Students create and observe wavelengths at various energy outputs.

What you’ll need:
- Power electric drill and chuck key
- One 20 penny nail, bent in vise with pliers
- Nylon cord; cut one piece to 15 feet and another to 1 foot
- Two #2 fishing swivels (found in fishing section of sporting goods)
- Toy Slinkies (optional)

Directions:
1. Before presenting this demonstration, provide some background information on the electromagnetic spectrum.
2. Prior to the demonstration, you will need to bend a 20-penny nail as shown. You will have to use a vise to accomplish this.
3. Attach a swivel to each end of the nylon cord.
4. Tie the 1-foot piece of cord to one of the swivel holders. This is the piece of cord that a student will hold during the demonstration.
5. Slide the bent nail through the eye of the other swivel.
6. The nail end should be put into the drill bit fitting and tightened securely with the chuck key.
7. To ensure the safety of your students, it is imperative that the cord not break during the demonstration. Be sure to test it before you present it to your students. Also ensure that students helping with the demonstration are wearing safety glasses.
8. Ask a student to hold one end of the cord.
9. Plug in the drill and the demonstration begins. The less tension you apply, the more waves will appear. You can also vary the speed and reverse the direction of the drill to get different wave effects. Experiment and have fun!

Note: If you do not want the complication of using a drill, you can simply have students use their arms and hands to generate the wave using a length of rope or have class groups use a Slinky to demonstrate energy and wavelengths.

Ask yourself the following questions:
1. What happens to the length of the wave when the drill speeds up, i.e., when more energy is added? (The wavelength shortens.)
2. What occurs to the wavelength when the drill is slowed? (Wavelength increases.)
3. UV radiation is a relatively short wavelength. It is shorter than visible light. What is the energy of UV radiation relative to visible light? (It has higher energy.)
4. What about infrared radiation? How does it compare to visible light? (It has a longer wavelength and has less energy.)
5. What type of electromagnetic energy has the shortest wavelength and what does that signify? (Gamma rays have even shorter wavelengths, and thus have higher energy, which can be damaging to lifeforms on earth.)

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- UCAR Science Education [http://spark.ucar.edu/teachers]
Figure 1. Electromagnetic Spectrum

Source: Windows to the Universe