to nasa-esc@nasa.gov |
| DLN Event 2 | October 24 – 28 | Measurement Uncertainty |
| DLN Event 3 | November 14-18 | Data Analysis |
| Final reports due | December 1-16 | Submit written reports to your teacher and complete oral presentations. |
| Local Challenges | December 1-16 | Scores can be submitted to NASA-ESC@nasa.gov |
| Regional/National Challenge | January/February | Judged by NASA scientists and educators via DLN |

In order for students to complete **Moon Math** successfully, they must use the scientific method to conduct their investigation. Distribute the next four pages to your students as a general guide to conducting their projects.

# MISSION: MOON MATH - STUDENT INSTRUCTIONS

**1. Investigate**
All good scientists start an experiment by first doing some background research. Make a list of the questions you have about the Moon in a project notebook. Use the web and the library to learn about the Moon. Are all of your questions answered? Keep track of the books or websites you use while you are doing your background research.

**2. Create a question**
Now you must ask a question that you can answer by making a measurement. You can choose one of the sample projects, ask your teacher for ideas for a different project, or come up with an idea of your own.

**3. Design an experiment**
It is important to design an experiment that is not too hard. Try to keep your experiment simple. Make it so that someone else could repeat your experiment easily.

For example:

- If you are going to build a stand to set a camera on to keep it pointed at the Moon, make it as simple as possible.
- If you are drawing a wall map of the Moon using the electronic eyepiece on your telescope, mark the spot on the floor where the telescope sits so that it will be the same each time.
- If you are measuring how high the Moon is above the horizon at the same time each night, ask a family member to help by setting an alarm for that time so you don't forget.

**4. Make a prediction (Hypothesis)**
Now that you have a question that your experiment will try to answer, what do you predict the answer will be? Write a hypothesis down in your notebook because you will need to include it in your final report or presentation.

**5. Make your measurements**
Record all your experimental methods and data in your notebook. What is the quantity you are measuring? If you are measuring the time the Moon rises each night, the quantity would be *Time of Day*. If you are measuring the size of craters you have drawn, the quantity would be *centimeters*.

Units of measure are very important. Are you using inches or centimeters? Minutes or seconds? Because the scientific standard is metric, if you make measurements in English units (such as inches), be sure to include an extra column in your table where you have converted to metric units (such as centimeters).

**6. Analyze your data**

After you make all of your measurements, you must decide what they mean. You will interpret your results. For example, if you are measuring the size of craters on a wall map, and you have made your measurements in centimeters, you have to figure out what that means for the actual size of the craters on the Moon, say, in kilometers.

You must also decide how to best show your results to the judges. Often charts or graphs are easier to explain than tables of numbers. Make sure to include a finished data table(s) and a chart or a graph in your final report or presentation.

# SAMPLE PROJECTS

Herein is a listing of sample projects. Each question requires a measurement to be made with the Moon. This list is by no means a limit to the types of investigations in context of the Moon. Explore your own questions you may have about the Moon.

**Project A**

Your mission is to place solar powered transmitters on the Moon. The receiving stations on Earth (one at your latitude and one at the Equator) need to be able to track the Moon as a function of phase and are programmed to receive signals at a certain time.

- ★ **Question:** At what phase(s) is the Moon at an altitude of 45 degrees above the horizon at the two receiving stations?
- ★ **Measurement:** Measure the altitude above the horizon and record the phase of the Moon at a given time (e.g. 6 PM) from one location. Build your own quadrant with cardboard, a straw, string and a washer.

**Project B**

The Moon, like the Earth, is not a smooth, round ball. It has features like mountains and valleys and seas. You have to decide where your spacecraft should land on the Moon.

- ★ **Question:** Does a spacecraft have to land on the lunar maria, or could it land in a crater?
- ★ **Measurement:** Determine the sizes of the craters on the Moon.

**Project C**

You are looking for a place to land your spacecraft on the Moon.

- ★ **Question:** Is there any difference between the near and far sides of the Moon, other than one faces Earth and one doesn't?
- ★ **Measurement:** Determine if the size distribution of craters is the same on the near and far sides of the Moon using <u>Clementine</u> data.

**Project D**
A landing site has been selected.  You need to know about the rotation of the Moon so that the spacecraft can be pointed in the correct direction with the correct speed.

★ **Question:** How long does it take the Moon to rotate once on its axis?

★ **Measurement:** Track the speed of features across the surface of the Moon throughout a complete lunar cycle.

**Project E**
You need to know where to point your spacecraft and how fast to send it.

★ **Question:**  Does the Moon move at a constant speed in its orbit?

★ **Measurement:**  Measure the times between transits (of a pre-determined line) by the Moon over the course of a lunar cycle to determine its orbital speed as a function of time (e.g. date, phase).

**Project F**
You need to know how much fuel you'll need to send a spacecraft from the Earth to the Moon, so you need to know how far the Moon is from the Earth.

★ **Question:** Is the Moon always the same distance from the Earth?

★ **Measurement:** Measure the size of the Moon over the course of one lunar cycle and determine how much the distance from the Earth to the Moon is changing. Use a digital camera or make your own drawings.

# INTERNET RESOURCES:

- Basic Moon facts:
  - http://solarsystem.nasa.gov/planets/profile.cfm?Object=Moon

- NASA's Lunar Reconnaissance Orbiter (LRO) is the first of the Robotic Lunar Exploration (RLE) missions, planned for launch by late Fall 2008 and will orbit the Moon nominally 1 year.
  - http:// lunar.gsfc.nasa.gov/

- Developed by researchers at NASA Ames Research Center, World Wind is a free downloadable program that lets you zoom from satellite altitude into any place on Earth. And now World Wind has the ability to browse Clementine moon data with full 3D terrain.
  - http:// worldwind.arc.nasa.gov/moon.html

- Research the history of NASA's Apollo Program.
  - http:// spaceflight.nasa.gov/history/apollo/

- View NASA educator guides and lithographs related to the Moon at
  - http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Exploring.the.Moon.html

  - http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Earths_Moon_Lithograph.html

- Check out this educational resource that provides an assortment of lunar images, each accompanied by a description referring to visible details.
  - http:// www.lpod.org/

# PRE-CHALLENGE ACTIVITIES:

## A. A Mathematical Exercise

If the gravity on the Moon is 1/6$^{th}$ of the gravity here on Earth, then how would that make things different? Use your mathematical skills to answer the following questions.

1. Your mom can jump a pile of laundry that is three feet across. On the Moon how big is the pile of laundry she can jump?
2. Your little brother can leap two feet on Earth. How high can he leap on the Moon if he can leap six times as high?
3. You can spit a watermelon seed one foot on Earth in your back yard. How far might that seed travel on the Moon?
4. If the lunar rover weighs about 460 pound on earth how much does it weigh when it is on the moon?
5. If you are able to lift 30 pounds on Earth how much can you lift when you are on the Moon?

## B. Moon Rotation Exercise – Does the Moon rotate on its own axis?

Select two students to represent the Earth and the Moon. Each student must hold the end of a 5 or 7ft string or jump rope. The Moon orbits the Earth by keeping the rope taunt as it moves around the Earth moves along its orbit. Halt the demonstration and explain that the Moon takes about 27 days to go around the Earth. Ask the students to choose appropriate speed of travel for the moon and how many steps represent on Earth day. (For example, the Earth might take heel-to-toe steps while the Moon takes longer steps.) Now add that the Earth rotates on its axis once every 24 hours and tell the Earth student to spin as required. Next add that the Moon rotates on its axis at the same rate that it revolves around the Earth. Students should determine that this results in the “face” of the Moon always being directed toward the Earth. *The Moon does rotate and the far side of the moon is only dark to us from Earth’s perspective.* The sun sees it regularly. Take it one step further and add a third student to represent the Sun.

# GENERAL RULES AND REGULATIONS FOR NASA ESC

1. All participants must successfully register online.

2. Participation is restricted to students and teachers attending U.S. Schools (this includes U.S. possessions and schools operated by the U.S. for the children of American personnel overseas).

3. Teachers or administrators must register his/her students[a] by emailing nasa-esc@nasa.gov. Include teacher name, school name, school address, number of students participating, grade level, and email address.

4. There is no limit to the number of student participants from each school.

5. Only students whose names have been submitted through his/her teacher's registration will be allowed to submit entries to the NASA ESC.

6. All students must have access to the internet in order to participate in a NASA Exploring Space Challenge.

7. All entries are evaluated according to the published rubrics and requirements for each respective challenge. Judges' decisions are final.

8. Each registered student/class/school must submit separate entries for their respective challenge.

9. Each document submitted to the NASA ESC project office must include the student last name, or the school's name, and the challenge abbreviation in the title of the document. Please see the following examples:

| Challenge | Example |
|---|---|
| Habitat Moon | YourName_HM.ppt |
| Moon Math | YourName_MM.ppt |
| Hurricanes | YourName_Hurr.doc |
| Teacher Challenge | YourName_TC.doc |

10. All work submitted to NASA ESC must be original and free from copyright.

11. NASA maintains the right to accept or reject any submitted work. All entries become the property of NASA and the Exploring Space Challenges.

12. Final documents for each respective challenge must be electronically submitted by their deadlines, as follows:

| Challenge | Deadline | Documents |
|---|---|---|
| Habitat Moon | November 16, 2007 | Slide presentation |
| Moon Math | November, 30, 2007 | Slide presentation and report |
| Hurricanes! | November 2, 2007 | Character story |
| Teacher Challenge | January 4, 2008 | Proposal |

If you encounter any difficulties, or have any questions please direct them to the NASA ESC project office at nasa-esc@nasa.gov.

[a] The NASA ESC Project Office understands that some students may drop out during the course of their Challenge. If such an event occurs please notify the NASA ESC Project Office. If this event leaves a team with only one student, the student remaining in the Challenge will not be penalized and may have the choice to continue with their project of his/her own or join another team. It is the teacher's responsibility to contact the NASA-ESC Project Office if any changes occur in a teams' participation status.

## SPECIFIC RULES FOR MOON MATH CHALLENGE

1. Only students in grades 5-8 may participate.

2. Each *Mission: Moon Math* challenge team must be composed of two students and may include one family member.

3. Each registered team must submit a letter of intent to the NASA ESC. Please see your challenge timeline for this deadline.

4. Only one team from each school may be selected from the Local Challenge to participate in the Regional/National Challenge hosted through the Digital Learning Network (DLN).

5. All registered schools are expected to be involved in each videoconferencing event. Missing a scheduled videoconference *could* disqualify your teams.

6. All Local Challenges must be completed by December 16$^{th}$, 2006. The National Challenge will be completed by February 28$^{th}$, 2007.

7. One student team will be selected as the national winner**.** Each student of the winning team will receive a certificate plaque and a $100 gift card. Teacher of winning team will receive a $100 credit towards purchases at NASA Core[1].

[1] NASA and the Exploring Space Challenges have the right to change any prize as resources may allow. If circumstances beyond our control necessitate the invalidation of a prize to any student, teacher, class or school, then NASA and the Exploring Space Challenges cannot be held liable.

# JUDGING RUBRIC

## ORAL PRESENTATION

| CATEGORY | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Content** | Information presented by both team members is accurate, concise and relevant to the Moon Math Challenge. **Project is described completely.** | Information presented by both team members is accurate, concise and relevant to the Moon Math Challenge. **Presentation lacks a statement of the question** being answered OR **lacks the answer to the question** in the conclusion. | Information presented by both team members has **minor** errors. Project is not described completely. | Information presented by both team members has **major** errors. Project is not described completely. |
| **Comprehension** | Both team members demonstrate understanding with **superior** answers, pertaining to the history, relevance to NASA efforts to return to the moon, application and theory of the Moon Math Project. | Both team members demonstrate understanding with **adequate** answers, pertaining to the history, relevance to NASA efforts to return to the moon, application and theory of the Moon Math Project. | Team members have **minor errors** in their understanding of history, relevance to NASA efforts to return to the moon, application and theory of the Moon Math Project. | Team members have **major errors** in their understanding of history, relevance to NASA efforts to return to the moon, application and theory of the Moon Math Project. |
| **Speaks Clearly** | Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words. | Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word. | Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word. | Often mumbles or cannot be understood OR mispronounces more than one word. |
| **Preparedness** | Students are completely prepared and have obviously rehearsed. There is a logical order and smooth transitions. | Students seems pretty well prepared but might have needed a couple more rehearsals. Presentation has a logical order. Presenters have slight hesitation during transitions. | The students are somewhat prepared, but it is clear that rehearsals were lacking. Hesitation and disorganization are distractions. | Students do not seem at all prepared to present. Presentation lacks organization and smooth transitions. |

**Oral presentation rubric continued.**

| CATEGORY | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Visual Aids** | Student uses several visual aids that show considerable work/creativity and which make the presentation better. These aid in understanding the presentation. | Student uses 1 visual aid that shows considerable work/creativity and which make the presentation better. This aids in the understanding of some of the presentation. | Student uses 1 visual aid, which makes the presentation better. This aid helps very little in understanding the presentation. | The student uses no visual aids or the visual aids chosen detract from the presentation. |
| **Posture & Eye Contact** | Stands up straight, looks relaxed and confident. Establishes eye contact with everyone in the room during the presentation. | Stands up straight and establishes eye contact with everyone in the room during the presentation. | Sometimes stands-up straight and establishes eye contact with most people in the room. | Slouches and/or does not look at people during the presentation. |
| **Time Limit** | Presentation is 8-10 minutes in length. | Presentation is 6-7 minutes in length. | Presentation is 5 minutes in length. | Presentation is less than 5 minutes OR more than 10 minutes in length. |

# Deciphering the Sample Projects

## Project A

**What is being measured?** Altitude.

**Learning outcomes:**
- Understand the lunar phases.
- Determine the time of day that lunar phase can be observed.
- Use a quadrant to measure altitude of the Moon.

Take a step back and not worry about the specifics of the sample project. Simply think of measuring the Moon's altitude from the Earth's horizon at a specified time each night. The Moon is only above the horizon a couple weeks per month during the fall. Students will need to learn the phases of the Moon to help them figure out what days in the month they will be able to see the Moon. Search the web for an Altitude Activity , which includes a description of how to build your own quandrant. Each student of a team should measure from their own geographical location, then compare data.

## Projects B and C

**What is being measured?** Diameter.

**Learning outcomes:**
- Understand differences between lunar maria and lunar craters.
- Understand differences between the near and far sides of the Moon.
- Determine crater diameter with the use of ratio proportion equations.

Crater diameter measurement is demonstrated in the videoconferences and videos. If you would like to preview the videos, they can be found at:

http://learners.gsfc.nasa.gov/mediaviewer/MoonMath/MoonMath1/
http://learners.gsfc.nasa.gov/mediaviewer/MoonMath/MoonMath2/
http://learners.gsfc.nasa.gov/mediaviewer/MoonMath/MoonMath3/

Remember, students can collect their own images of the Moon by using a telescope, digital camera or video camera. I would actually recommend students to collect at least one of their own images and then compare it to the images they find on the web. You must always have a complete full Moon to obtain the diameter of the Moon in the image. Half or quarter Moon images will not work.

## Project D

**What is being measured?** Speed, but not really…

**Learning Outcomes:**

- Understand lunar phases.
- Understand the differences between near and far sides of the Moon.
- Understand Moon rotation on its own axis and around the Earth.

Bottom line, this project produces a null result. The student will never see the features move across the Moon during the month because the Moon is in synchronous rotation about the Earth. Using the activity described in the Moon Math Guide Pre-Challenge Activities section demonstrates why an observer won't "see" the Moon rotate, but at the same time, demonstrate that the Moon does rotate on its own axis. Another example is on the last page of this document, a web page extracted from a McGraw Hill Astronomy textbook. This is a challenging project in that it will take patience and the right type of student that won't mind getting a null result. With that said, don't bail on it quite yet. Students learn to keep a project notebook because they will need to take nightly pictures of the Moon or draw what they see each night.

## Project E

**What is being measured:** Time.

**Learning Outcomes**:

- Understand lunar phases.
- Understand lunar transit.
- Determine time difference in daily Moon transits over a predetermined line.

This is a project for the strong-willed. The experiment is relatively simple, just time consuming. Determine a line in your field of view. For example, I would pick a transit line from my front porch step to the maple tree in the front yard. What time of day does the Moon transit across that line? It changes every day. The student would need to record that time every day of a lunar cycle. Since I can't be on my front porch at 10am on a weekday because I am sitting at my desk at work, what can I do? Take a few days to first figure out about what time the Moon transits across your determined line. Remember, it is going to change each day, usually by about an hour later as the lunar cycle progresses. I would suggest that a student set up a video camera to record the Moon's transit, making sure that the time is set correctly on the camera and is displayed in the view of the image. Collect the transit image each day. Each night, fast forward through the tape to find the time the Moon transits the predetermined night (also, by fast-forwarding, the student will truly see how the Moon transits across the sky). Record the time in a notebook. Reset the tape. Load up the camera and set it to record the next day. Repeat. Example data collection may look like the following:

| Date | Moon transit time |
|---|---|
| September 3 | 9:15am |
| September 4 | 10:16am |
| September 5 | 11:15am |
| September 6 | 12:09pm |
| September 7 | 1:02pm |
| September 8 | 1:52pm |
| September 9 | 2:43pm |
| September 10 | 3:35pm |
| September 11 | 4:29pm |
| September 12 | 5:25pm |
| September 13 | 6:22pm |
| September 14 | 7:19pm |
| September 15 | 8:13pm |
| September 16 | 9:04pm |
| September 17 | 9:50pm |
| September 18 | 10:34pm |
| September 19 | 11:14pm |
| September 20 | 11:53pm |
| September 21 | 12:31am |
| September 22 | 1:10am |
| September 23 | 1:15am |
| September 24 | 2:33am |
| September 25 | 3:19am |
| September 26 | 4:09am |
| September 27 | 5:03am |
| September 28 | 6:04am |

## Project F

**What is being measured?** Diameter.

**Learning Outcomes:**
- Understand the lunar phases.
- Determine the time of day that lunar phase can be observed.
- Determine the diameter of the Moon in digital images.

The method for this is easy: take digital pictures of the Moon every day at the same time. Compare the diameters of the images. Does the Moon travel around the Earth in a perfect circle? Does the Moon seem to move farther away from the Earth and then move closer throughout a lunar cycle? Seems simple, however, the results may be null. Why? There is only a difference of 10% in the Moon's elliptical orbit, so the difference may be too slight to see in the images. But it is worth a try! Student can still collect their own data, then compare their data to the information they collect in the library or on the web about the Moon's orbit. For additional help on this project visit:

http://www.ifa.hawaii.edu/~barnes/ASTR110L_S03/lunarorbit.html