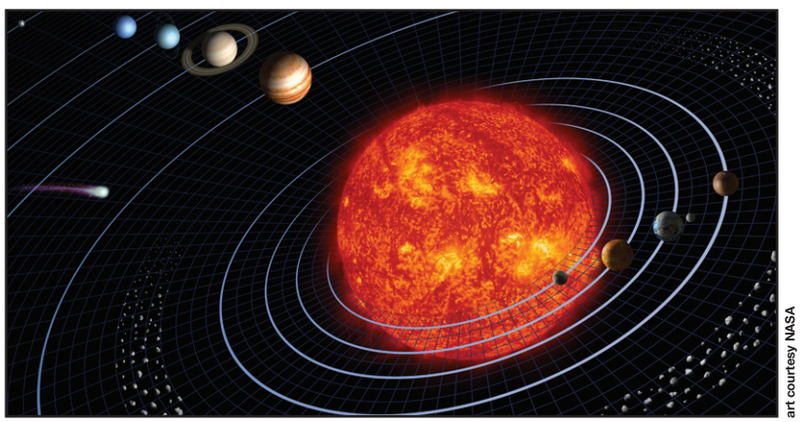
The Mini Page®
Betty Debnam, Founding Editor and Editor at Large

The Force Is With Us

Experiencing Gravity

Gravity is one of the most important forces in the universe. It causes planets and stars to form. It keeps everything, including us, on our planet. It traps the air in our atmosphere and causes the tides.

The Mini Page talked with an expert from the National Science Foundation to learn more about this important force.



art courtesy NASA

Gravity keeps our solar system together. It keeps the moon revolving around the Earth and the Earth and other planets orbiting the sun. It holds galaxies together.

Forces of nature

Gravity is one of the four forces that affect the universe. Gravity causes every object to attract every other object.

The three other forces keep atoms together or are connected with electricity and magnetism.

A **force** is something that pushes or pulls something. It can make an object move in a certain direction, or it can make an object stop moving.

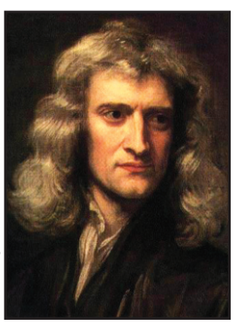
A force is like an imaginary elastic band attached to an object. The force pulls the object just as an elastic band pulls an object.

Gravity is the weakest force. It is also one of the most mysterious. We know little about it.

Newton changes everything

Sir Isaac Newton was a scientist who lived nearly 400 years ago. He was the first person to explain gravity.

The story goes that Newton was sitting under a tree when an apple fell and bonked him on the head. He wondered what made the apple fall down. Why didn't it go up instead? Why didn't it fly to the side?



art courtesy Wikimedia Commons

Isaac Newton (1642-1727)

When Newton was still in his 20s, he figured out that the same force that made the apple fall also made the moon orbit the Earth and the planets orbit the sun. He was the first person to make this connection.

Everything changes again

In the early 1900s, another young genius, Albert Einstein, realized that Newton's idea of gravity doesn't work for huge distances. It doesn't work near massive objects such as black holes.

He figured out that time had to be part of the picture. Time and space are linked together. To understand gravity, we need four dimensions — length, width, height and time.

photo by Lucien Chavan, courtesy Wikipedia

Albert Einstein (1879-1955)

If you watch science fiction shows, you may have heard about the **space-time continuum** (kuhn-TIN-u-uhm). This is what they're talking about.

The Curves of Gravity

The fabric of space-time

In Einstein's vision, space and time are woven together, similar to the threads in fabric. This imaginary fabric stretches all over the universe.

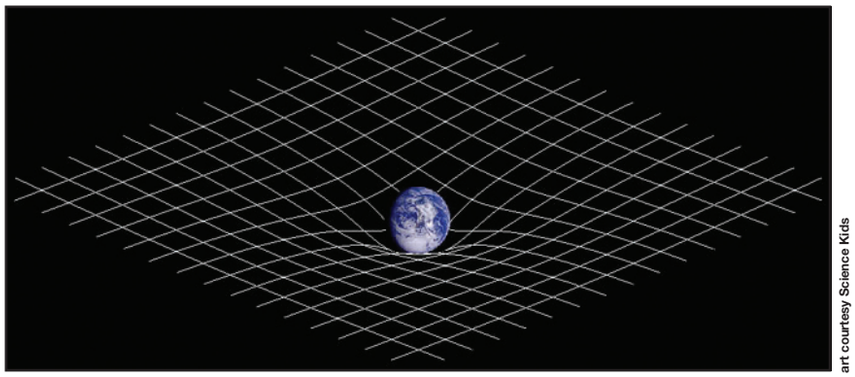
Picture a sheet of fabric stretched out tight, like a trampoline top. If you place a ball in the center of the fabric, the fabric will curve around the ball. It makes a kind of bowl.

The fabric closest to the ball is the deepest part of the bowl. The fabric farthest from the ball curves the least.

If you place smaller objects, such as marbles, on the fabric, they will roll toward the bigger object. They will follow the curve around the bigger object.

In the same way, space-time curves around an object with **mass***, such as the sun. Planets orbit along the sun's curve. Gravity is the curve around an object in the fabric of space-time.

***Mass is how much stuff, such as atoms, something contains.**



art courtesy Science Kids

As with other planets, the Earth causes the fabric of space-time to curve around it. Moons orbit around the curved bowl made by a planet.

Gravity waves

When an object moves, it bends space-time. It creates waves in space-time called **gravitational waves**.

Speed and mass affect the strength of these waves. Faster objects create stronger gravitational waves. The more massive something is, the stronger the gravitational wave will be.

Fast-moving massive objects, such as black holes, create gravitational waves that are so powerful that they can be detected on Earth, billions of miles away.

photo courtesy CaltechSSC/J.Rho and T. Jarrett and NASA/CXC/SSC/J. Keohane et al

Huge events such as supernova explosions and black holes colliding can cause gravitational waves. This image shows the remains of Supernova W49B.

Ready Resources

The Mini Page provides ideas for websites, books or other resources that will help you learn more about this week's topics.

On the Web:

- youtube.com/watch?v=74Ckkraqb-Q
- spaceplace.nasa.gov/what-is-gravity/en
- 1.usa.gov/ZAMvbb
- sciencekids.co.nz/videos/physics/gravity.html

At the library:

- "Investigating Forces and Motion: Physical Science" by Jane Weir
- "Gravity, and How It Works" by Peter Jedicke

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Gravity

TRY 'N' FIND

Words that remind us of gravity are hidden in the block below. Some words are hidden backward or diagonally. See if you can find: AIR, APPLE, ATTRACT, CURVE, EARTH, EINSTEIN, FAR, FLOW, FORCE, HEAVY, LIGHT, MASS, MOVE, NEWTON, ORBIT, PLANET, RIPPLES, SATELLITE, SPACE, STAR, SUN, TIME, UNIVERSE, WAVE.

T	E	C	A	P	S	M	N	P	T	E	N	A	L	P
M	I	S	O	L	M	O	T	C	A	R	T	T	A	F
R	A	M	T	R	N	V	F	L	E	L	P	P	A	O
I	S	S	E	A	B	E	F	L	E	V	R	U	C	R
P	U	R	S	V	R	I	F	A	O	E	V	A	W	C
P	N	Y	V	A	E	H	T	M	R	W	R	I	A	E
L	H	T	R	A	E	E	T	I	L	L	E	T	A	S
E	K	T	H	G	I	L	E	S	R	E	V	I	N	U
S	N	I	E	T	S	N	I	E	N	O	T	W	E	N

Mini Spy . . .

Mini Spy is learning about gravity with her friends the Dots. See if you can find:

- walrus
- fish
- letter A
- ring
- owl
- number 2
- stork
- butterfly
- number 3
- net
- rose
- number 7
- feather
- pear
- word MINI
- man in the moon

Rookie Cookie's Recipe
Panko Parmesan Chicken

You'll need:

- 4 medium boneless chicken breasts
- salt and pepper
- 1 tablespoon olive oil
- 1 garlic clove, minced
- 3/4 cup panko bread crumbs (or regular bread crumbs)
- 1/4 cup shredded parmesan cheese
- 2 teaspoons Italian seasoning

What to do:

1. Lightly sprinkle salt and pepper on chicken breasts.
2. Combine olive oil and minced garlic.
3. Brush chicken breasts with oil.
4. Mix bread crumbs, parmesan cheese and Italian seasoning in a pie plate.
5. Roll chicken breasts in mixture to coat both sides and place in greased baking dish. Sprinkle any remaining mixture on top of chicken.
6. Bake at 350 degrees for 30 to 35 minutes until done and juices run clear when cut. Serves 4.

You will need an adult's help with this recipe.

Meet Ilana Melmed

photo courtesy Townsley Portraits

Ilana Melmed is the leader of the band "Young Avenue Kids." The band's first album is "Whatever I Want to Be." She has written words, or **lyrics**, to go with classical music by composers such as Rossini, Grieg and Strauss.

She teaches English as a second language at the University of Southern California. She decided to produce an album of the songs she loves in order to introduce her grandkids and other kids to her favorite composers. Six of the kids singing in the band are her grandchildren.

Ilana named the band after Young Avenue, a street in Johannesburg, South Africa, where she grew up. She and her family moved to the United States in the 1970s. She taught middle school in Los Angeles before teaching college.

MIGHTY FUNNY'S Mini Jokes

All the following jokes have something in common. Can you guess the common theme or category?

Eric: What happened when the electrician mixed up the wires of the electric blanket and the toaster?
Elsa: He kept popping out of bed all night!

Elliot: What is the electrician's favorite ice cream flavor?
Ellen: Shock-a-lot!

Emily: What did the electrician's boss ask when he arrived late for work?
Emma: "Wire you insulate?"

22-4 (13); release dates: June 1-7

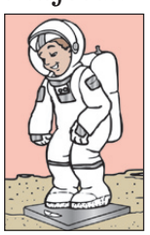
Gaining Knowledge

The facts of gravity

Gravity is a mysterious force. Here are some fun facts about gravity:

• Bigger objects have stronger gravity than smaller objects.

• Closer objects have a stronger gravitational pull than distant objects.



• Weight is tied to gravity. The more gravity there is, the more something weighs. For example, the moon has only about one-sixth the gravity of Earth. You would weigh about one-sixth as much on the moon as on Earth. If you weigh 84 pounds on Earth, you would weigh about 14 pounds on the moon.

• Around really massive objects such as black holes, the gravity is so strong that it actually bends light.

• The stronger the gravity is, the slower time moves.

• Gravity effects are measured in **G-forces**, or G's. One G is the effect of gravity on the Earth's surface. It is what we feel all the time without even realizing it.

Space shuttle astronauts experienced about 3 G's at liftoff. This means they felt about three times heavier. Roller-coaster riders can briefly experience about 5 G's.

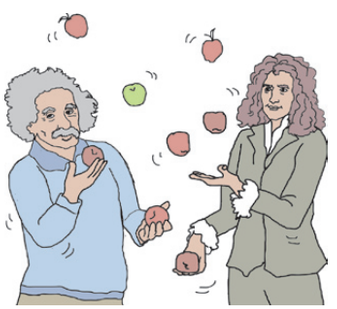
• Gravitational waves can actually change the shape of matter. On Earth, we're hit by gravity waves all the time. They actually stretch or squash our bodies. But they are so weak that we don't even notice them.

photo courtesy LIGO Scientific Collaboration

Two buildings, in Louisiana and Washington state, serve as giant gravity detectors in a U.S. project called LIGO (Laser Interferometer Gravitational-Wave Observatory). Because gravity waves change the length of things, lasers check to see if the long wings in the buildings change length.

So far, scientists haven't had any luck. More powerful detectors should be working by 2015.

Counting on gravity



Newton's ideas about gravity were so accurate, we used them to send men to the moon. But they are not accurate enough to let us use a GPS system. We need Einstein's theories for that.

Einstein realized that time flows slower where gravity is stronger. That means that time flows slower on Earth than it does on satellites up in space. The gravity on Earth is stronger. The farther away from Earth something is, the weaker the gravity is.

Atomic clocks on board **GPS**, or Global Positioning System, satellites help us figure out Earth locations. In order for GPS to work, experts have to figure out how much slower time flows on Earth than on the satellites. This is just one difference in time that experts need to figure out for GPS systems to work.

Gravity discoveries

Right now, most of what we know about the universe is through radiation, such as visible light or X-rays. Gravity waves could give us an entirely new tool for exploring the universe.

Nothing stops gravity waves. They go through everything. This is different from anything else. For example, objects such as planets can block light. But nothing affects gravity waves very much.

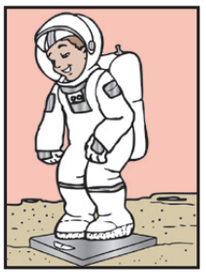
This means that gravity waves reaching us would be mostly unchanged from when they were formed. Gravity waves could show us what the universe was like less than one second after the Big Bang, when matter was created.

The Mini Page thanks Dr. Pedro Marronetti, project director for gravitational physics, National Science Foundation, for help with this issue.

Look through your newspaper for pictures showing gravity at work.

Next week, The Mini Page celebrates Father's Day.

Read all about gravity



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The Mini Page®

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Appearing in your newspaper on _____.

(Note to Editor: Above is camera-ready, one column-by-3 1/2-inch ad promoting Issue 22.)

release dates: June 1-7

22-5 (13)

The Mini Page® Standards Spotlight: Experiencing Gravity

Mini Page activities meet many state and national educational standards. Each week we identify standards that relate to The Mini Page's content and offer activities that will help your students reach them.

This week's standard:

- Students understand the characteristics of objects. (Science: Physical Science)

Activities:

1. Draw a picture of how gravity affects you in real life.
2. Divide a piece of paper into two halves. On one half, paste newspaper pictures of items that have large mass. On the other, paste items that have small mass.
3. In the newspaper, find examples where gravity is a good thing and examples where gravity creates problems. Explain your choices.
4. How are these important to gravity: (a) GPS, (b) Einstein, (c) G's and (d) force?
5. Select a sports story from your newspaper where the reporter describes many plays in a game. Explain where gravity plays a part in each play described in the game.

(standards by Dr. Sherrye D. Garrett, Texas A&M University-Corpus Christi)

(Note to Editor: Above is the Standards for Issue 22.)

Goldie Goodsport's Report

Supersport: Keilani Ricketts

Height: 6-2 Hometown: San Jose, Calif.

On the pitcher's mound, Keilani Ricketts baffles opposing batters. At the plate, she batters opposing pitchers.

Her hurling and hitting heroics helped the University of Oklahoma women's softball team gain a No. 1 ranking and have Ricketts on track to earn All-American honors for the fourth straight year.

The tall lefthander with the sizzling fastball and deceptive change-up won 24 of her first 25 pitching decisions, which included 246 strikeouts. Add to that her solid .402 batting average and 11 home runs.

Last season's National Player of the Year is strong academically, as well; she's an honor student majoring in health and exercise science. Her other chief interest is collecting sports equipment to send to people in Somalia, in Africa. And, of course, Ricketts plans to keep on collecting wins for the Sooners.

(Note to Editor: Above is copy block for Page 3, Issue 22, to be used in place of ad if desired.)