



“Let’s talk about why we had to travel so far to see our eclipse,” Grandpa said.

He held a Ping-Pong ball between Sammy’s head and the bulb that was our Sun. The ball made a dark shadow on only one part of my brother’s face.

“This is the same thing that happens on the Earth,” Grandpa explained. “The dark eclipse shadow falls only on one small spot on the Earth at a time. You have to be right where the dark spot is to see a total eclipse.”

I could see how there was one really dark spot on Sammy’s face. Grandpa moved the Ping-Pong ball a little in orbit around Sammy’s head, and the dark spot moved across his face. It went from his cheek to one of his ears.

“This is the same thing that happens to an eclipse spot on Earth as the Moon moves in orbit,” Grandpa said. “The eclipse shadow moves along a narrow path that can be thousands of miles long before the eclipse is over. On the other hand, the shadow is only about a hundred miles across! You

have to be right in that path to see the total eclipse. Anyone outside it will see only a partial eclipse.”

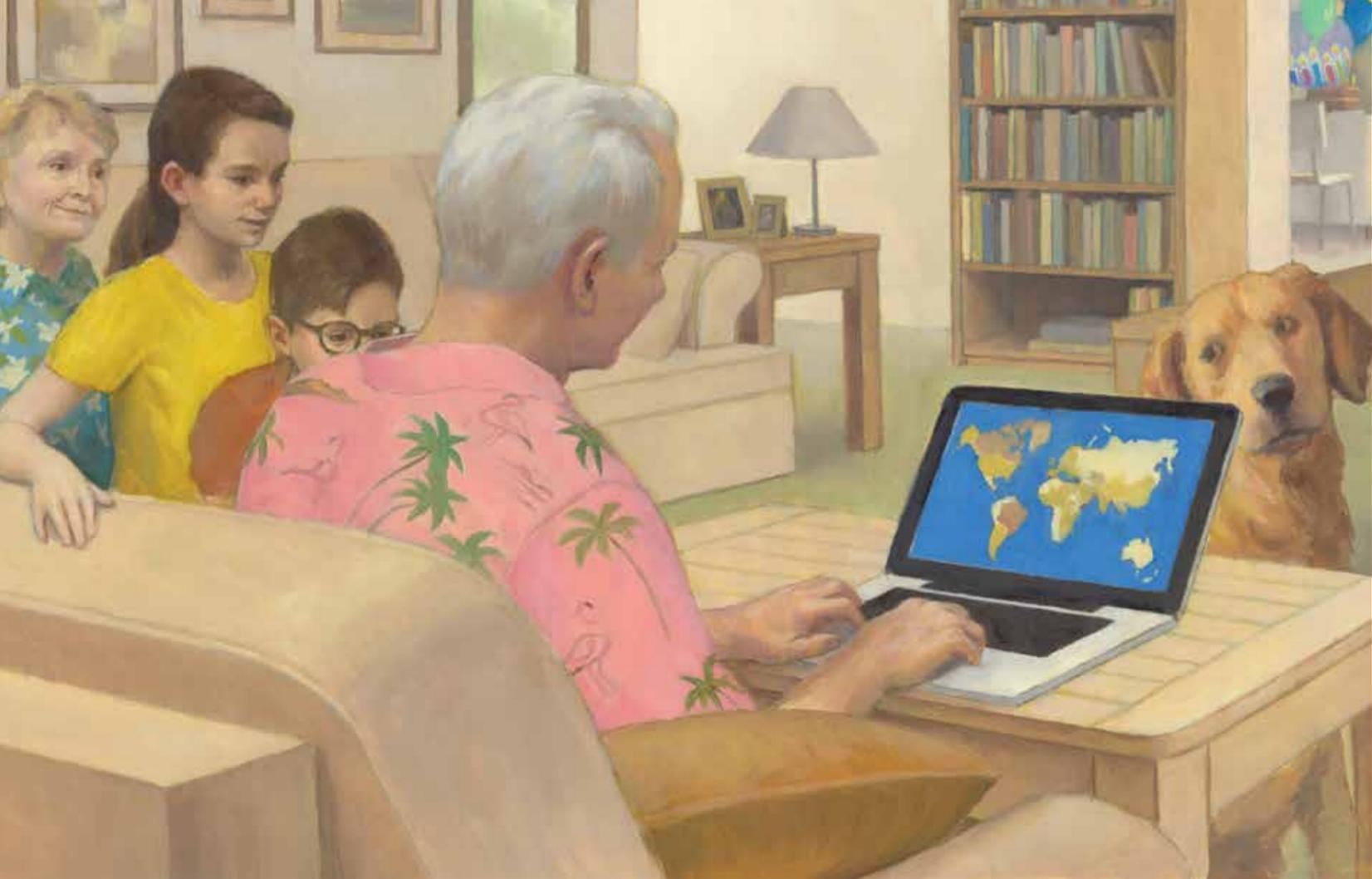
I had to think about those numbers. “How big is the Earth?” I asked Grandpa.

We looked it up on the web and I was surprised. The Earth sure is a big planet! If we put a measuring tape around the Earth’s equator, the tape would be almost 40,000 kilometers long, which is about 25,000 miles. So only a small part of the Earth sees a total eclipse.

“So you see that each time there is a total eclipse, only people in the right location can see it,” Grandpa said. “That’s why people like us travel long distances to be where we can see a total solar eclipse.”

I remembered that over dinner my grandparents told us they had planned this trip a couple years ago. So I started to wonder how they knew so far in advance when and where on Earth the total eclipse would be visible.





ABOVE: Three eclipse paths, each 18 years apart and shifted to eight hours later than the previous eclipse

Grandpa turned the lights back on, and we got cozy on the couch.

“How did you know two years ago that this eclipse was going to happen and where you had to fly to see it?” I asked.

“Diana, when I got interested in eclipses, I learned that astronomers can predict them hundreds of years in advance,” Grandpa replied. “It surprised me, too. An astronomer on one of our trips explained it to me like this: The movements of the Earth and the Moon may be complicated, but there are regular cycles to how they move. By *cycles*, we mean things that repeat regularly, like the cycle of the Moon’s phases or the cycles of

the seasons from winter to summer and back to winter. Scientists have been following the Moon’s and the Sun’s cycles for many years.”

Grandma jumped in. “A good example is the cycle of your birthday. Your birthday falls on the same date every year. But it’s not always on the same day of the week, is it?”

“My birthday was on a Sunday this year,” Sammy said.

“Exactly,” Grandma said, smiling at him, “but it wasn’t Sunday the year before. Eclipses repeat regularly, too, but where the eclipses are visible on Earth is not the same from one cycle to the next. Still, there is a pattern to them. Now imagine you

have a friend whose birthday is February 29th. What would that be like?”

I was going to say that there is no February 29th; February has only 28 days. But then I remembered about leap years. We had just covered that in school. Every four years, there is a leap year, which means they add a leap day—the 29th of February. But I never thought about somebody actually having that for a birthday.

“Huh,” I said. “That means the kid would have a birthday only during leap years. That’s kind of weird.”

“You see, some cycles take much longer to repeat than others,” Grandma said.

“Astronomers discovered that eclipses repeat on an 18-year cycle,” Grandpa told us. “So every 18 years, we get eclipses for which the exact lineup of the Earth, Moon, and Sun is the same. But the new cycle’s eclipses happen eight hours later than the previous cycle’s, so the path will be on a different part of the Earth.”

I said, “Wow, that sounds complicated.”

And Grandpa replied, “Yes, Diana, nature can be complicated, but isn’t it great that people have been able to figure all of this out about eclipses?”

And I had to agree that it was.