Finally, let's look at the physics of rainbows. Why do rainbows form after it rains? You may already know that white light is composed of all the colors in the rainbow, and that each color has a different wavelength. This is why a prism works—when white light enters a prism, the glass bends each wavelength of light by a different amount, separating the colors and creating a rainbow on the other side.

Image Credit: Tim Perdue

After a rainstorm, the little droplets of water in the air act like tiny prisms, bending all the different colors contained in sunlight to create beautiful rainbows. Here is how this works. There are many different ways in which sunlight can pass through a droplet of water, but let's look at one of the most important paths light can take. When light first passes into the droplet, it is bent, because light travels differently in water than in air. This is called "refraction." The light is then reflected off the back of the droplet and passes back through the droplet and into the air, refracting once more upon entering the air. In every instance of refraction or reflection, each different wavelength of light is bent by a different amount, creating the rainbow we see. Rainbows often appear in the water droplets from fountain streams and sprinklers as well!

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Physics Brochures Series by Sarah Marie Bruno, '16
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The Physics Hiding...

Image Credit: Kevin Dooley, Wikimedia Commons

...In Everyday Life!

HELPING TO FURTHER

PUBLIC UNDERSTANDING

OF PHYSICS CONCEPTS

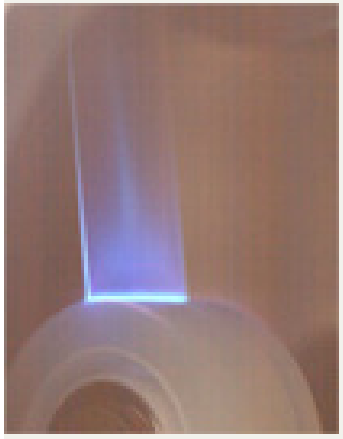
The Physics of Everyday Life:

Physics is everywhere. It is part of everything we do from riding a bike to turning on the lights in the morning. Actually, it is thanks to the laws of physics that we even exist rather than exploding into millions of protons, electrons, and neutrons!

Let's look at some examples of physics phenomena showing up in everyday things. First up—Scotch tape.

At the University of California, Los Angeles, researchers found that X-rays were released when they unrolled Scotch tape! Quickly snapping the adhesive goop off the surface released electrons, resulting in short (about a billionth of a second) X-ray bursts. Dr. Seth Putterman, a professor of physics at U.C.L.A described this as a "microscopic lightning effect." While the X-ray bursts are extremely short, they are actually powerful enough to take an X-ray of a finger!

Don't worry—you won't irradiate your finger by using Scotch tape. The X-rays are only produced when tape is peeled in a vacuum (where there is no air). Still, if you peel tape in a dark closet, you may be able to see some visible light such as in the photograph below! Try it!



You can see this blue glow, because some materials release light when they undergo friction or pressure. This is called "triboluminescence," and is the same reason why wintergreen LifeSavers candies glow in the dark when you bite down on them.

Image: Carlos G, Camara, Juan V. Escobar and Seth J. Putterman

Now let's look at something a bit different—cats. You may have noticed that no matter how a cat is dropped it will always land on its feet. How does Fluffy do this? Actually, this has to do with Conservation of Angular Momentum.

Image from Imgur.com

Momentum is the tendency for something to resist changes in its motion. Heavier objects have more momentum, which is why it is harder to maneuver a full grocery cart as compared to an empty one. Angular momentum is the tendency of a spinning object to keep spinning in the same direction. One of the laws of physics is that momentum is ALWAYS conserved. If no outside forces act on an object to make it spin, it will not spontaneously begin spinning. When Fluffy starts to fall, she has no angular momentum; she is not spinning at all. So how can she turn herself around without defying physics?

Physicists TR Kane and MP Scher from Stanford University studied the technique kitties use to land on their feet, modeling the cat as two cylinders—one for the front half and one for the back half. They found that these two "cylinders" move separately, causing the cat to change its shape. This shape change introduces angular momentum. However, since there was no angular momentum initially, there cannot be any later, because momentum is conserved. As a result, the cat will spin so that the angular momentum from the spinning motion cancels the angular momentum created by the shape change resulting in no net angular momentum! She then lands smoothly on her feet. Fluffy is smart!

Angular momentum is also very important in ice-skating. Have you ever seen a spinning figure skater pull her arms in and then begin to spin faster and faster? Just like cats change their shape to rotate, the figure skater is effectively changing her shape by pulling her arms inward. This reduces what is called her "moment of inertia." A lower moment of inertia would result in less angular momentum, but, remember, angular momentum is always conserved. In order to maintain the same angular momentum, the laws of physics demand that she spin faster.

Image: Yuko Kawaguti at the 2010 Cup of Russia (Wikimedia Commons)