

Project 1

THE MOON



Taken on 29/09/2023

Credit: Photo was taken by a student from AST101H1 Fall 2023

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Introduction

The moon has been Earth's constant companion for millions of years. Humans have been fascinated by its imposing presence in our night sky for millennia, with records dating back to the most ancient of cultures. Our perception of our Moon has drastically changed over time with advancements in technology, from being just a rock in space to false myths of being made of cheese to the successful Apollo missions where mankind first set foot on the Moon to modern day missions for our return to our galactic neighbour.

The aim of this project is to analyse data and create visualisations of the Moon and attempt to explain phenomena based on the data.

Methodology

Pictures of the Moon were taken by members of the class over an approximate two month period. Pictures which reflected Moon phenomena were carefully selected and visualisations were created by combining pictures together. Possible explanations for the patterns observed in the visualisations were written with the support of secondary sources such as books, journals, blogs and websites.

Data Analysis



FIGURE 1 SHOWING THE PICTURES OF THE MOON OVER A ONE MONTH PERIOD

Based on the figure above, these photos were taken approximately 29 days apart, during which the moon is seen to start at full, wane over 2 weeks until it is not seen, and then reappear fully 2 more weeks later.. Hiesinger and Jaumann (2014) explained that these phases were due to the relative orientation of the Sun, Earth and Moon in their respective orbits, that is how much of the illuminated Moon we see from Earth. They further explain that the Moon ‘wanes,’ to become a New Moon and ‘waxes’ to become a Full Moon. NASA(2023) stated that this takes place over an approximate 29.5 day period, which is consistent with the dates recorded. Moreover, they stated that during a New Moon, the Moon is directly between the Earth and Sun, so we do not see the illuminated side, which is clearly seen on the picture 14/10/2023. Also, during a Full Moon, the Earth is between the Sun and Moon, so we see the entire illuminated side, as seen on 29/09/2023 and 28/10/2023. Interestingly, according to Jaggard & Staff (2023), the Full Moon of each month has a special name associated with it based on beliefs. Based on the data, the Full Moon on 29/09/2023 is called a ‘Harvest Moon’ and the one on 28/10/2023 is called a ‘Hunter’s Moon.’



FIGURE 2 SHOWING PHOTOS OF THE MOON OVER A ONE MONTH PERIOD

In this figure, it can be seen that the same view of the Moon is always present. Keeton (2014) attributes this to the tidal forces between the Earth and the Moon. He explains that this force is dependent on the mass of the Earth and Moon and their distance and even angle from each other. The Moon exerts tidal forces on Earth, slightly distorting it and creating the tides we know as high tide and low tide. However, the Earth also exerts tidal forces on the Moon, slowing down its rotation time over millennia such that the Moon's rotational period is equal to its orbital period. Hiesinger and Jaumann (2014) called this phenomenon tidal locking and uses the term synchronous rotation to refer to the Moon's equal orbital and rotational periods. The data does indeed reflect this as no matter what date or angle the Moon is viewed at, the same view is always present.

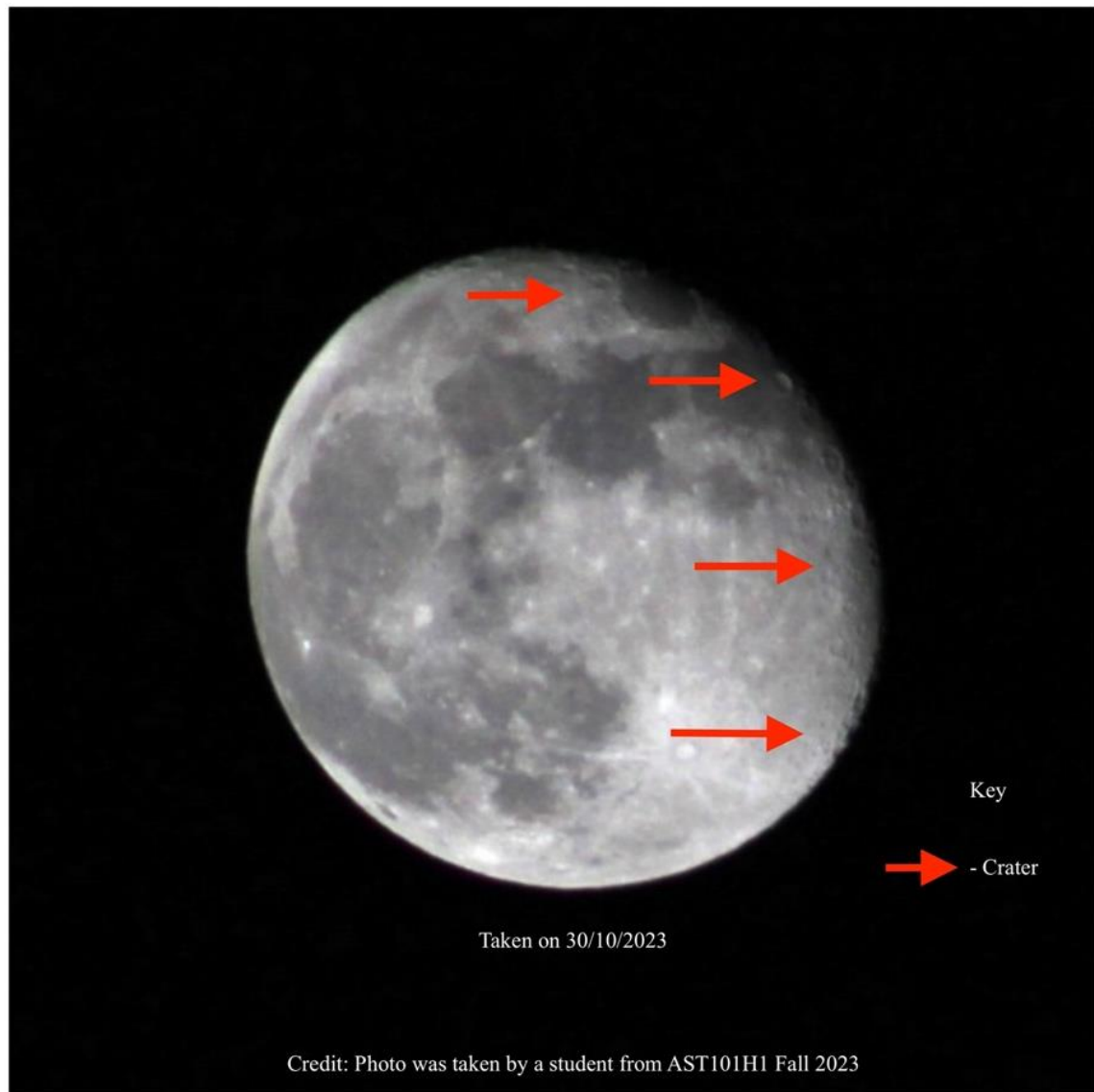


FIGURE 3 SHOWING AN ENLARGED PHOTO OF THE MOON

The figure above illustrates a single photograph of the Moon with red arrows. These red arrows point to what seems to be circular depressions on the Moon's surface. Koeberl (1999) explained that these were craters, depressions formed the collision between interstellar objects with high velocities and the Moon's surface, which he calls the impact hypothesis. He explained that the object itself did not cause the crater, but the energy released during the impact from the conservation of energy blowing outwards in all directions caused the crater to be formed, especially in circular shapes. Hiesinger and Jaumann (2014) identified that asteroids and comets were the main culprits for these craters. They also went on to state that the Moon's lack of current geological activity and lack of atmosphere means that these craters will remain almost the same for millennia, as there is little to no agents of erosion present. Each red arrow on Figure 3 points to craters on the Moon's surface, supporting the explanation.

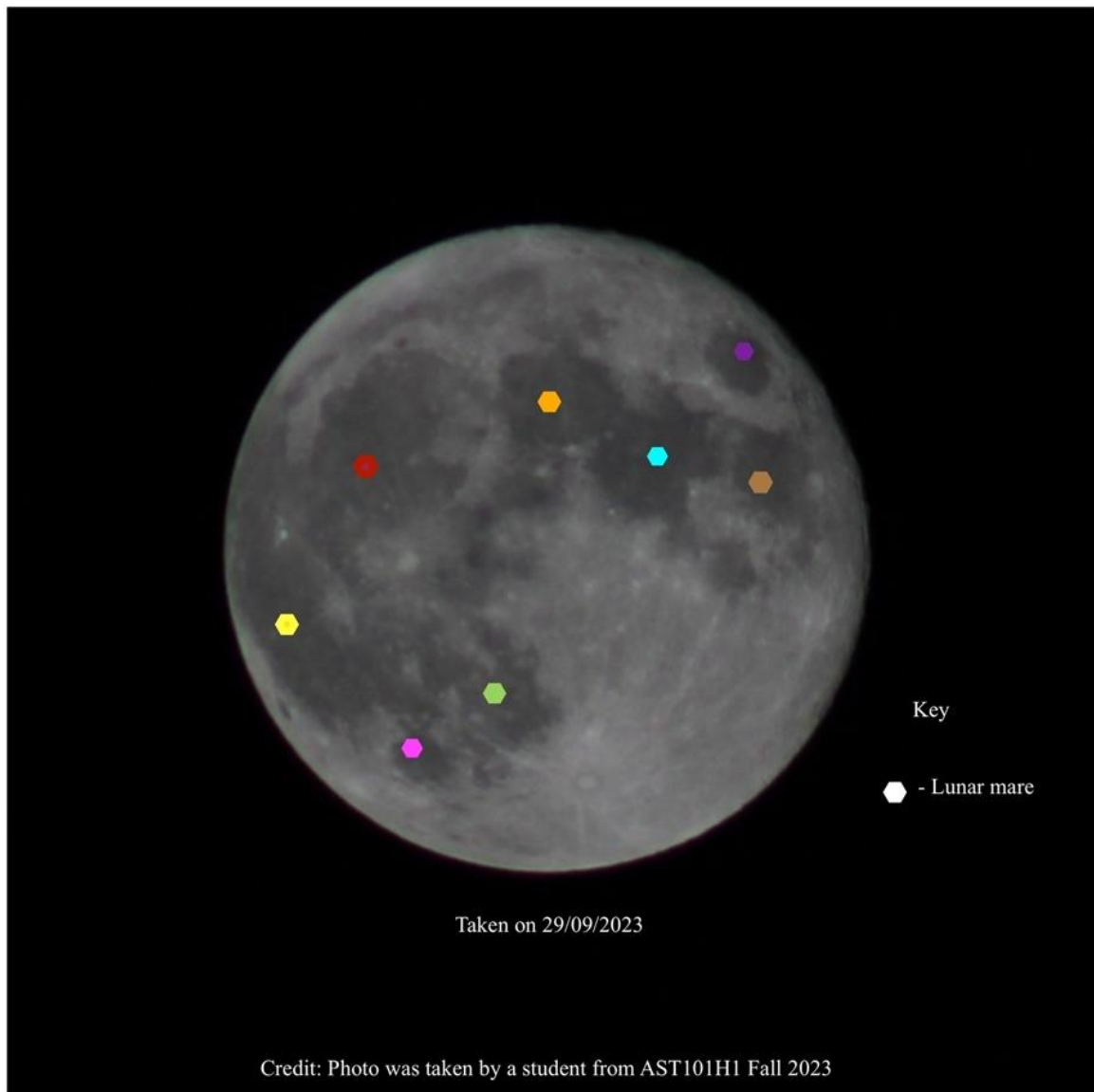


FIGURE 4 SHOWING AN ENLARGED PHOTO OF THE MOON

Figure 4 shows coloured indicators on what seems to be dark patches on the Moon's surface and look very different to the craters seen earlier on. Spudis (2001) identifies these as lunar maria (singular – mare: Latin for 'sea'), which are dark, smooth plains on the Moon's surface. He elucidates that this is actually solidified basaltic lava that have filled basins/craters on the Moon's surface. He elaborates that when the Moon was much younger, it had geological activity such as volcanism present and these lunar volcanoes would spew molten rock (lava) which would flow into these basins/craters and harden, forming a relatively dark, smooth surface where the basin/crater used to be. It can be deduced that the surface of the maria are younger, due to less evidence of impacts. Numerous of these maria are visible on Figure 4, and some even have unique names. Cross referencing with data from Simon J (2017) gives us some names of these plains. For example, the purple indicator is called the Mare Crisium, 'Sea of Crises,' the blue indicator is called the Mare Tranquilitis, 'Sea of Tranquility,' and largest of these, the yellow indicator, is Oceanus Procellarum, 'Ocean of Storms,' to name a few. These are clearly seen from Figure 4, and are always seen when the Moon is viewed from Earth due to the tidal locking of the Moon explained earlier.

Limitations

Several limitations were encountered while carrying out this project, namely:

- A portion of the data was unusable due to blurriness of some photos taken, rendering a visual analysis of the Moon difficult.
- The weather was overcast on certain days when the Moon was visible in its cycle, meaning that taking a picture of it was near impossible.

Conclusion

Based on the data gathered and analysed, it can positively be concluded that the Moons undergoes a cycle of phase changes every approximately 29 days, the same view of the Moon is seen from Earth due to tidal locking, craters are present on the Moon due to high velocity impacts of objects from space and the Moon has plains of cooled lava which indicates past volcanism, implying past geological activity.

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