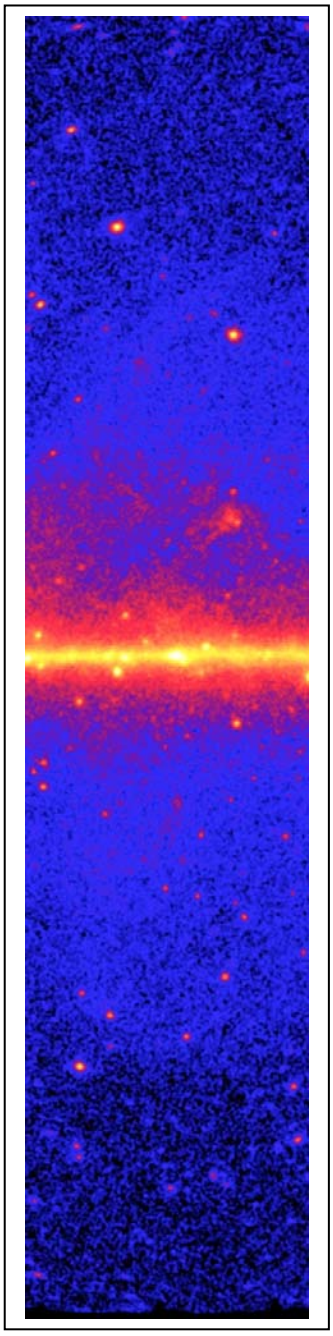
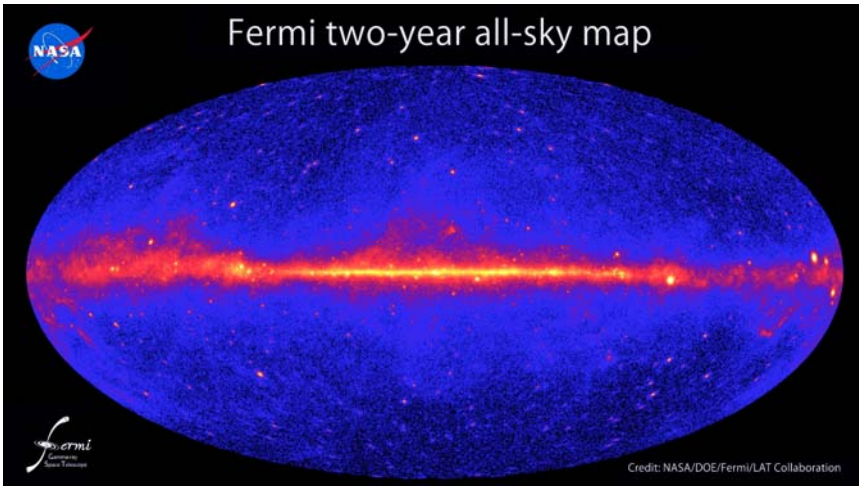




This all-sky image, constructed from two years of observations by NASA's Fermi Gamma-ray Space Telescope, shows how the sky appears at light energies greater than 1 billion electron volts (1 GeV). As a comparison, the x-rays used by your dentist to search for cavities have energies of only about 5,000 electron volts (5 KeV).

In the false-color diagram above, brighter colors like red orange and yellow, indicate brighter gamma-ray sources. A diffuse glow fills the sky and is brightest along the plane of our galaxy (middle). The point-like gamma-ray 'spots' are believed to be pulsars and supernova remnants within our galaxy, as well as distant galaxies powered by supermassive black holes. (Credit: NASA/DOE/Fermi LAT Collaboration)

Earlier this year, the Fermi team released its second catalog of sources detected by the satellite's Large Area Telescope (LAT), producing an inventory of 1,873 gamma-ray point-sources found in their survey. The resulting classifications of the sources are shown in the lower-left table.

A much smaller study of 11 of these 572 unidentified Fermi/LAT sources by the Japanese Suzaku X-ray Observatory revealed that 6 could be identified as pulsars, 3 were unknown, 1 was a normal flaring star and 1 was a blazar-type galaxy.

Type of Object	Number
Blazar galaxy	1069
Pulsars	115
Supernovae	77
Active Galaxies	20
Normal galaxies and stars	20
Unknown objects	572

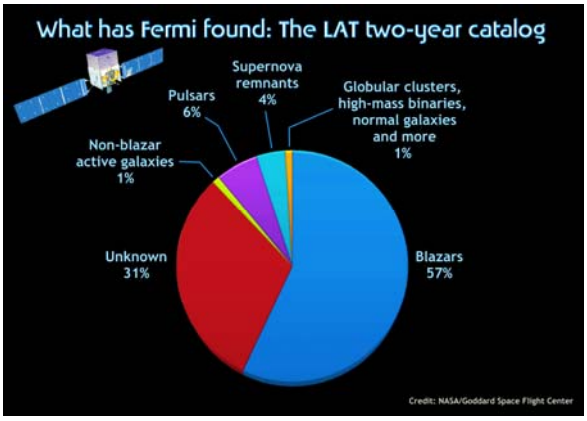
Problem 1 – Create a pie graph showing the percentage of gamma-ray sources in each of the six different categories listed in the original Fermi/LAT survey.

Problem 2 – Based upon the results from the second Suzaku Survey of the 'unknown' objects, and assuming that the Suzaku objects were randomly selected from the Fermi/LAT 'unknowns' , what are the new percentages for the 6 categories?

Problem 3 – What is the probability that the remaining unknown Fermi/LAT survey sources are very faint blazer galaxies and pulsars?

Problem 1 –Answer: See the percentages listed in the table below and the actual pie graph provided by the Fermi/LAT research report.

Type of Object	Number	Percentage
Blazar galaxy	1069	**57%**
Pulsars	115	**6%**
Supernovae	77	**4%**
Active Galaxies	20	**1%**
Normal galaxies and stars	20	**1%**
Unknown objects	572	**31%**



This pie graph is from
http://www.nasa.gov/mission_pages/GLAST/news/gamma-ray-census.html

Problem 2 – Answer: The 11 Suzaku survey says that the 572 Fermi/LAT unknowns should be distributed as follows among the Fermi/LAT source types:

Pulsars = 6/11 x 572 = 312 sources
Unknown = 3/11 x 572 = 156 sources
Normal star = 1/11 x 572 = 52 sources
Blazar = 1/11 x 572 = 52 sources.

Adding these to the already identified Fermi/LAT source types we get the new distribution:

Type of Object	Number (N=1873)	Percentage
Blazar galaxy	1069 +52 = 1121	**60%**
Pulsars	115 + 312=427	**23%**
Supernovae	77=77	**4%**
Active Galaxies	20=20	**1%**
Normal galaxies and stars	20 + 52=72	**4%**
Unknown objects	156	**8%**

Problem 3 – What is the probability that the remaining unknown Fermi/LAT survey sources are very faint blazer galaxies and pulsars? Answer: 60% + 23% = **83%**