

# Post Cards from Outer Space

THIS SPACE FOR WRITING MESSAGES

Do you love those NASA Hubble Telescope photos, but wonder "What exactly am I looking at?" Then take a tour of the universe and send back your own Post Cards from outer space.

PLACE  
ONE CENT  
STAMP  
HERE  
MADE IN U.S.A.

POST CARD

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Over the course of their lifetime, stars change. For example, at a certain point in its lifetime, a red giant star puffs off its exterior gasses. The star's core collapses to form a white dwarf star. The result is called a "planetary nebula" (a misnomer, they have no connection to planet formation).

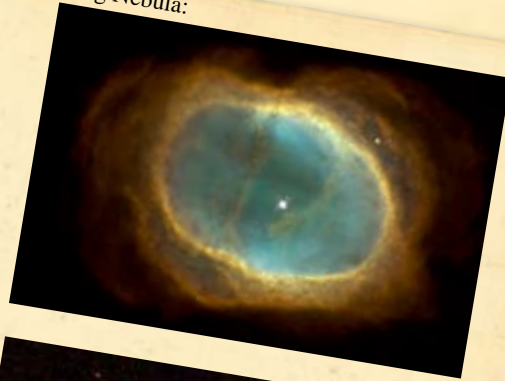
#### What to look for:

- Wispy cloud (called nebula). Some are spherical, but most have a double-lobe configuration, where matter has been ejected from the stellar poles. Sometimes the lobes are oriented head-on toward us and appear as a ring (for example, the Ring Nebula).
- Like snowflakes, no two of the same complex patterns in each nebula, indicative of multiple emissions by the dying star.
- Tiny white dwarf star in the center of the nebula. White dwarf star is the remnant of a once huge red giant star.

Photos of planetary nebulae:



Ring Nebula:



Stars are colorful: white, blue, red, yellow (our Sun appears yellow from within Earth's atmosphere). However, photos capture star color, as in this Hubble telescope image of a globular cluster.

Globular clusters are regions dense with stars -- located above and below the spiral arms of our galaxy. It is unknown why globular clusters formed.

#### What to look for:

- Globular clusters- star clusters with dense central regions.
- Red stars rule! Few blue stars!

#### Why more RED stars?

Red dwarf stars burn very slowly over time, while the bright blue stars burn fast and die young.

Comparing the relative abundance of long lived red dwarfs with the less prevalent stars of other colors in globular clusters allows astronomers to date our galaxy at about 13 billion years.<sup>1</sup>

Also, aging yellow stars temporarily become red giants, adding to the population of red stars.

<sup>1</sup>[http://map.gsfc.nasa.gov/universe/uni\\_age.html](http://map.gsfc.nasa.gov/universe/uni_age.html)

Photo of Globular cluster, Red stars rule!



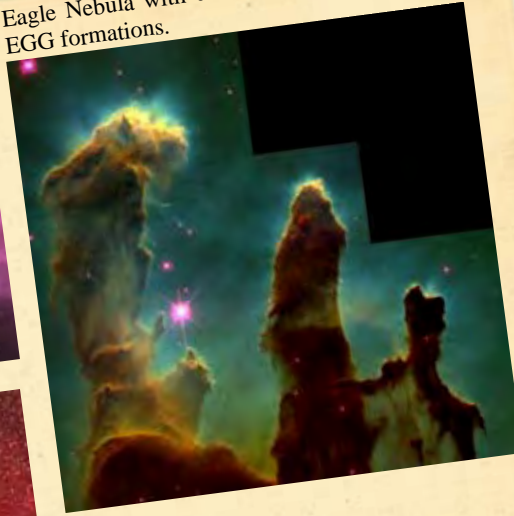
Photo of Horsehead Nebula



Emission nebula:



Eagle Nebula with columns and other smaller EGG formations.



Nebulae are clouds of gas and dust, remnants of previously exploded stars. Some nebulae form shapes appealing to the human eye, such as the Horsehead Nebula.

In dense nebulae, stellar material is recycled to form new stars, so that many nebulae act as baby star nurseries, where a new generation of stars is born.

**What to look for:**

Different types of nebulae including:

- Glowing nebulae (“emission nebula”) composed of hot gases.
- Nebulae that are thermally cool just reflect light from nearby stars (“reflection nebula”) but only if that light is available. Otherwise they appear dark. The Horsehead Nebula is illuminated from behind.
- Small dense regions called Evaporating Gaseous Globules, or EGGs, which are exposed via photo-evaporation by light from nearby stars. New stars are believed to form inside EGGs (no pun intended).

Einstein’s General Theory of Relativity first predicted that light could be deflected by the gravitational well of a star or a galaxy.

Gravitational lenses have been used to observe other galaxies that are even more distant (and hence younger).

Micro-lensing has allowed astronomers to infer the presence of planets. Someday direct viewing of distant planets as small as earth may be possible.

**What to look for:**

- Central galaxy (or cluster of galaxies) that is creating the effect,
- Smear/stretched repeating images of another object (such as a galaxy) around the periphery (blue in this photo).

Photo of Gravitational lens



Other great pictures can be obtained from NASA’s Astronomy Picture of the Day website <http://apod.nasa.gov/apod/archivepix.html>  
Another great website is: <http://www.seds.org/MESSIER/>