

Mercury - Immersion in Robotic Exploration of the Solar System Culture

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Question:

Mercury surface should be the hottest planet in the Solar System, right? Why or why not?

I. INTRODUCTION

The following report analyzes why Mercury is not the hottest planet in the Solar System despite being closest to the Sun and provides a detailed answer to that question.

II. MERCURY

This section intends to summarize and give a brief overview of Mercury. Mercury is the smallest planet in the Solar System and closest to the Sun. It is only slightly larger than Earth's Moon. Mercury is the fastest planet, zipping around the Sun every 88 Earth days. The planet is riddled with craters because it lacks a strong atmosphere to deflect impacts. An asteroid around 100 kilometers diameter collided with Mercury around 4 billion years ago, leaving a massive impact crater 1550 kilometers wide. Scientists believe this impact may be the source of Mercury's strange spin [1] [2] [3] [4].

Mercury speeds around the sun every 88 Earth days, traveling through space at nearly 180,000 km/h, faster than any other planet. Its oval-shaped orbit is highly elliptical, the perihelion of the orbit is around 47 million km whereas the aphelion can be up to 70 million km from the Sun.

III. MERCURY'S COMPOSITION AND SURFACE

According to NASA [4], the atmosphere of Mercury is a "surface-bound exosphere, essentially a vacuum." It contains 42 percent oxygen, 29 percent sodium, 22 percent

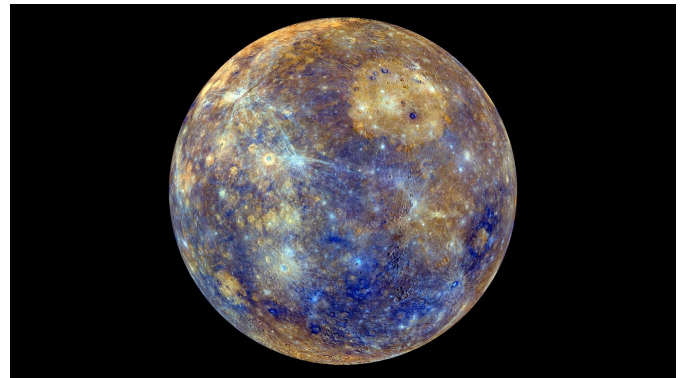


Fig. 1. Mercury enhanced-colour image processed from NASA's Messenger probe. Source: [5]

hydrogen, 6 percent helium, 0.5 percent potassium, with possible trace amounts of argon, carbon dioxide, water, nitrogen, xenon, krypton and neon. Also, it has a magnetic field but it's strength is as much as 1% the strength of Earth's.

Mercury's surface resembles Earth's moon. There are a vast number of impact craters on it. There is practically no atmosphere on Mercury. Because it is so close to the sun, its surface can become really hot. Mercury may reach a blistering 426 degrees Celsius on its sunny side. However, Mercury is not the Solar System's hottest planet. Venus holds the title of being the hottest planet. There is a huge temperature difference between Mercury's dark side and bright side.

Mercury's dark side is extremely cold due to the lack of an atmosphere to trap heat and keep the surface warm. The temperature can drop down to -184 degrees Celsius. Sunlight never reaches into the bottoms of some craters near Mercury's poles. That could mean that ice may be inside those craters, because they always stay cold.

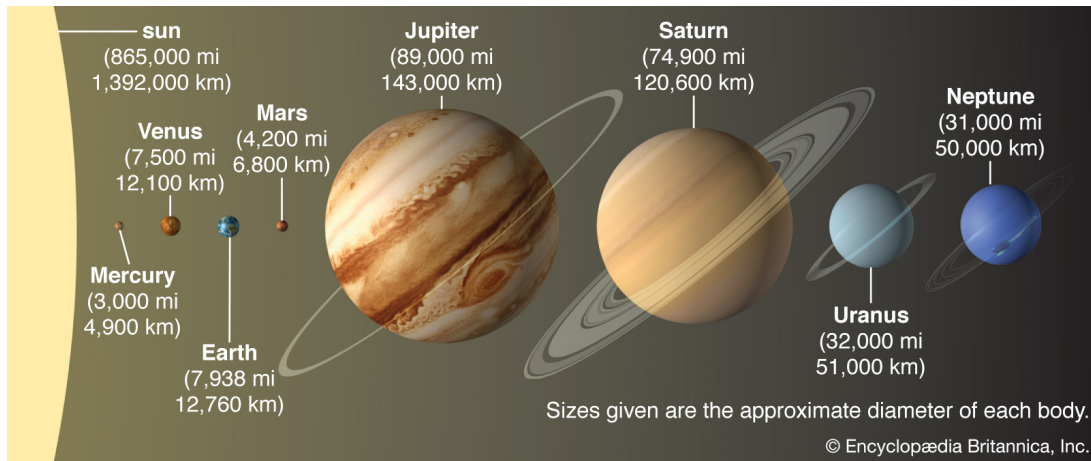


Fig. 2. Solar system. Source: [6]

Regarding Venus, the second closest planet to the Sun and the closest neighbour to Earth. Venus size and structure is similar to Earth and it spins slowly in the opposite direction from the rest of the planets. It completes one rotation in 243 Earth days — the longest day of any planet in our solar system, even longer than a whole year on Venus.

Because Venus is covered in clouds that reflect and scatter sunlight, it appears dazzling white from space. The rocks on the surface are various hues of grey, similar to those found on Earth, but the thick atmosphere filters the sunlight, making everything appear orange if a human were standing on Venus. Mountains, valleys, and tens of thousands of volcanoes abound on Venus.

Unlike Mercury, Venus does have an atmosphere. Venus' atmosphere consists mainly of carbon dioxide, with clouds of sulfuric acid droplets. In fact, it has an atmosphere about ninety times thicker than that of Earth, and made almost entirely of Carbon dioxide. To put it in perspective, Venus has an atmosphere about ninety times thicker than that of Earth. This atmosphere is so dense that walking through would be like wading through water.

Its atmosphere traps heat in a runaway greenhouse effect, hence, making it the hottest planet in the solar system with surface temperatures hot enough to melt lead [7]. The cloud layers also act as a blanket. Thus, as a result of its thicker atmosphere, Venus is hotter than Mercury. Mercury is closer to the Sun, but it has a relatively thin atmosphere, so all of the trapped heat escapes into space, but Venus has a considerably thicker atmosphere, which traps all of the heat it receives resulting in surface temperatures higher than 470 degrees Celsius. That is the reason why despite being closer to the Sun, it is not the hottest planet in the Solar System.

Comparing these two planets, there are four very stark

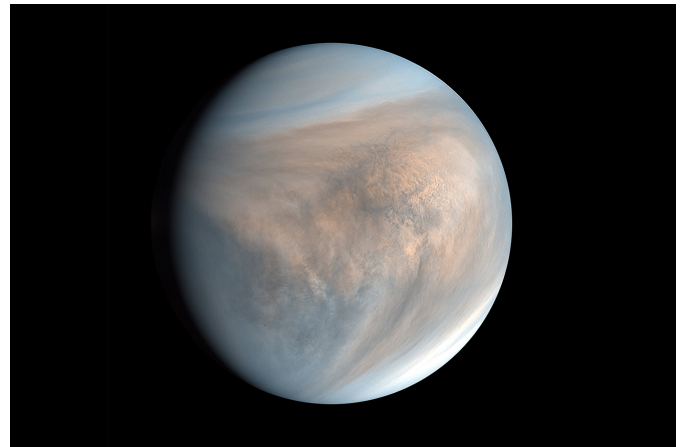


Fig. 3. An image of Venus, made with data recorded by the Japanese Akatsuki spacecraft in 2016. So close, so similar and very mysterious, the planet surprised scientists with a chemical signature in its clouds. Source: [8].

differences:

- Mercury is much smaller than Venus,
- Mercury is about twice as close to the Sun as Venus,
- Mercury is much less reflective than Venus, and
- Mercury has no atmosphere, while Venus has a very thick atmosphere.

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