Report: Asteroid Mining and Spectroscopy

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Introduction

Resource gathering from asteroids used to be like something out of a movie. But now, it's becoming a reality with a serious penny for pound value, science, and new technology. Retrieving scarce metals and stones from space might revolutionize how we conduct business on Earth and make us explore space better. This report synthesizes information from five sources that describe the finances of asteroid mining, the science involved in discovering resources, and the technologies that assist us in doing such things.

1. The Money Potential of Asteroid Mining

The piece "Economics of the Stars" in *Harvard International Review* discusses asteroid mining as a great potential that can transform the world economy. Asteroids such as 16 Psyche are thought to contain enormous quantities of metals, worth as much as \$700 quintillion. With that much at stake, asteroid mining could someday be a gold rush in space. NASA's OSIRIS-REx mission, which will retrieve a small sample from an asteroid, demonstrates how seriously we are taking this possibility, even if it takes more than a billion dollars.

But there's another part to the story. While space mining may cut back on destructive mining on Earth and prevent child labor in hazardous mines, it can also damage poor nations that are reliant on mining. If space metals become affordable and accessible, then conventional mining employment could be eliminated. Employees in nations such as the Congo who are dependent on mining to make a living may lose their livelihoods. Thus, asteroid mining would make certain nations and corporations richer at the expense of others, falling behind. That makes it not only a science problem but an issue of fairness as well.

The *Phys.org* piece "Asteroid Mining: A Potential Trillion-Dollar Industry" approaches the subject from an analogous standpoint. It discusses asteroid 2024 PT5, a tiny boulder that was temporarily caught in Earth's gravity. Researchers were intrigued because such near-Earth asteroids have metals such as gold, platinum, cobalt, and nickel. They are used in electronics and energy. According to the article, thousands of them exist in space—some are even larger than one kilometer. So much material is just waiting to be discovered.

But space mining will not be cheap or simple. We would require strong robots, spaceships, and equipment to excavate and transport material back home. That will cost a lot of money and wait for advancement in technology. Although exciting, it is still a long way from simple.

2. Science of Finding Resources

In order to understand which asteroid is profitable to mine, scientists employ a technique known as spectroscopy. According to *Encyclopedia Britannica*, spectroscopy is a method of observing how materials interact with light. Through observation of colors and light patterns on an asteroid, we can make an educated estimate of what it's composed of and if it has useful materials.

LibreTexts describes a unique form of spectroscopy known as Raman Spectroscopy. This technique is highly beneficial in asteroid mining since it is able to indicate the types of minerals that are available without degrading or preparing the specimen extensively. It is based on observing how the molecules within the material oscillate when they are exposed to light. This is useful in the identification of metals, silicates, and other significant compounds that are worth extracting.

3. The Light Measuring Tool

To conduct these light-based tests, researchers employ an instrument known as an **optical spectrometer**. This instrument, as explained by *Wikipedia*, is used to measure the intensity of light at various wavelengths. It assists researchers in determining the type of material found on the asteroid, depending on whether it reflects or emits light. These instruments usually accompany space probes or telescopes. They enable us to research asteroids at a distance and determine which of them can be visited.

4. Results and Future Perspective

The combination of potential high profits and scientific instruments makes asteroid mining a highly prospective sector. With advanced techniques such as spectroscopy and enhanced instrumentation, we are capable of analyzing space material more precisely. It can alleviate pressure on Earth's environment and urge nations to collaborate in space missions.

But many problems have yet to be solved. Space mining is expensive. There are also no definite guidelines on who can own and sell space resources. And the technology isn't advanced yet. That's why fair policies need to be made and space resources shared by everyone, and not just a few wealthy nations or corporations.

Conclusion

Asteroid mining is a thrilling mix of economics, science, and space exploration. Based on precise research with light and supported by enormous financial expectations, it tells us what could be next in space. But it's not about discovering metal in space. It's about doing it in a responsible and fair manner. With proper execution, asteroid mining can revolutionize our future. What was once considered science fiction may soon become a reality.

References

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