# Multiwavelength Astronomy: Your World in Different Light

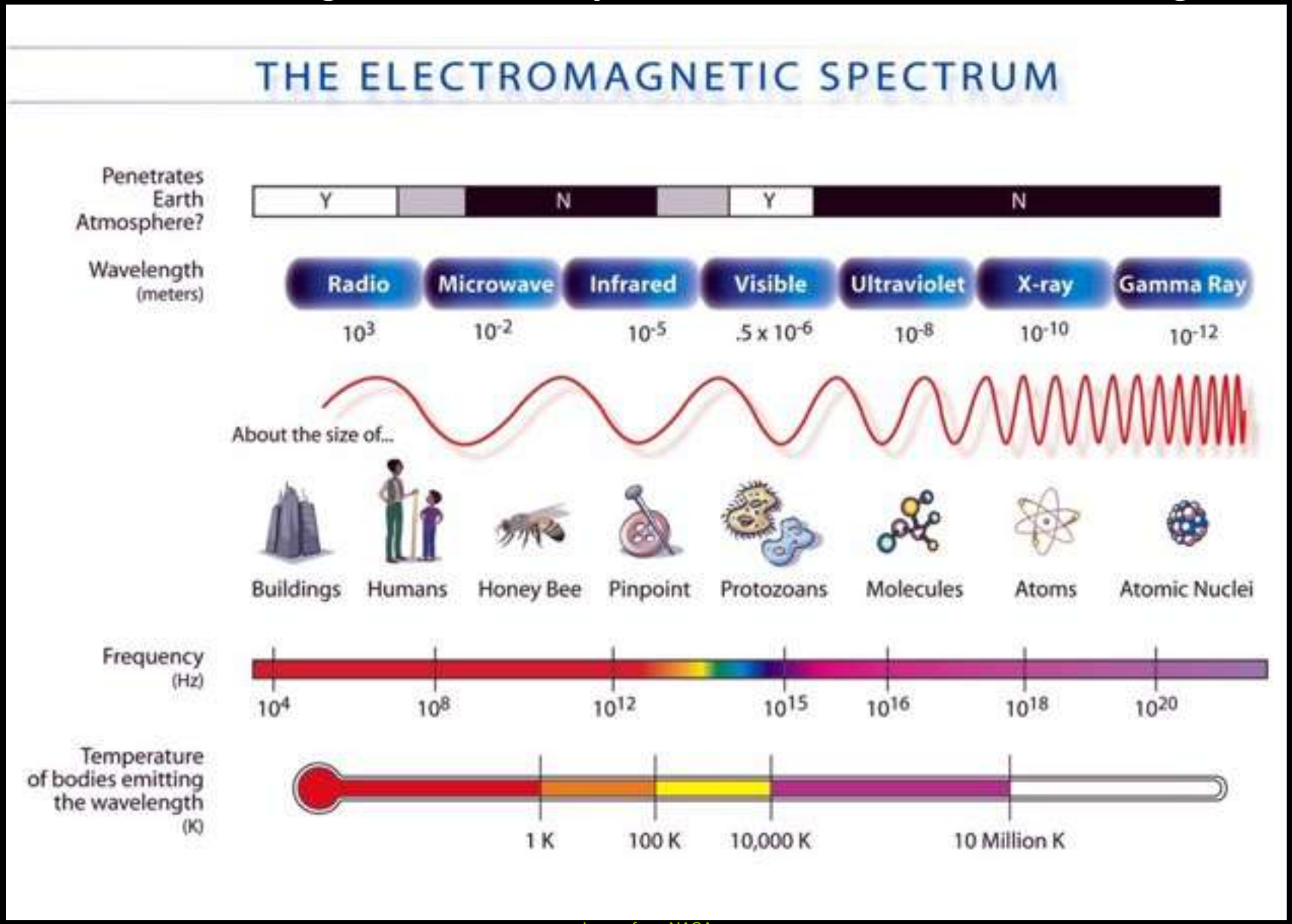
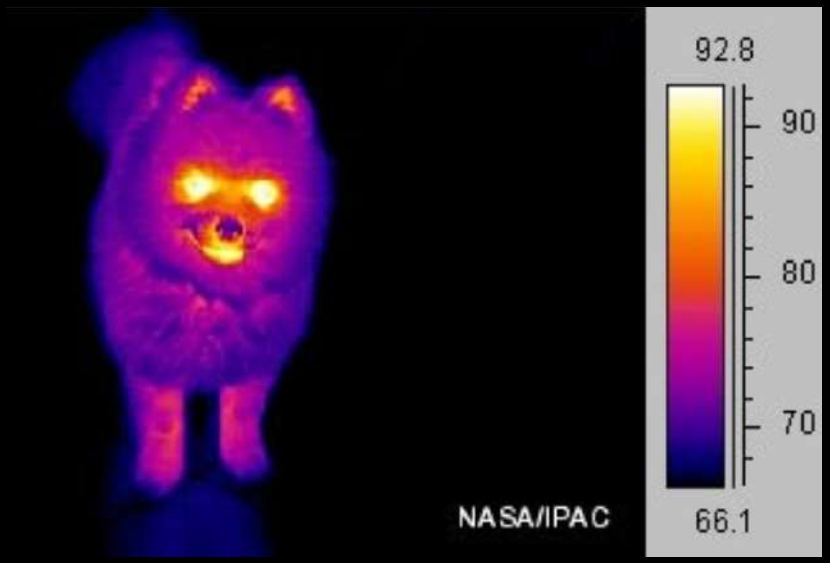



Image from NASA

# Infrared Dog



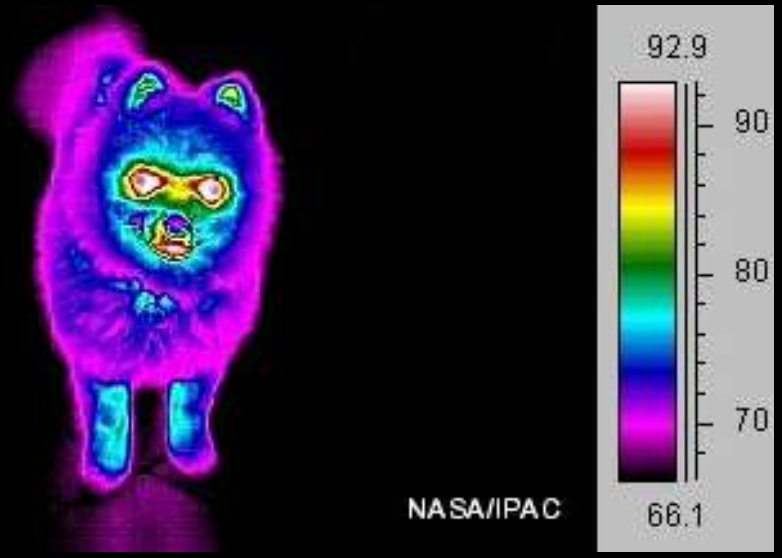
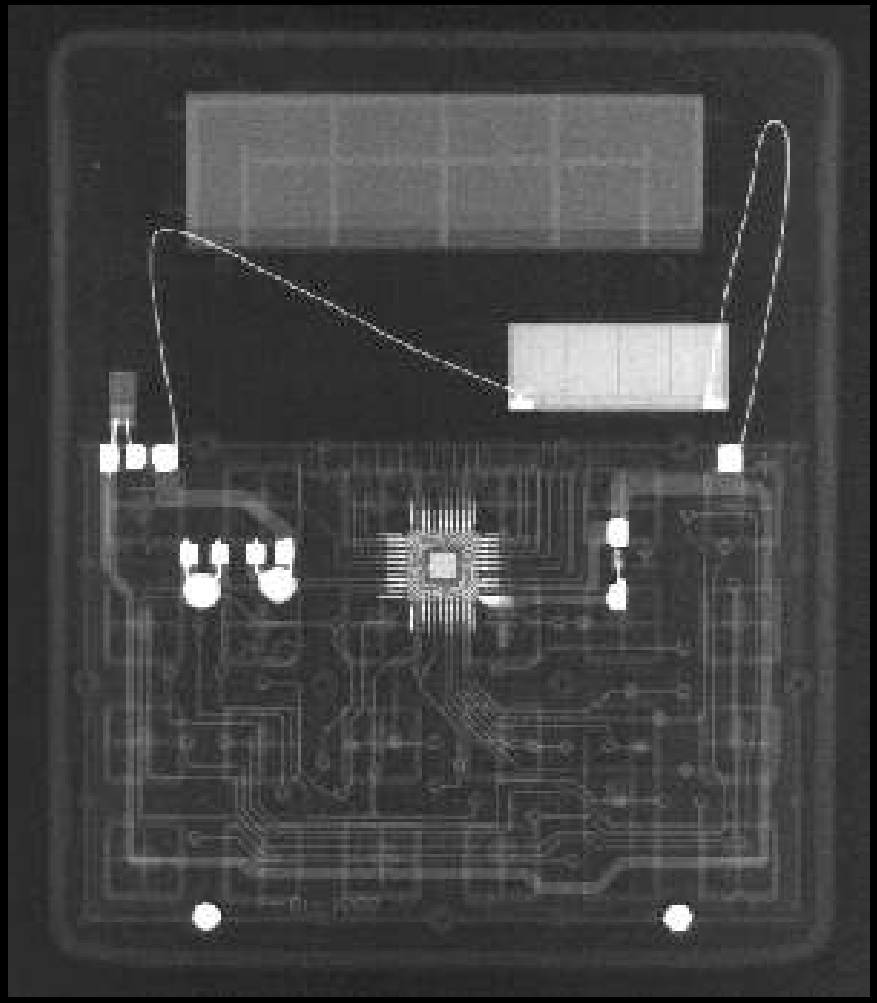




Image from Cool Cosmos

- False color images of a dog photographed in the infrared
- Which parts are hottest? Coolest? Can you normally tell just by looking?

# X-Ray Challenge

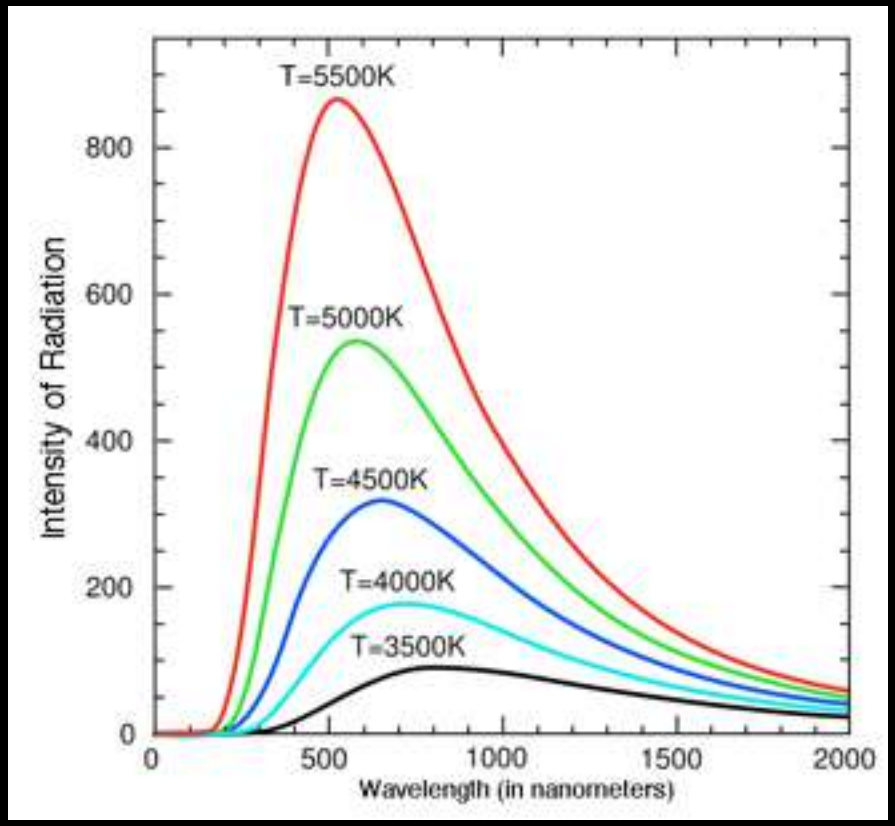
- This X-Ray image was taken of a closed object.
- What ordinary object do you think this is?
- What are the bright areas made of?

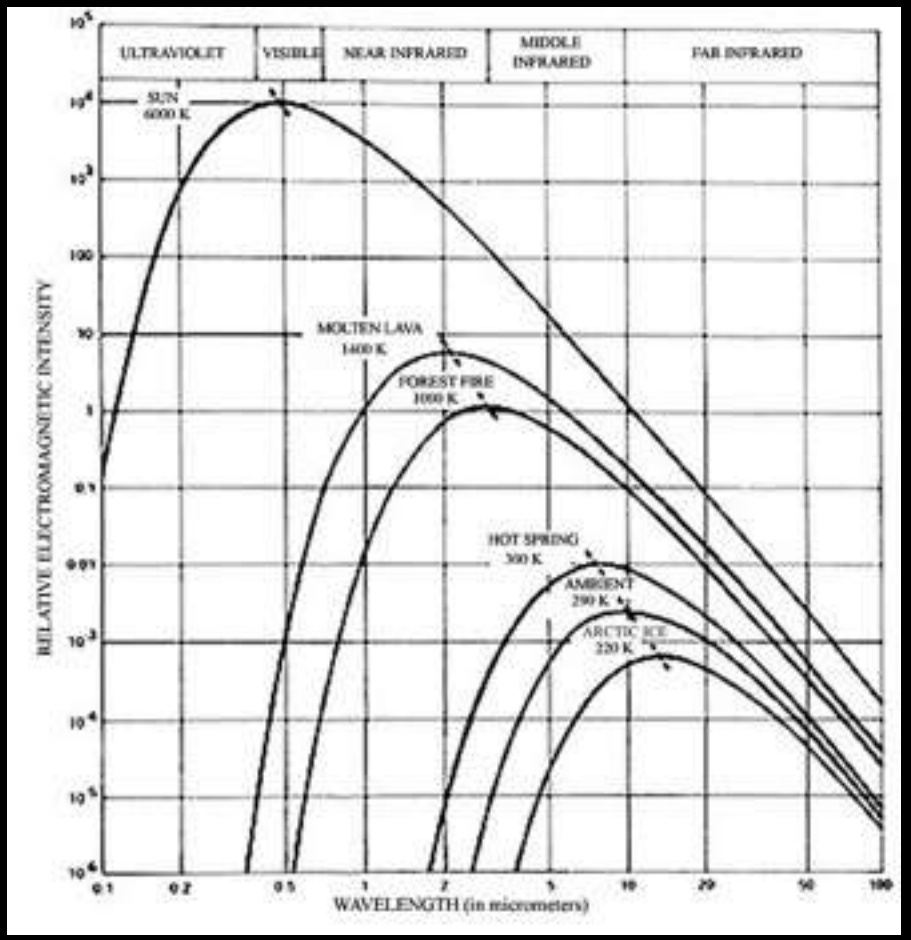


# Wien's Law

$$\lambda_{max} = \frac{3{,}000{,}000\ (K \cdot nm)}{\text{Temperature (K)}}$$

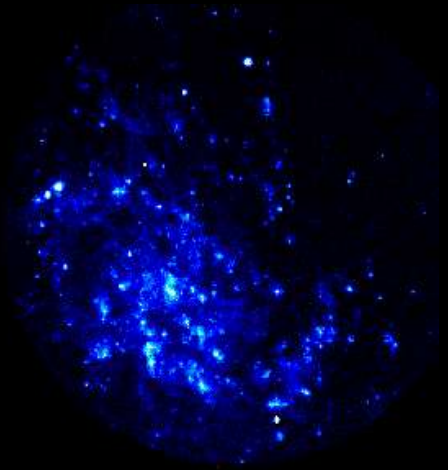
$\lambda_{max}$: wavelength of maximum intensity (in nanometers)
K: Kelvin
nm: nanometers



# Galaxy Features

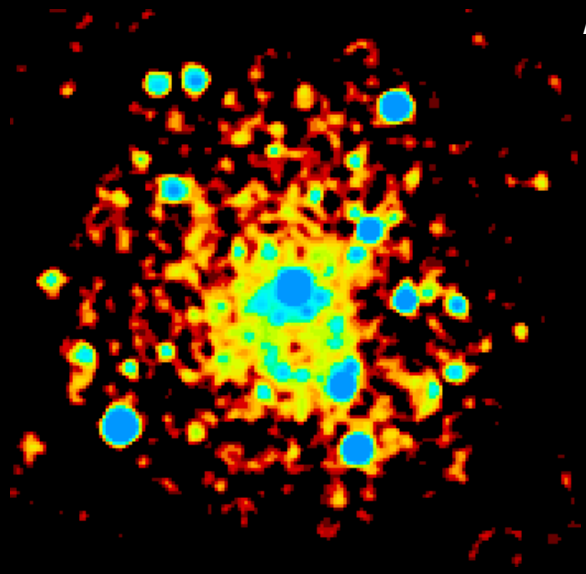
This is a galaxy called M33
viewed in 5 different wavelengths…



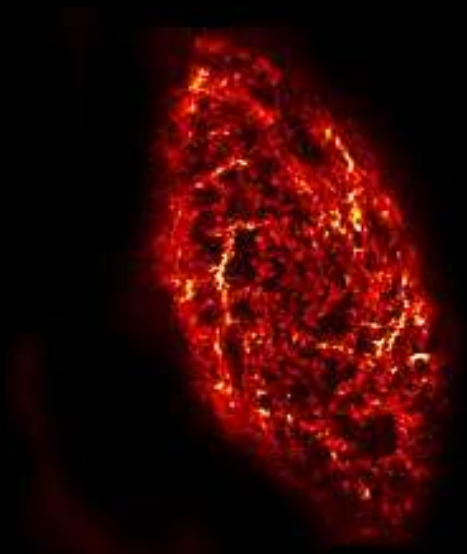
**Ultraviolet:**
*Young, Hot Stars*

**Visible:**
*Most Other Stars*

**Infrared:**
*Dust*



**X-Ray:** *Hot Gas*



**Radio:** *Cool Gas*

# Multiwavelength Astronomy

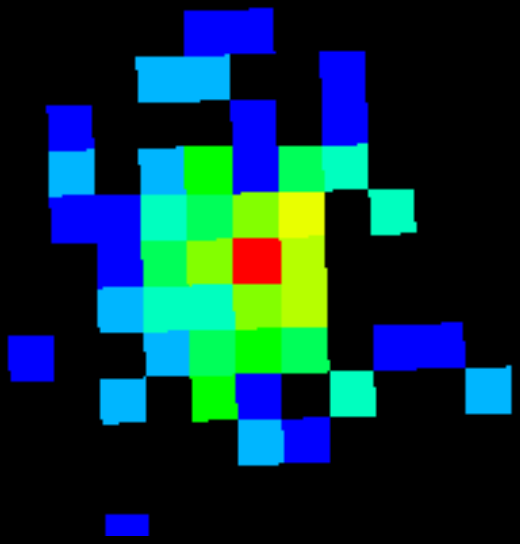
## Galaxies in Different Light

# M94

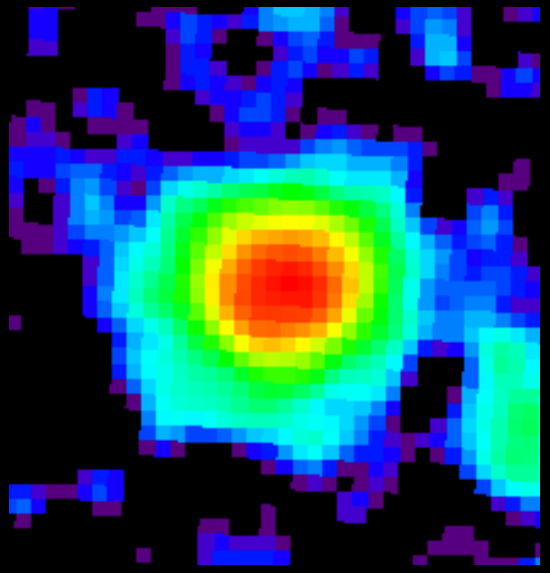
Ultraviolet - VII

Visible - 1

Infrared

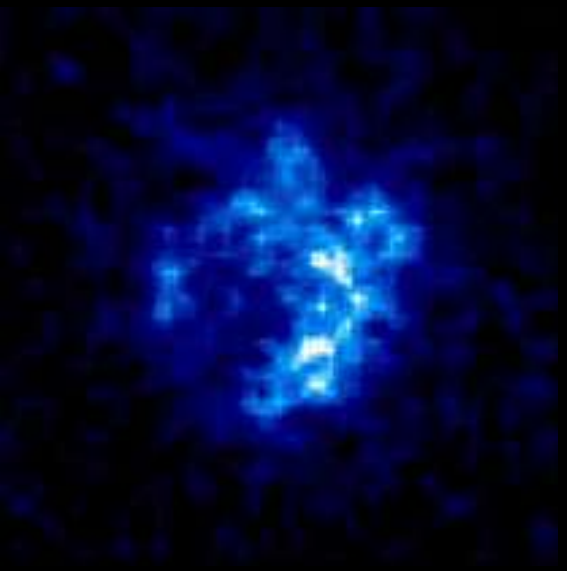


X-Ray



Radio - C

# M100



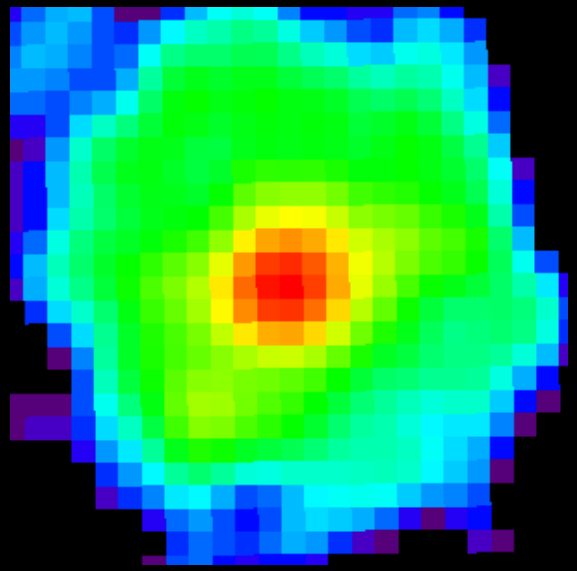
Ultraviolet - IV

Visible - 2

Infrared

No X-Ray Image Available

X-Ray

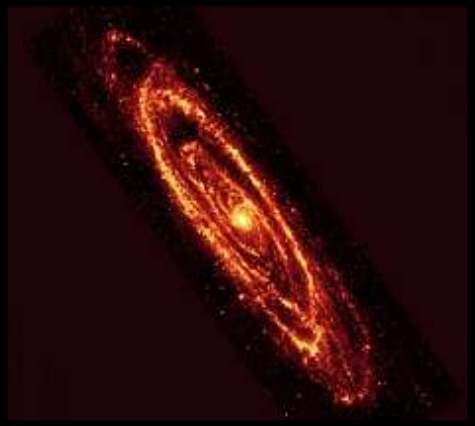


Radio - A

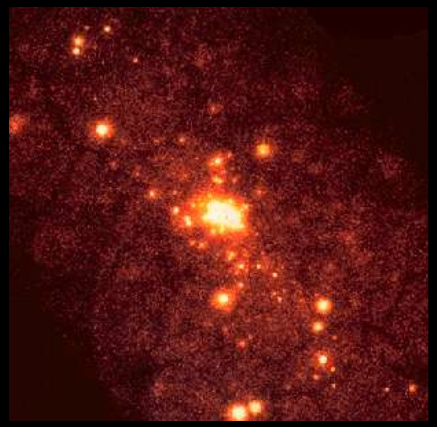
# M31

Ultraviolet - III

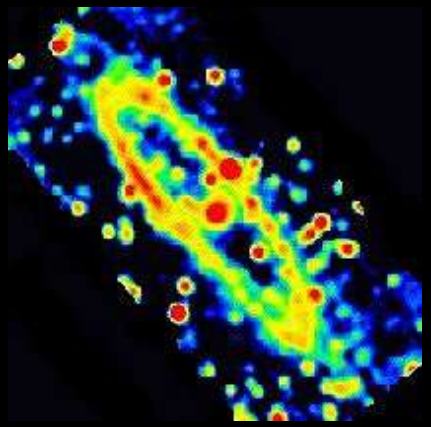
Visible - 3



Infrared



X-Ray



Radio - G

# M101

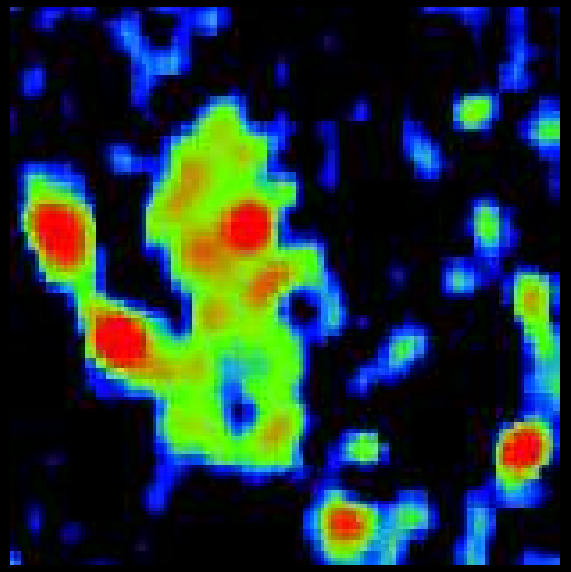
Ultraviolet - II

Visible - 4

Infrared

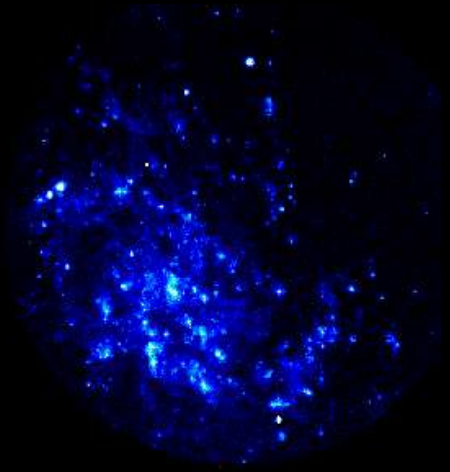
No X-Ray Image Available

X-Ray



Radio - H

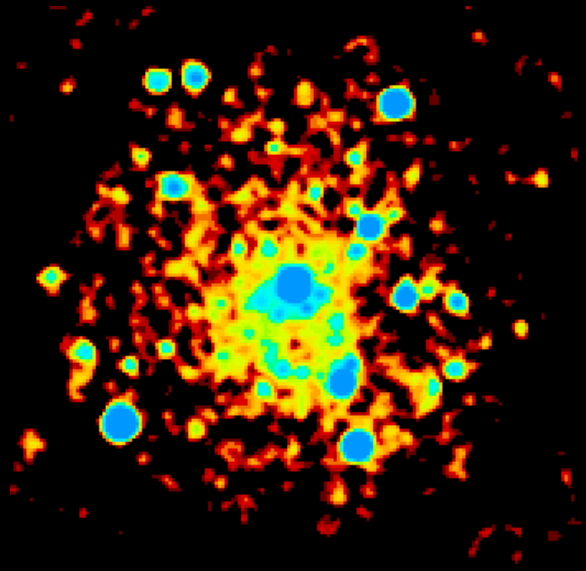
# M33



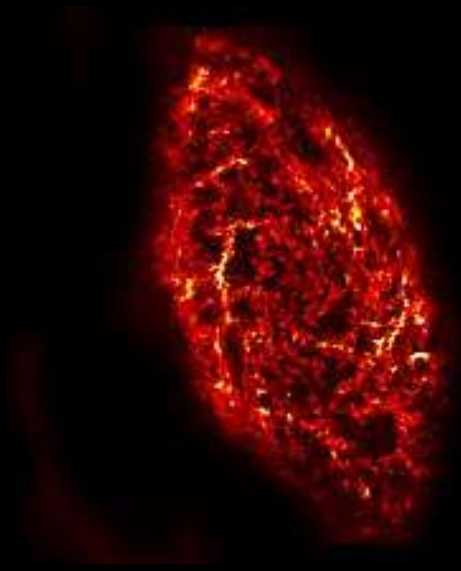
Ultraviolet - VI

Visible - 5

Infrared

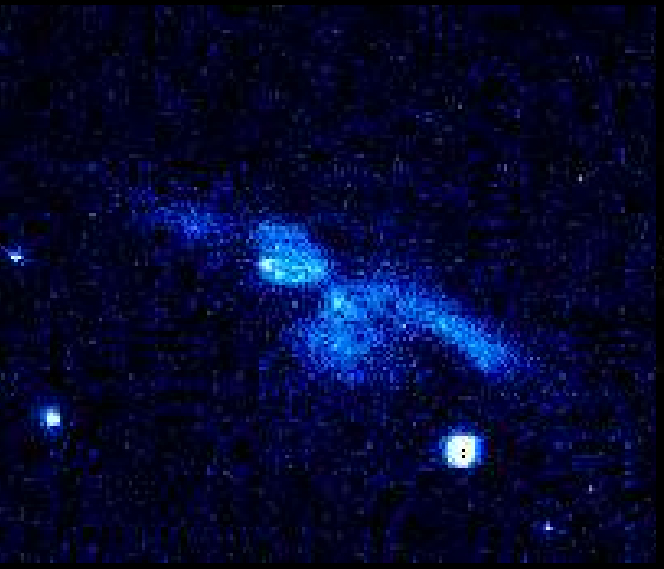


X-Ray



Radio - D

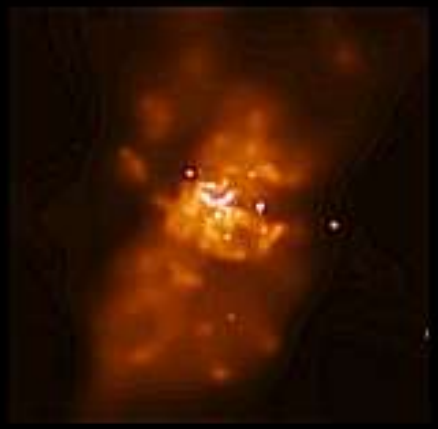
# M82



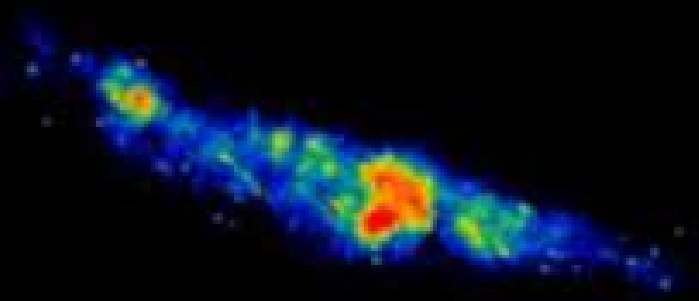
Ultraviolet - I

Visible - 6

Infrared



X-Ray



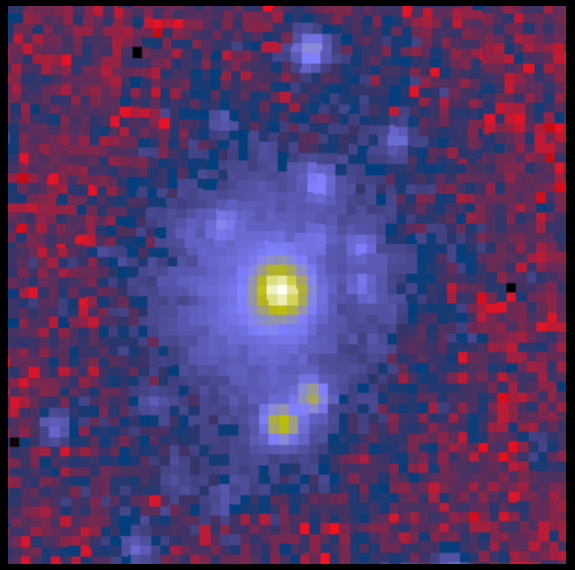
Radio - F

# M81

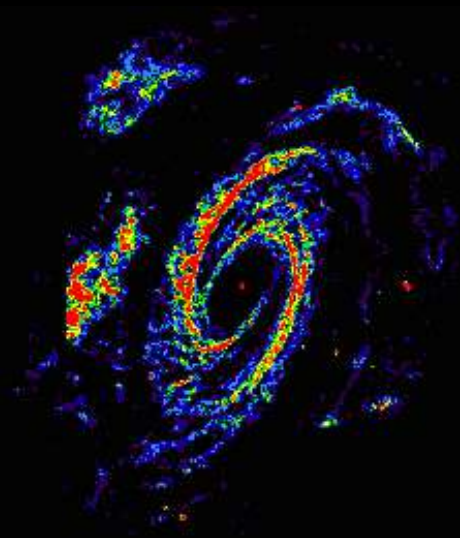
Ultraviolet - V

Visible - 7

Infrared

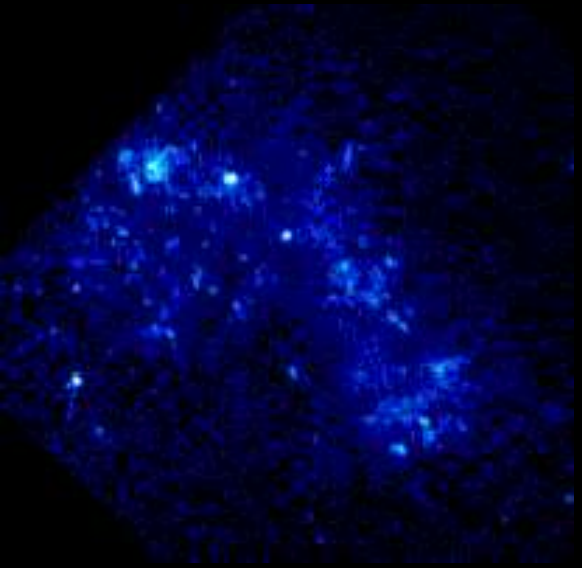


X-Ray



Radio - E

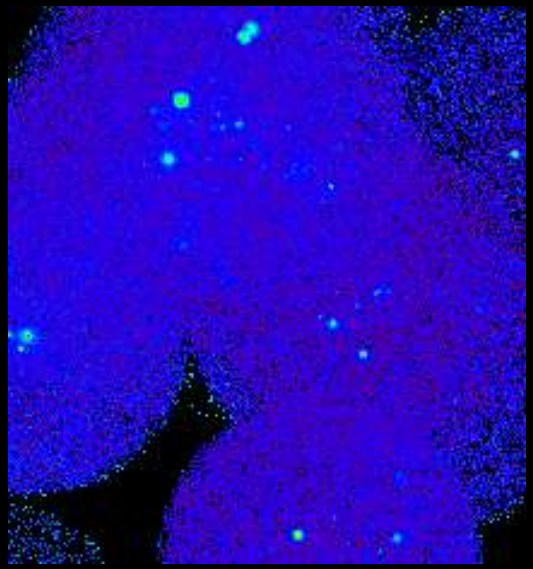
# The Small Magellanic Cloud



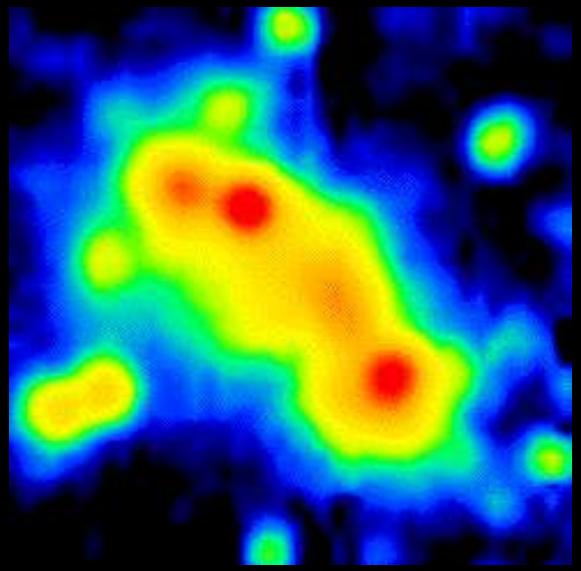
Ultraviolet - VIII

Visible - 8

Infrared



X-Ray



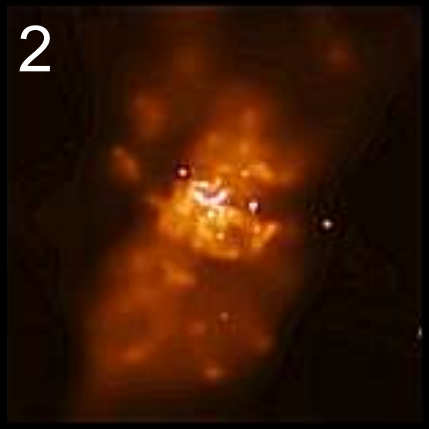
Radio - B

# Assessment Challenge

Guess which wavelength is shown in each picture, and then write down three galaxy features that emit most of their radiation at that wavelength

1

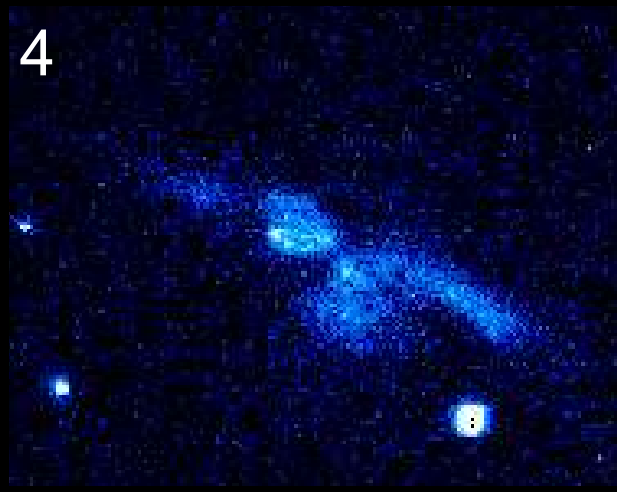
2



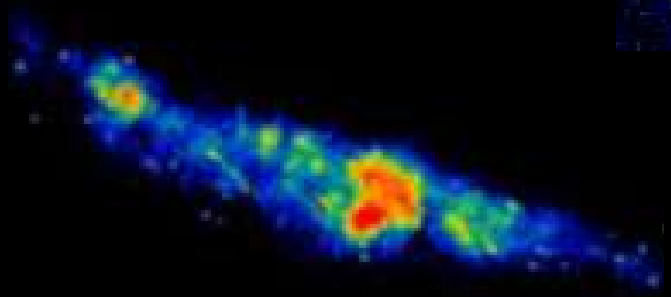
3

Note: These are all images of the same galaxy (M82)

4

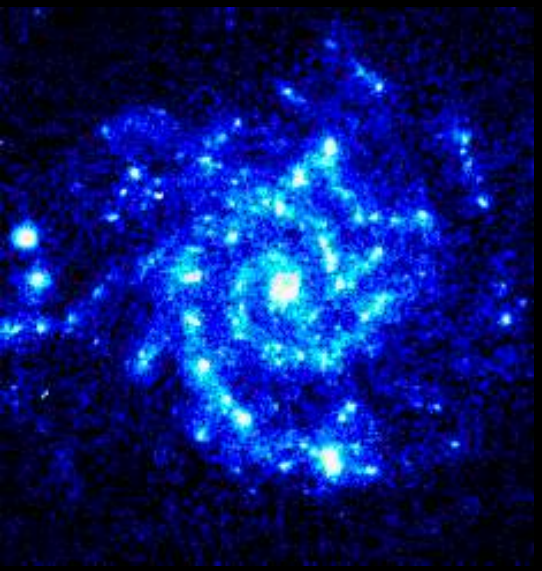


5




Proceed to Extra
Bonus Images

# M74



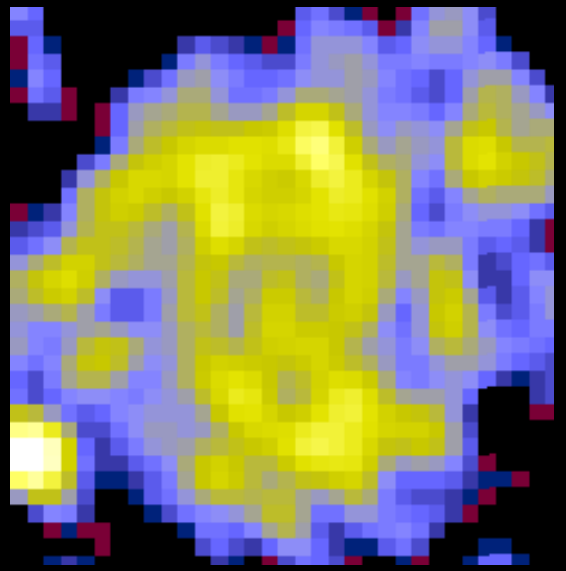
Ultraviolet

Visible

Infrared

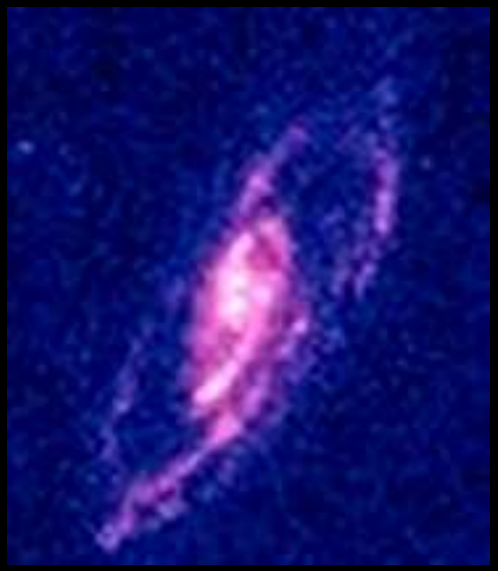
No X-Ray Image Available

X-Ray



Radio

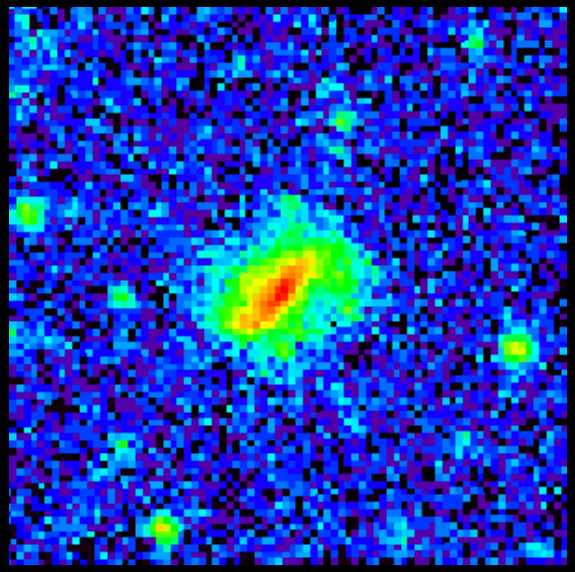
# M106



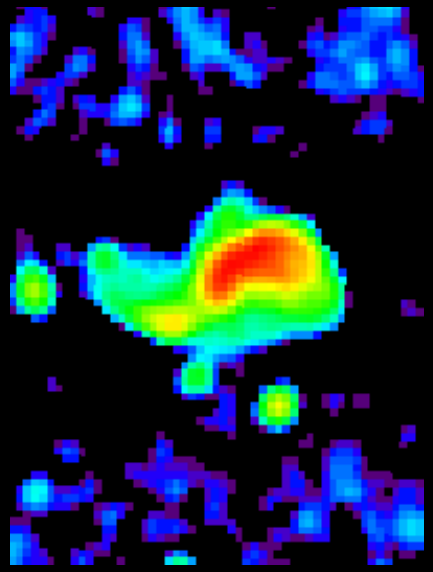
Ultraviolet

Visible

Infrared



X-Ray



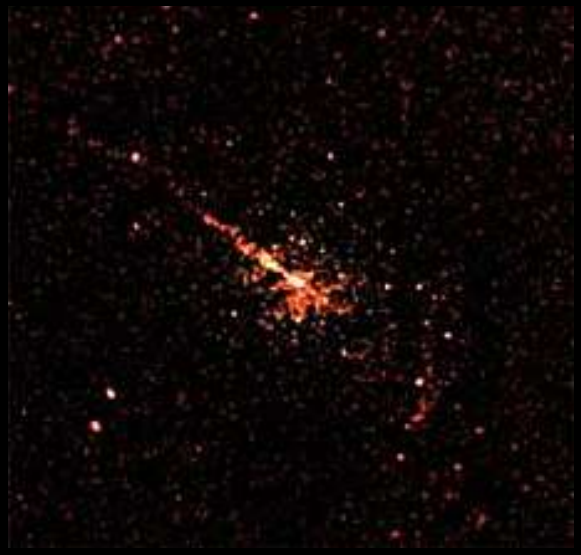
Radio

# Centaurus A

Ultraviolet

Visible

Infrared



X-Ray

Radio

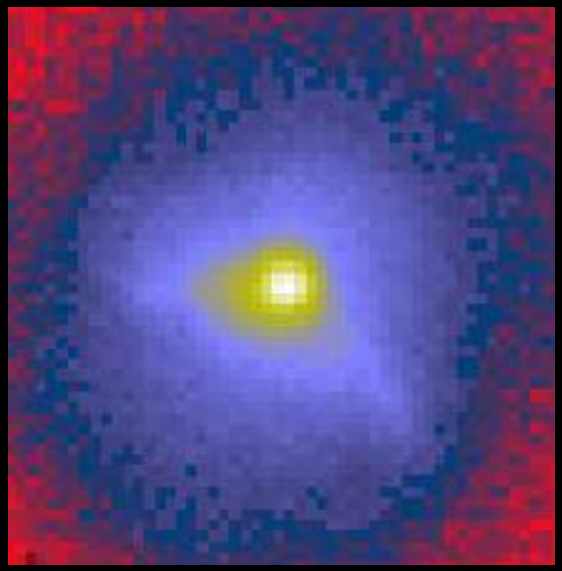
# M87

No UV Image Available

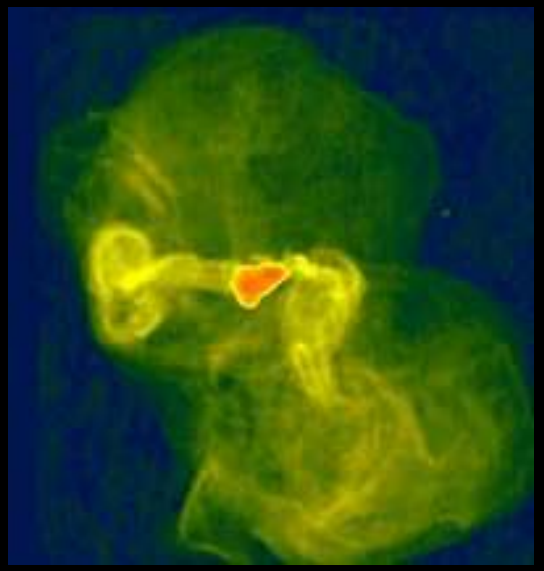

Visible

Infrared

Ultraviolet



X-Ray



Radio

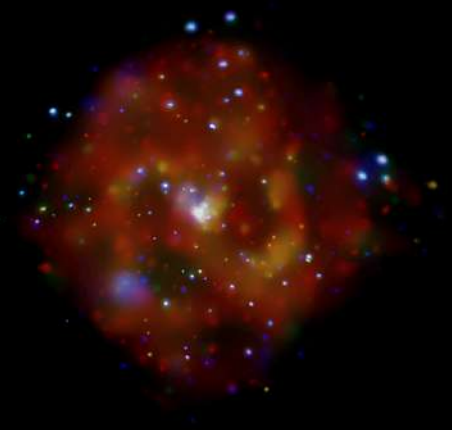
# M83

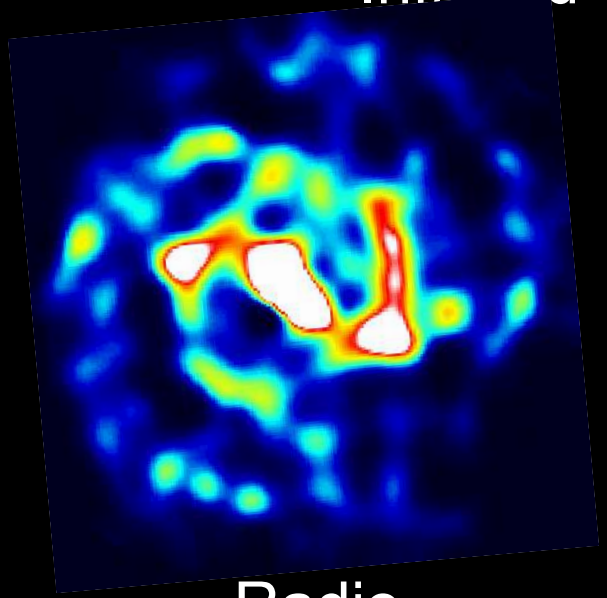
No UV Image Available

Ultraviolet

Visible

Infrared

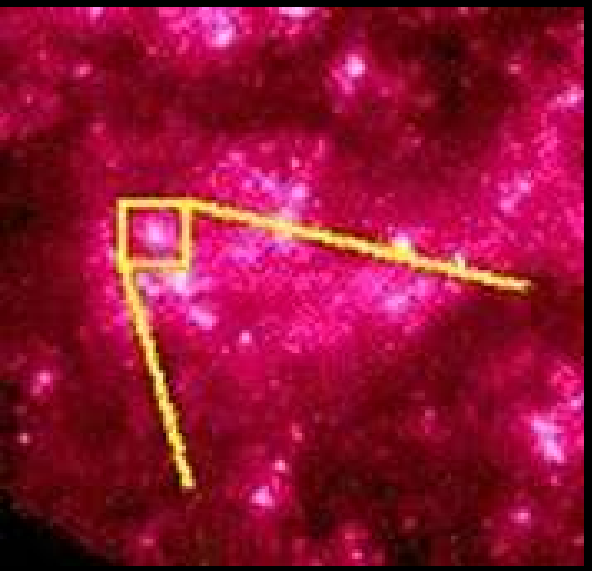




X-Ray

Radio

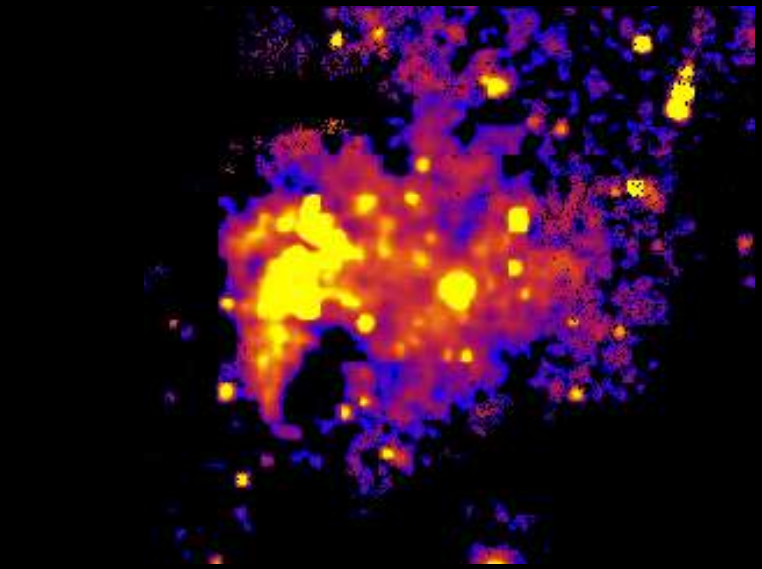
# The Large Magellanic Cloud



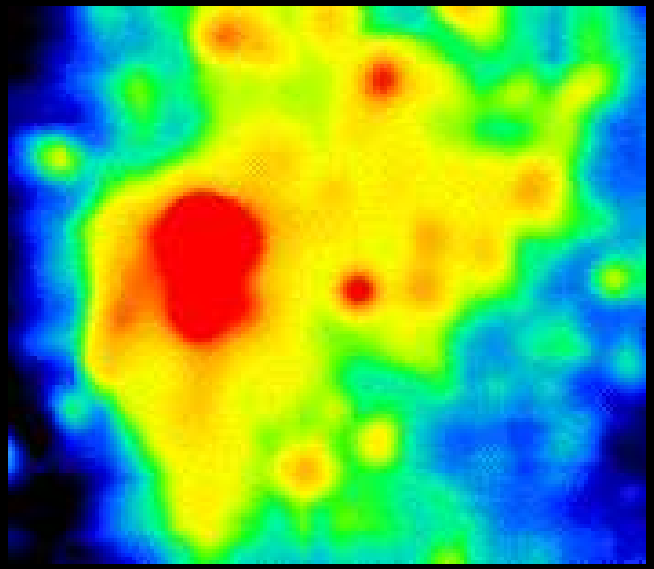
Ultraviolet

Visible

Infrared

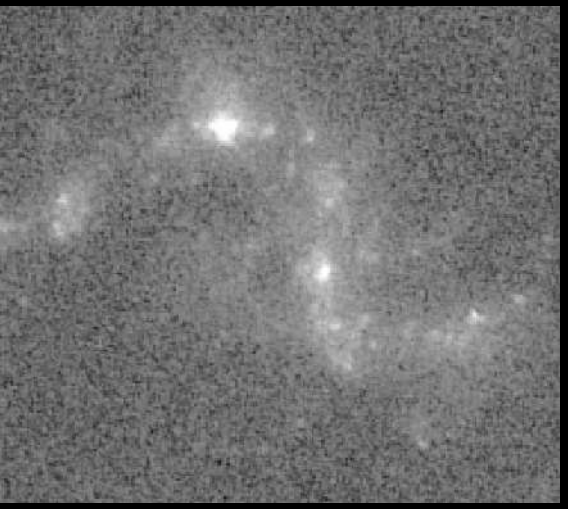


X-Ray

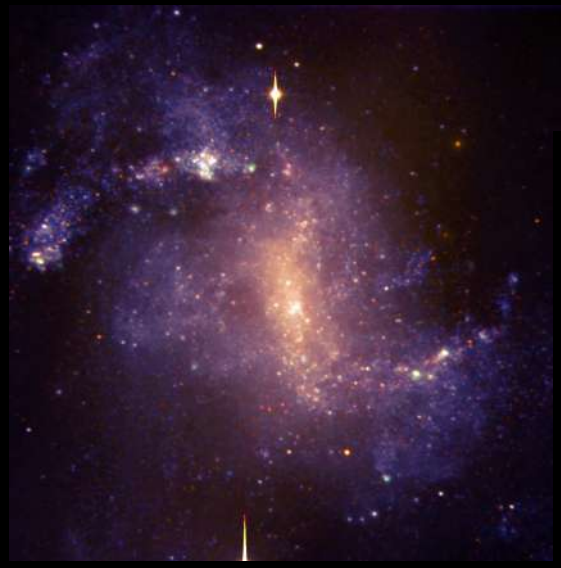


Radio

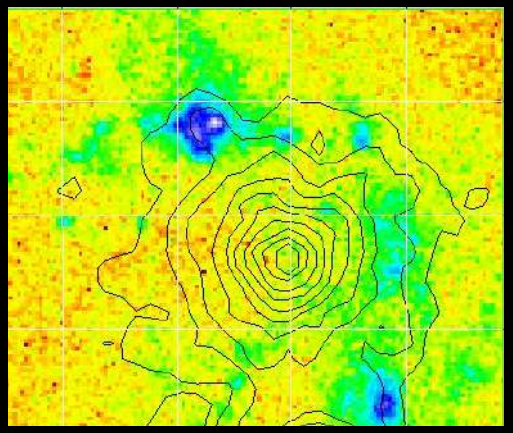
# NGC 1313



Ultraviolet

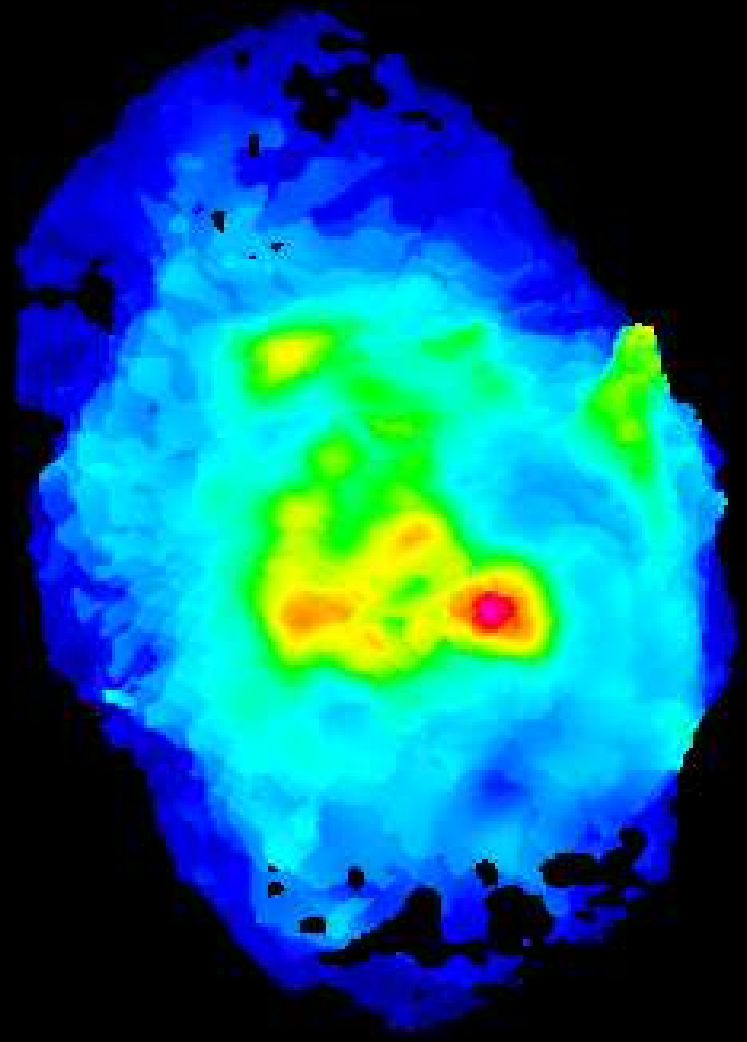


Visible



X-Ray

Infrared



Radio

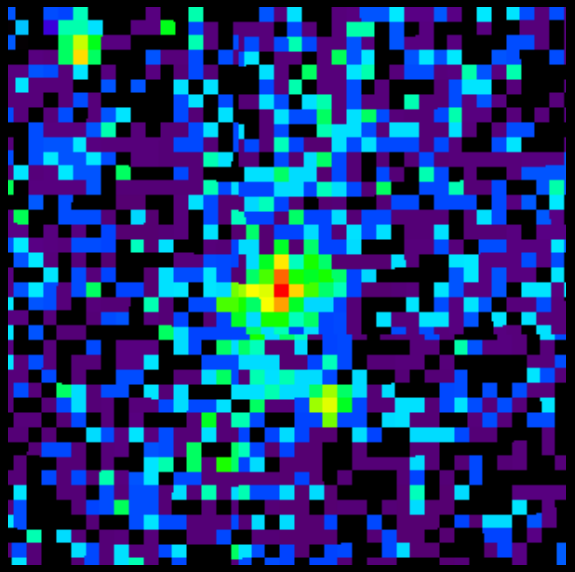
# M65

No UV Image Available

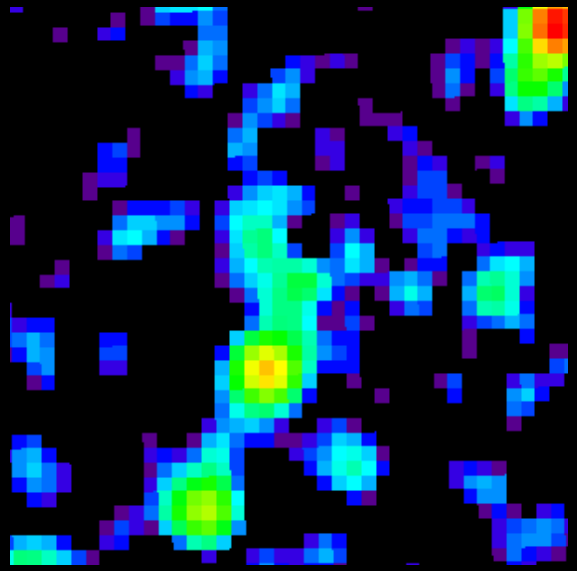
Ultraviolet

Visible

Infrared



X-Ray



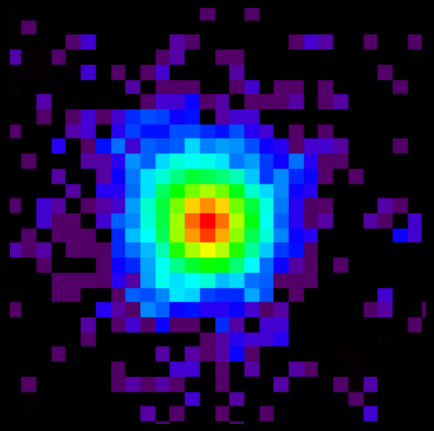
Radio

# M77

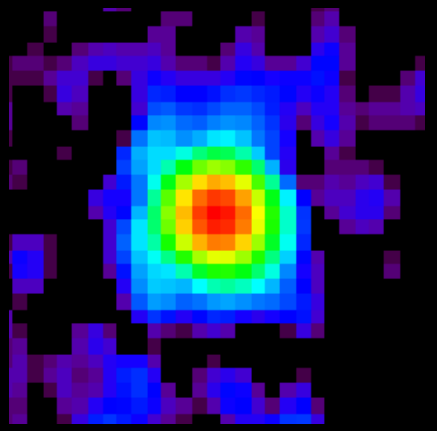
Ultraviolet

Visible

Infrared



X-Ray



Radio

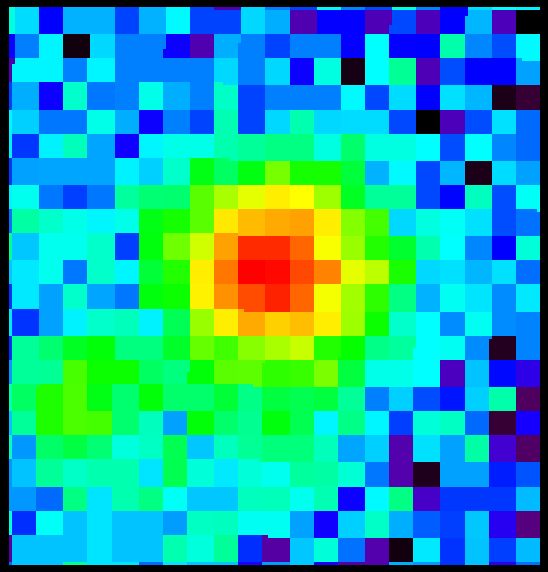
# M84

No UV Image Available

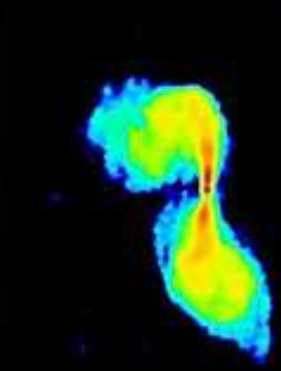
Ultraviolet

Visible

Infrared



X-Ray



Radio

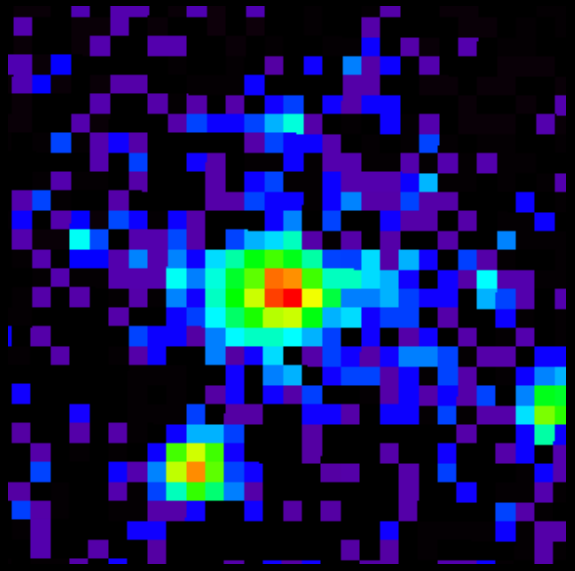
# M104

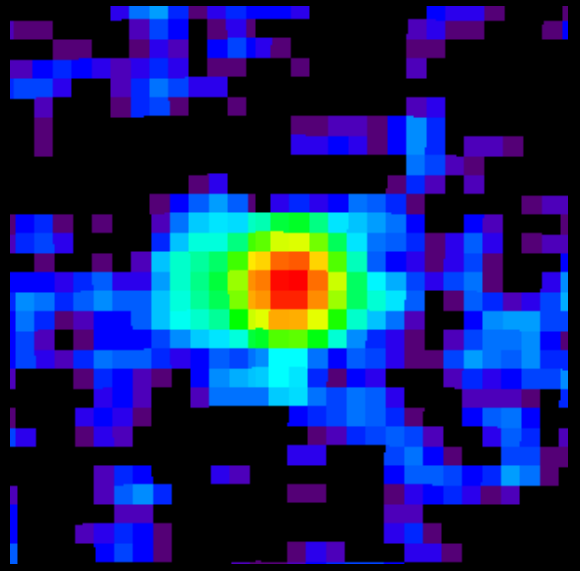
No UV Image Available

Ultraviolet

Visible

Infrared





X-Ray

Radio