

2 Gravity

Forces of Flight

Four forces push and pull an airplane in flight. The force of **gravity** pulls the airplane downward. The airplane's wings produce an upward force called **lift** that counteracts gravity. A force called **drag**, caused by air resistance, slows the airplane down. To fight drag, the airplane uses a propeller or jet engine to produce a forward force called **thrust**.

The Basics

Gravity is the invisible force of attraction that exists between two objects.

Most of us think of gravity as the force that pulls objects toward Earth and gives us weight. In fact, gravity attracts all objects to one another. However, the force of gravity depends on the size or mass of the two objects. Because Earth is so large, its force of attraction is more noticeable. So the force of attraction that exists between your hand and a ball, for example, is far less apparent than the force that exists between the ball and Earth.

Many scientists have contributed to our knowledge of the law of gravity. Galileo Galilei and Sir Isaac Newton are two of the most famous. Today scientists continue to study gravity and its effects on vehicles, living things, and satellites of all kinds.



Natural Satellites

The Moon is a natural satellite. Gravity attracts the Moon toward Earth and keeps it in its elliptical (oval-shaped) orbit. Because of the Moon's smaller size, its gravity is one-sixth that of Earth.

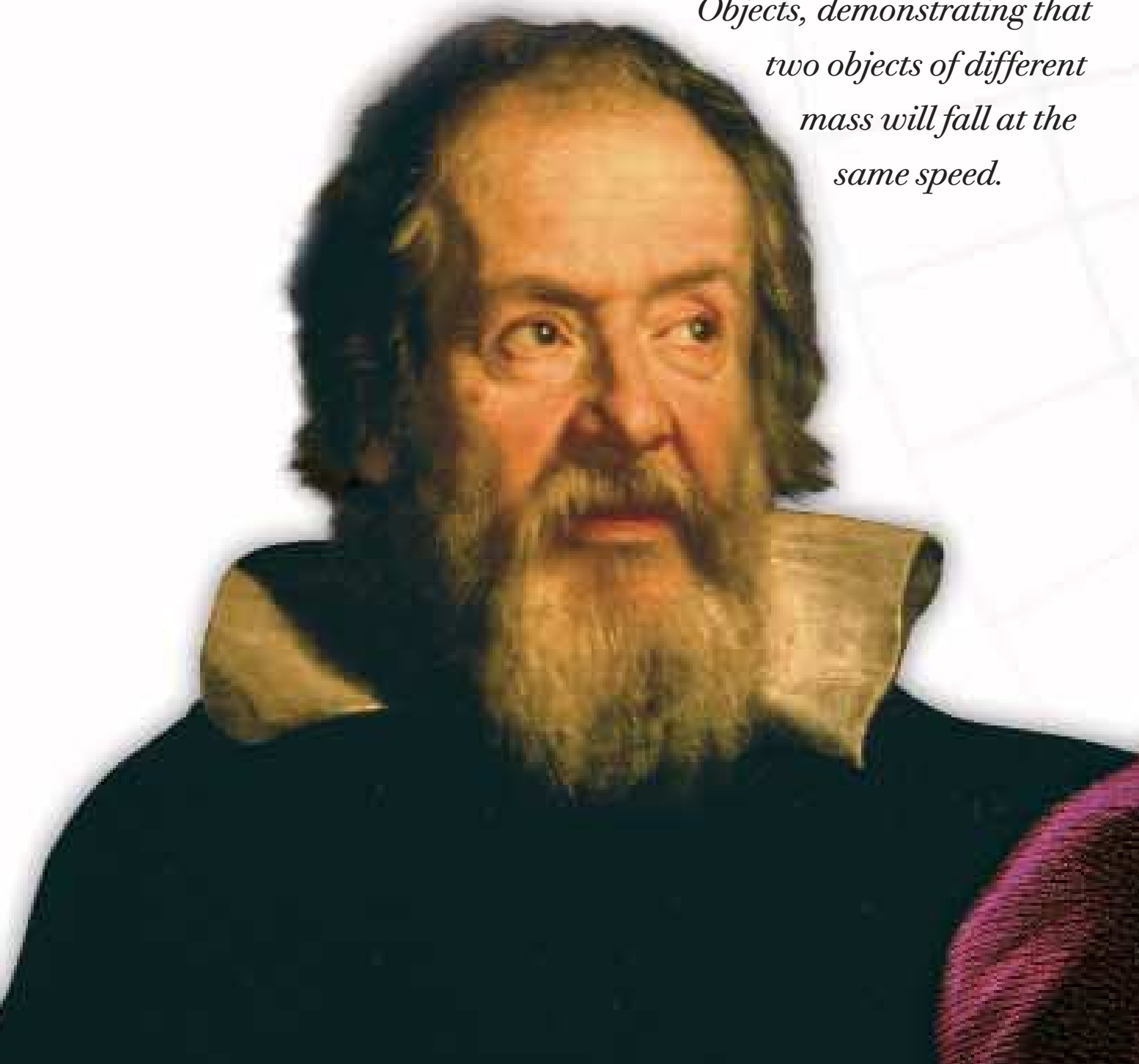
$$F = \frac{Gm_1 m_2}{r^2}$$

Newton's Law of Gravitation



Galileo Galilei, 1564–1642
Italian mathematician and astronomer who developed the Law of Falling

Objects, demonstrating that two objects of different mass will fall at the same speed.



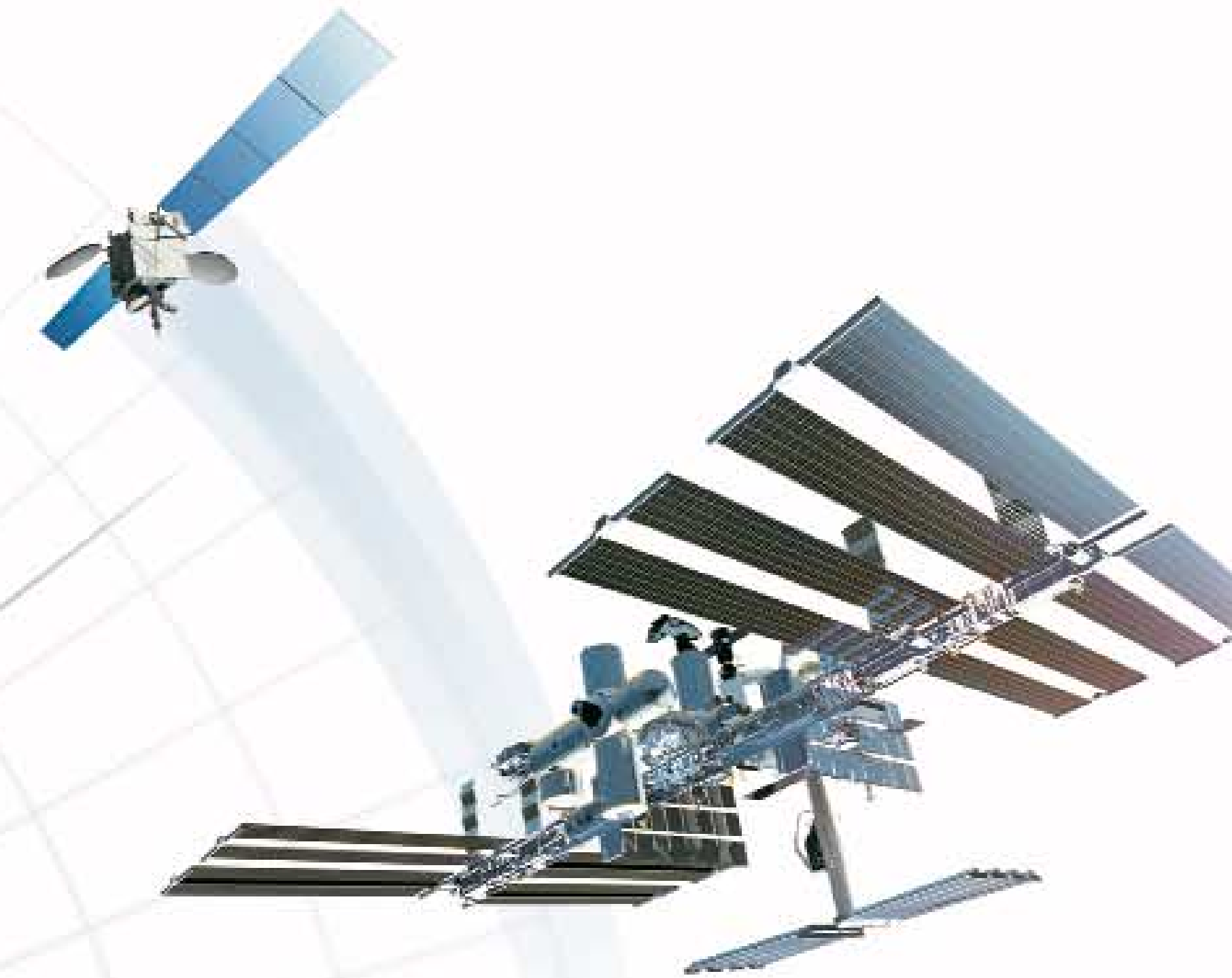
Sir Isaac Newton, 1642–1727

English scientist and mathematician who developed a mathematical Law of Gravitation that allowed him to measure gravity.



Human-Made Satellites

Gravity pulls satellites toward Earth. If a satellite moves fast enough, it falls in a curved path and circles Earth. If it does not move fast enough, it will spiral closer to Earth and burn up in the atmosphere. The same balance of gravity and speed keeps the Moon and the International Space Station in orbit.



Microgravity in Space
Experiments in microgravity, or very low levels of gravity, are conducted aboard the U.S. space shuttle and International Space Station. Many of these experiments, which study the effect of microgravity on living things, were designed by students.



When a skateboarder takes to the air in the trick known as an "ollie," gravity keeps his or her feet firmly on the board.

