



# **Herschel Space Observatory**

## **The Multiwavelength Universe**

### **Wavelength Summary Table**

<b>Spectral regime</b>	<b>Wavelength</b>	<b>Frequency</b>	<b>Temperature</b>	<b>Types of objects</b>
<b>Gamma Ray</b>				
<b>X-ray</b>				
<b>Ultraviolet (UV)</b>				
<b>Visible</b>				
<b>Near-Infrared (NIR)</b>				
<b>Mid-infrared (MIR)</b>				
<b>Far-infrared (FIR)</b>				
<b>Sub-mm and millimetre</b>				
<b>Microwave</b>				
<b>Radio</b>				

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For the objects below, write down the numbers of the corresponding images at other wavelengths.

### Crab



X-ray

Ultraviolet

Far-Infrared

Radio

### Centaurus A



X-ray

Mid-Infrared

Far-Infrared

Radio

### Antennae



X-ray

Mid-Infrared

Far-Infrared

Radio

### Cassiopeia A



X-ray

Mid-Infrared

Far-Infrared

Radio

### Large Magellanic Cloud



X-ray

Ultraviolet

Far-Infrared

Radio

### Triangulum



X-ray

Ultraviolet

Mid-Infrared

Radio

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### Orion



X-ray

Near-Infrared

Mid-Infrared

Far-IR

### M81



X-ray

Ultraviolet

Far-Infrared

Radio

### M87



X-ray

Mid-Infrared

Far-Infrared

Radio

### Sombrero



X-ray

Near-Infrared

Mid-Infrared

Radio

### M82



X-ray

Mid-Infrared

Far-Infrared

Radio

### Andromeda



X-ray

Ultraviolet

Far-Infrared

Radio

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### Links to Objects

Below are links to the various objects. The codes in brackets are the name you may find it under.

Links are given for finding the object in Chromoscope, as well as a few other links to more details.

Using Chromoscope:

- Click the link to open Chromoscope with the object centred.
- Use the "+" and "-" keys (or buttons on the screen) to zoom in and out, and drag the sky around to explore the region.
- Turn on and off constellation labels by pressing "L"
- Use the slider in the top right to fade between wavelengths shown.
- You can re-order the wavelengths by dragging their names in order to easily compare different wavelengths.
- For more help, press the "h" key.

#### Crab (M1)

**Chromoscope:** <http://www.chromoscope.net/?l=-175.4429&b=-5.7847&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Crab\\_Nebula](http://en.wikipedia.org/wiki/Crab_Nebula)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astrology/multiwavelength\\_museum/m1.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astrology/multiwavelength_museum/m1.html)

**Chandra:** <http://chandra.harvard.edu/photo/1999/0052/>

**Spitzer:** <http://www.spitzer.caltech.edu/Media/mediainages/sig/sig05-004.shtml>

**Herschel:** <http://herschel.cf.ac.uk/results/crab-nebula>

#### Centaurus A (NGC 5128)

**Chromoscope:** <http://www.chromoscope.net/?l=-50.4844&b=19.4172&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Centaurus\\_A](http://en.wikipedia.org/wiki/Centaurus_A)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astrology/multiwavelength\\_museum/cenA.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astrology/multiwavelength_museum/cenA.html)

**Chandra:** <http://chandra.harvard.edu/photo/2008/cena/>

**Herschel:** <http://herschel.cf.ac.uk/results/centaurus>

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### Antennae (NGC 4038)

**Chromoscope:** <http://www.chromoscope.net/?l=-73.0444&b=42.4614&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Antennae\\_Galaxies](http://en.wikipedia.org/wiki/Antennae_Galaxies)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/ant.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/ant.html)

**Chandra:** <http://chandra.harvard.edu/photo/2000/0120/>

**Spitzer:** <http://spitzer.caltech.edu/images/1266-ssc2004-14a%20Fire-Within-the-Antennae-Galaxies>

### Cassiopeia A (Cas A)

**Chromoscope:** <http://www.chromoscope.net/?l=111.7353&b=-2.1299&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Cassiopeia\\_A](http://en.wikipedia.org/wiki/Cassiopeia_A)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/casA.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/casA.html)

**Chandra:** <http://chandra.harvard.edu/photo/2006/casa/>

**Spitzer:** <http://www.spitzer.caltech.edu/Media/releases/ssc2005-14/release.shtml>

### Large Magellanic Cloud (LMC)

**Chromoscope:** <http://www.chromoscope.net/?l=-79.5344&b=-32.8887&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Large\\_Magellanic\\_Cloud](http://en.wikipedia.org/wiki/Large_Magellanic_Cloud)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/lmc.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/lmc.html)

**Herschel:** <http://herschel.cf.ac.uk/results/centaurus>

### Triangulum (M33)

**Chromoscope:** <http://www.chromoscope.net/?l=133.6106&b=-31.3308&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Triangulum\\_Galaxy](http://en.wikipedia.org/wiki/Triangulum_Galaxy)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m33.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m33.html)

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**Spitzer:** <http://spitzer.caltech.edu/images/2625-sig09-003-Multispectral-Triangulum-Galaxy-3-Channel>

### Orion (M42)

**Chromoscope:** <http://www.chromoscope.net/?l=-150.9866&b=-19.3813&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Orion\\_Nebula](http://en.wikipedia.org/wiki/Orion_Nebula)

**Chandra:** <http://chandra.harvard.edu/photo/2007/orion/>

**Spitzer:**

<http://www.spitzer.caltech.edu/Media/releases/ssc2006-21/ssc2006-21a.shtml>

**Vista:** <http://www.eso.org/public/news/eso1006/>

### M81

**Chromoscope:**

<http://www.chromoscope.net/?l=142.0920&b=40.8999&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Messier\\_81](http://en.wikipedia.org/wiki/Messier_81)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m81.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m81.html)

**Chandra:** <http://chandra.harvard.edu/photo/2008/m81/>

**Spitzer:** <http://spitzer.caltech.edu/images/2126-sig07-009-Multiwavelength-M81>

### M87

**Chromoscope:** <http://www.chromoscope.net/?l=-76.2224&b=71.4990&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Messier\\_87](http://en.wikipedia.org/wiki/Messier_87)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m87.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m87.html)

**Chandra:** <http://chandra.harvard.edu/photo/2008/m87/>

### Sombrero (M104)

**Chromoscope:** <http://www.chromoscope.net/?l=-61.5396&b=51.1494&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Sombrero\\_Galaxy](http://en.wikipedia.org/wiki/Sombrero_Galaxy)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m104.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m104.html)

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**Chandra:** <http://chandra.harvard.edu/photo/2007/sombrero/>

**Spitzer:** <http://www.spitzer.caltech.edu/Media/releases/ssc2005-11/release.shtml>

### **M82**

**Chromoscope:**

<http://www.chromoscope.net/?l=141.4094&b=40.5667&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Messier\\_82](http://en.wikipedia.org/wiki/Messier_82)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m82.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m82.html)

**Chandra:** <http://chandra.harvard.edu/photo/2006/m82/>

### **Andromeda (M31)**

**Chromoscope:** <http://www.chromoscope.net/?l=121.1741&b=-21.5727&w=2.00&o=g,x,v,a,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Andromeda\\_Galaxy](http://en.wikipedia.org/wiki/Andromeda_Galaxy)

**Cool Cosmos:**

[http://coolcosmos.ipac.caltech.edu/cosmic\\_classroom/multiwavelength\\_astronomy/multiwavelength\\_museum/m31.html](http://coolcosmos.ipac.caltech.edu/cosmic_classroom/multiwavelength_astronomy/multiwavelength_museum/m31.html)

**Chandra:** <http://chandra.harvard.edu/photo/2006/m31/>

**Spitzer:** <http://www.spitzer.caltech.edu/Media/releases/ssc2005-20/release.shtml>

**Herschel:** <http://herschel.cf.ac.uk/results/andromeda-galaxy>

### **Eagle Nebula (M16)**

**Chromoscope:**

<http://www.chromoscope.net/?l=17.0865&b=1.0684&w=2.00&o=g,x,v,a,n,f,m,r&z=6>

**Wikipedia:** [http://en.wikipedia.org/wiki/Eagle\\_Nebula](http://en.wikipedia.org/wiki/Eagle_Nebula)

**Herschel:** <http://herschel.cf.ac.uk/results/eagle-nebula>

**Chandra:** <http://chandra.harvard.edu/photo/2007/m16/>

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### **Dumbbell Nebula (M27)**

Chromoscope: <http://www.chromoscope.net/?l=60.8359&b=-3.6966&w=2.00&o=g,x,v,a,n,f,m,r&z=6>

Wikipedia: [http://en.wikipedia.org/wiki/Dumbbell\\_Nebula](http://en.wikipedia.org/wiki/Dumbbell_Nebula)

Spitzer:

[http://www.nasa.gov/mission\\_pages/spitzer/multimedia/pia14417.html](http://www.nasa.gov/mission_pages/spitzer/multimedia/pia14417.html)

### **Pleiades (M45)**

Chromoscope: <http://www.chromoscope.net/?l=166.5707&b=-23.5212&w=2.00&o=g,x,v,a,n,f,m,r&z=6>

Wikipedia: <http://en.wikipedia.org/wiki/Pleiades>

ROSAT:

[http://heasarc.gsfc.nasa.gov/docs/rosat/gallery/stars\\_clus\\_pleiades.html](http://heasarc.gsfc.nasa.gov/docs/rosat/gallery/stars_clus_pleiades.html)

Spitzer: <http://www.spitzer.caltech.edu/images/1766-ssc2007-07b-Pink-Pleiades>

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### **Question Sheet**

1) What object are you looking at? Describe what it looks like at first sight.

2) Describe where it is in the sky. Is it in the Northern or Southern hemisphere as seen from Earth? Are there any nearby constellations?

3) How far away is it? Is that inside or outside our Galaxy?

4) Describe what type of object it is. Can you find any other pictures of it?

5) Does it look particularly different in any particular wavelengths? Does that tell you anything about it?

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6) What can you learn by comparing the appearance of the object at different wavelengths? What is it made of?

7) What is happening to the object? Is it doing anything?

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