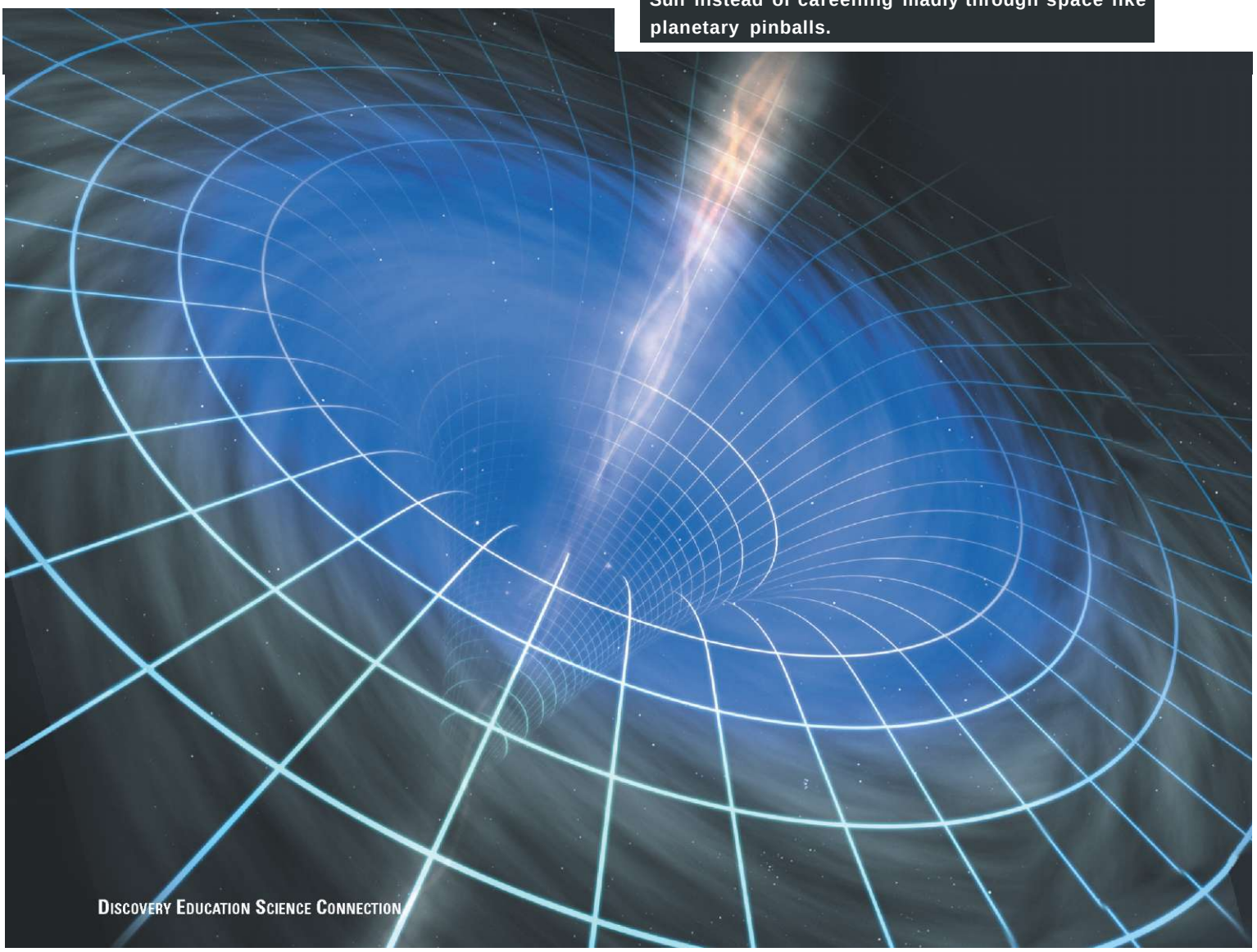
Black Hole: Like No Place in Space

When it comes to science, have you ever felt dense? No matter how hard you try to understand some scientific concept, do you ever just give up and figure that your brain is too thick to get it? If you have, maybe you'd like to take a trip to a place in space that is denser than anywhere or—anyone—in the universe. That place is called a black hole.

Before we go, you might want to know just exactly where you're headed—in other words, what is a black hole? Black holes were once known as frozen stars, and, basically, that's what they are. Stars are gigantic furnaces. Because even smallish stars like the Sun are incredibly large, they have a powerful gravitational pull. That's why the planets in our solar system orbit the Sun instead of careening madly through space like planetary pinballs.



A star's gravitational pull is balanced by a push outward from the energy at its core that keeps the fiery object from collapsing. When certain stars' energies die, or freeze, there may be no force left to push out from these stars' interiors. The pull force of gravity takes over and squeezes that star into a small, incredibly dense object. It's as if the largest mountain on Earth, Mount Everest, were compressed into an object the size of a marble—but with no loss of mass. That's dense with a capital D. From its center point, called the singularity, the black hole's pull is so powerful that nothing can move fast enough to escape its gravitational field—not even light. But instead of reading about them, let's go on a trip to the ultra-dense world of a black hole. We'll blast off from Earth in a rocket.

Ready?

Escaping from Earth's gravitational pull is a snap—all you have to do is reach a speed of about 25,000 miles per hour (11.2 kilometers per second). That's called escape velocity. Free of Earth's gravity, you head to the center of our galaxy, where astronomers believe that a black hole exists, one that is one million times heavier than our Sun. Because of the black hole's pull, you switch off your rockets far away from your destination and drift in. As you approach the dark circle in the distance, you witness a strange sight. There is a boundary: a curved band of light that is bent around the dark core. This is what astronomers call the event horizon. It is the farthest edge of the black hole's gravitational pull. The reason light stops at the boundary is that it cannot travel fast enough to escape from the gravitational grasp of the singularity. Strangely, as you approach the horizon, like any horizon, it seems to be still. Yet the light you see is still traveling at 186,000 miles per second—and getting nowhere.

Oh, by the way, if any of your pals on Earth are watching, they'll lose sight of you once you cross the horizon. Any radio signals you send from the space ship can't escape from the black hole. So to those back home, you've disappeared.

Once across the event horizon, you feel the tidal pull of the hole's singularity, a pull similar to the power that moves oceans on Earth. Since your feet are closer to the hole than your head, you'll soon feel as though you're being stretched like a piece of taffy candy. Every atom in your body is being pulled apart.

Unfortunately, you're moving so fast now that there isn't much to see. Any objects outside the horizon are bent into strange shapes by the curved light that is held inside the gravity field of the black hole. Faster now, the time until you make contact with the singularity is just seconds away. You feel like toothpaste being squeezed out of a tube as the power of gravity pulls you apart. Remember what it feels like going down a big roller coaster drop? Your head seems to wait in the sky as your legs head towards Earth? This is like that coaster ride—times a zillion. Are you having fun yet? What's that? You want to go back home? You'd rather read about black holes than reach one? That could be a problem. You see, even though your space ship had no problem reaching the 25,000 mile per hour escape velocity from Earth, there's no way it can reach 186,000 miles per second, the speed of light, to get out of the hole. In fact, your ship would have to go faster than that, since light can't even get away from the pull of a black hole. And faster than that is impossible. Perhaps it would have been wise to ask a little more about this trip before you climbed aboard.

You see, a voyage to a black hole is always a one-way trip.

Activity

FAR OUT TRIP Let's say you've landed on the singularity of a black hole. Obviously, everything is compressed into tiny dense objects. If a mountain could become the size of a marble, how big are you? Once you get your bearings, you stop in at the Black Hole Dock and Dine. What do you have to eat? A heavy meal, no doubt. After the meal, you pick up some postcards. What's on the front? What message do you send back to Earth? Write a journal entry describing your visit to a dense—and imaginary—world.