# Rocket Science

Fresh off the triumph of NASA’s New Horizons mission to Pluto, there was more big space news this week. And it may turn out to be much bigger than our first look at Pluto—a veritable revolution in physics and space travel.

At the beginning of the 20th century, the modern rocket was invented by an American physicist and engineer named Robert Goddard. He theorized that an object could propel itself not by pushing against something—as, say, a propeller does—but by expelling mass. In 1920, he published a paper explaining how rockets could operate in space and one day fly men to the moon.

Goddard’s work was roundly mocked. In its infinite wisdom, the New York Times pompously announced that “Professor Goddard, with his ‘chair’ in Clark College .  .  . does not know the relation of action to reaction. .  .  . [Goddard] seems to lack the knowledge ladled out daily in high schools.” Goddard reacted to the Times by pointing out that “every vision is a joke until the first man accomplishes it; once realized, it becomes commonplace.”

Needless to say, Goddard was right, both about the Times’s short-sightedness and the logic of rocketry: Because every action produces an equal and opposite reaction, the force of a rocket exhausting propellant from its engines can propel it through a vacuum.

This has, hitherto, been the basis for all space travel. It has also limited space travel: The heavier a rocket, the more fuel is required to push it along. A rocket is basically a giant gas tank with an engine at one end and a payload at the other; since fuel accounts for most of the weight, a lot of the fuel pushing the rocket is being used to push the rest of the rocket’s fuel. The more fuel a rocket has, the more fuel it needs. The relation isn’t one-to-one, but eventually it becomes self-defeating—NASA’s rule of thumb is that it costs $10,000 to put one pound of anything into orbit. It took New Horizons nine years to get to Pluto because getting there faster would have been impractically expensive.

So here’s the big news: In 2006, a British engineer, Roger Shawyer, announced he’d designed an electromagnetic propulsion system that needed no fuel and needed to expel no mass to propel itself. And everyone laughed, because that would violate one of physics’ fundamental principles, the conservation of momentum, which says an object can’t move by pushing on itself.

The thrust Shawyer’s device could theoretically produce—says Wired magazine—could have propelledNew Horizons to Pluto in just 18 months. Last year, NASA tested Shawyer’s design—and, to their astonishment, it worked. But they couldn’t explain how, and they hadn’t tested it in a vacuum. Many assumed their results were wrong.

A German research group at the Dresden University of Technology performed its own test, in a vacuum; this week they announced the results. And lo and behold, the Shawyer electromagnetic thruster still works.