



1

00:00:00,030 --> 00:00:04,040

NASA's Parker Solar Probe will soon fly closer

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00:00:04,040 --> 00:00:08,160

to the Sun than any spacecraft before it-about 4 million

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00:00:08,160 --> 00:00:12,270

miles from the visible surface. But getting that close to the Sun

4

00:00:12,270 --> 00:00:16,370

requires some fancy orbital mechanics. It takes 55 times

5

00:00:16,370 --> 00:00:20,480

more energy to go to the Sun than it does to go to Mars.

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00:00:20,480 --> 00:00:24,600

Why is it so hard to get to the Sun? The answer is related to why

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00:00:24,600 --> 00:00:28,690

Earth doesn't just fall straight into the Sun, despite the strong gravitational

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00:00:28,690 --> 00:00:32,790

attraction. Earth, and everything on it, is traveling very

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00:00:32,790 --> 00:00:36,810

fast-about 67,000 miles per hour-in a direction that is

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00:00:36,810 --> 00:00:40,880

basically always sideways relative to the Sun. If you launch a

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00:00:40,880 --> 00:00:45,010

rocket from Earth, straight toward the Sun, it won't lose that sideways speed,

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00:00:45,010 --> 00:00:49,140

and so it will miss the Sun. The only way to get the rocket

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00:00:49,140 --> 00:00:53,300

to go right into the Sun is to cancel all that sideways motion. Leave

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00:00:53,300 --> 00:00:57,430

even a little bit and it will miss the Sun and enter a new orbit.

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00:00:57,430 --> 00:01:01,560

To cancel Earth's motion, you have to launch the spacecraft backward as fast as Earth

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00:01:01,560 --> 00:01:05,710

is hurtling forward. But 67,000 miles an hour is really

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00:01:05,710 --> 00:01:09,870

fast. Spacecraft have to go upward at only 25,000 miles

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00:01:09,870 --> 00:01:13,980

an hour to escape Earth. Getting to Mars only requires a bit

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00:01:13,980 --> 00:01:18,100

more speed: 29,000 miles an hour. New Horizons,

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00:01:18,100 --> 00:01:22,180

which NASA sent rushing out to Pluto, managed 36,000 miles

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00:01:22,180 --> 00:01:26,280

per hour, or a little more than half what it would have to hit the Sun

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00:01:26,280 --> 00:01:30,430

instead. Since Parker Solar Probe plans to fly past the Sun,

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00:01:30,430 --> 00:01:34,600

it doesn't need to cancel out all of Earth's sideways speed, but it does need to remove

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00:01:34,600 --> 00:01:38,690

53,000 miles per hour of it. That's why it's using one of the most

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00:01:38,690 --> 00:01:42,880

powerful rockets available and additional gravity assists from Venus

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00:01:42,880 --> 00:01:46,970

over a period of several years. In this case, rather than speeding up

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00:01:46,970 --> 00:01:51,070

the spacecraft as in a typical gravity assist, Venus slows down its

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00:01:51,070 --> 00:01:55,090

sideways motion, so the spacecraft can get close to the Sun.

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00:01:55,090 --> 00:01:59,180

When it finally does make its closest approach to the Sun, Parker Solar Probe

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00:01:59,180 --> 00:02:03,200

will have lost much of its sideways speed, but gained a great deal of overall

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00:02:03,200 --> 00:02:07,310

speed, thanks to the Sun's gravity. Parker Solar Probe will hurtle

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00:02:07,310 --> 00:02:11,470

past the Sun at 430,000 miles an hour-

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00:02:11,470 --> 00:02:15,660

the very first human-made object to get that close.