# MAGNETIC GLOBE

## Assembly:

**1.** Using the knife, cut a small (approximately one inch) slit to the center of the globe.

**2.** Insert the magnet into the center of the sphere.

**3.** Align the poles of the magnet as close as possible to the correct orientation of the Earth's real magnetic poles. This can be done by placing about 3 "clamped" staples on each end of the globe, then moving them over the sphere until they stick out almost straight off of the globe. Another way to determine the poles is by using a compass just as you would to find the real Earth's poles. Place the compass against the globe, and follow the needle to the north pole. Once you have located the poles, rotate the magnet until the north pole is in the approximate location of the Queen Elizabeth Islands.

**4.** Seal up the seam on the rubber ball using two or three pins with plastic heads to bind the sides together as one would with fabric.

**5.** Slowly drop the "clamped" staples on the sphere, placing them so that they do not criss-cross along the latitude direction of the Earth globe. Make sure your globe looks like the image shown here.

### Materials:

- 1 – 2.5 inch diameter foam rubber Earth Globe (can be any similar foam rubber ball)
- 1- neodymium magnet – 1" sphere or cube
- Exacto or other very sharp cutting knife
- 2 or 3 pins with round plastic heads
- ~100 "clamped" staples (i.e., staples that have been produced by a stapler as if they were going through paper, except without the paper)

## What this globe ball demonstrates:

The staples provide a three dimensional representation of the magnetic field lines of our Earth. Our Earth's magnetic field is a configuration known as a "dipole field." This type of field is also observed from common magnets, such as bar magnets, but most representations of this field configuration appear in textbooks or are done on pieces of paper using iron filings, and therefore are only experienced in two dimensions.

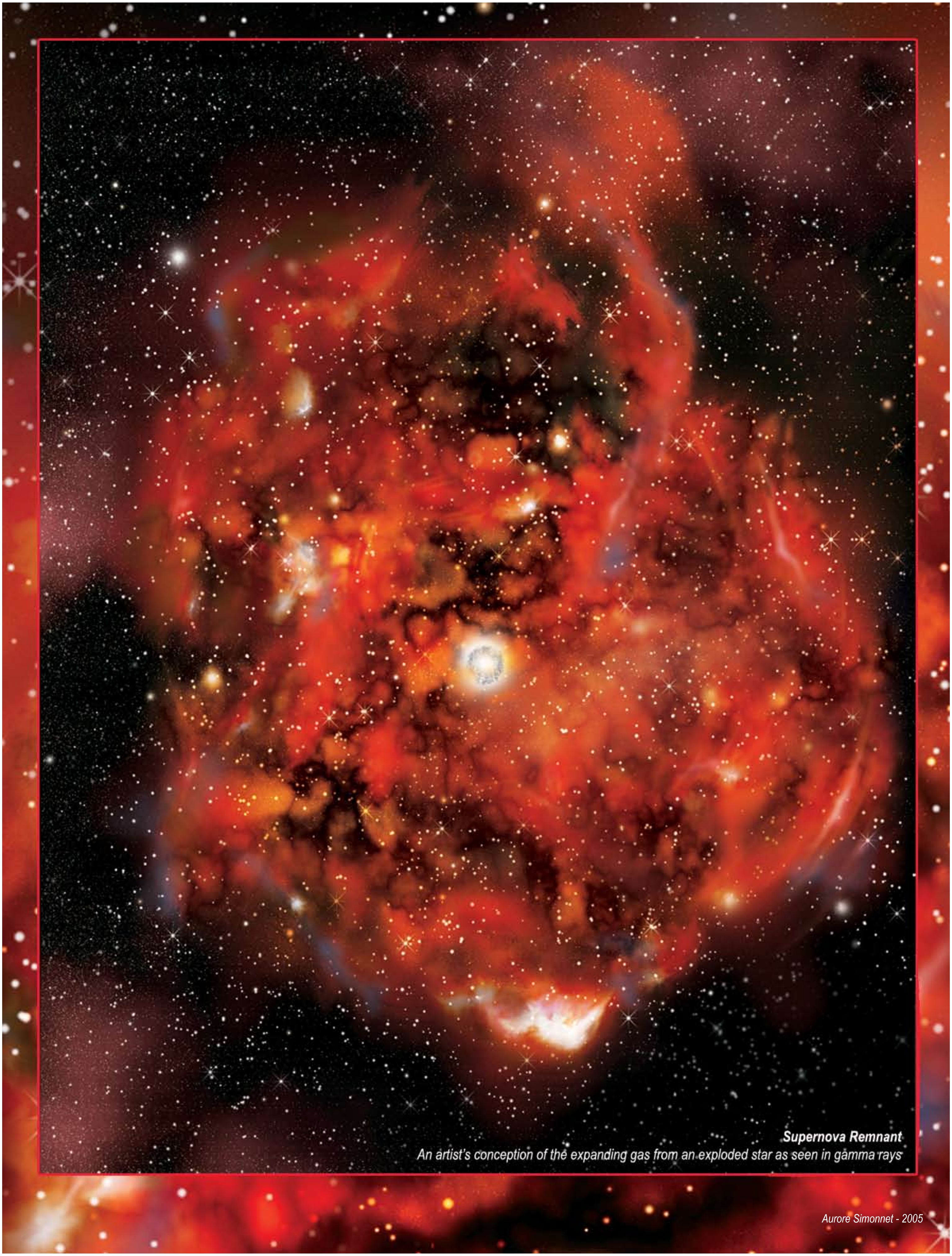
Many objects in space have dipole magnetic fields that are geometrically similar to that of the Earth. However, the strength of magnetic dipole fields in space vary dramatically – from fractions of a Gauss (solar surface) to billions of Gauss (magnetic white dwarf stars.) The most extreme magnetic fields in the Universe are seen from neutron stars known as magnetars (approximately one thousand trillion or $10^{15}$ Gauss). The strength of the magnetic field is proportional to the density of field lines in a given region: areas with a greater density of field lines have stronger fields. In this case, the field lines are represented by staples and so the field is stronger where the staples are closer together.

Using the magnet in the globe you can show your students that a stronger magnetic field source will have the staples aligned closer to each other. To properly demonstrate this, the magnet must be spherical in shape. Use a second magnet, or pull the magnet out of the foam rubber globe, and repeat the experiment with the staples placed directly on the magnet.


*The assembled Earth Globe with the magnet properly aligned. The staples follow the magnetic field lines.*

**Resources:**
For more activities about Supernovae see:
*http://xmm.sonoma.edu/edu/supernova*

More about the Earth's Magnetic Field see:
*http://liftoff.msfc.nasa.gov/academy/space/mag_field.html*
*http://en.wikipedia.org/wiki/Earth's_magnetic_field*



**Supernova Remnant**
*An artist's conception of the expanding gas from an exploded star as seen in gamma rays*

*Aurore Simonnet - 2005*