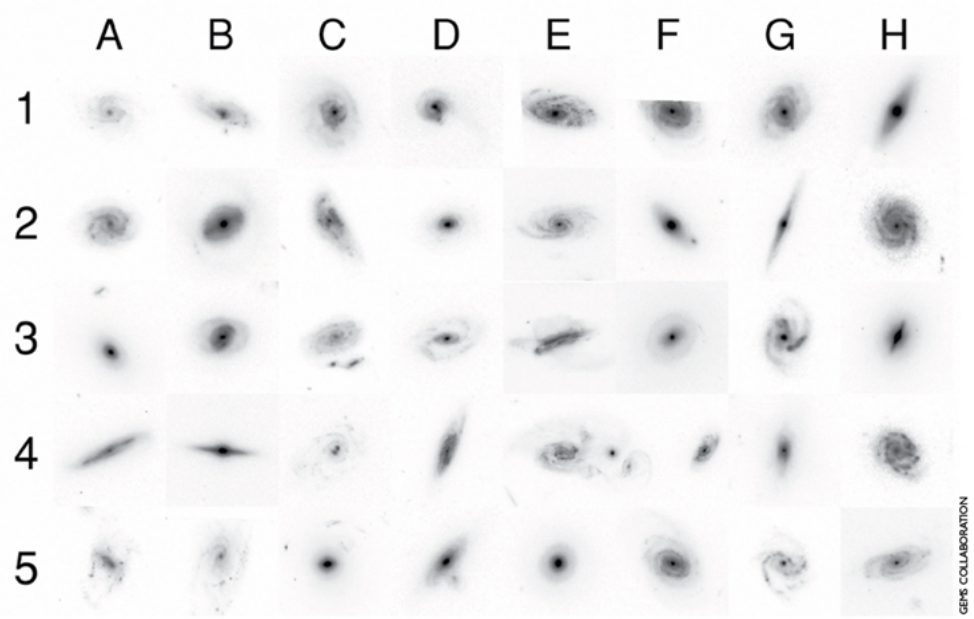
Coma Cluster of Galaxies

How are galaxies shaped differently? How do astronomers actually classify galaxies?



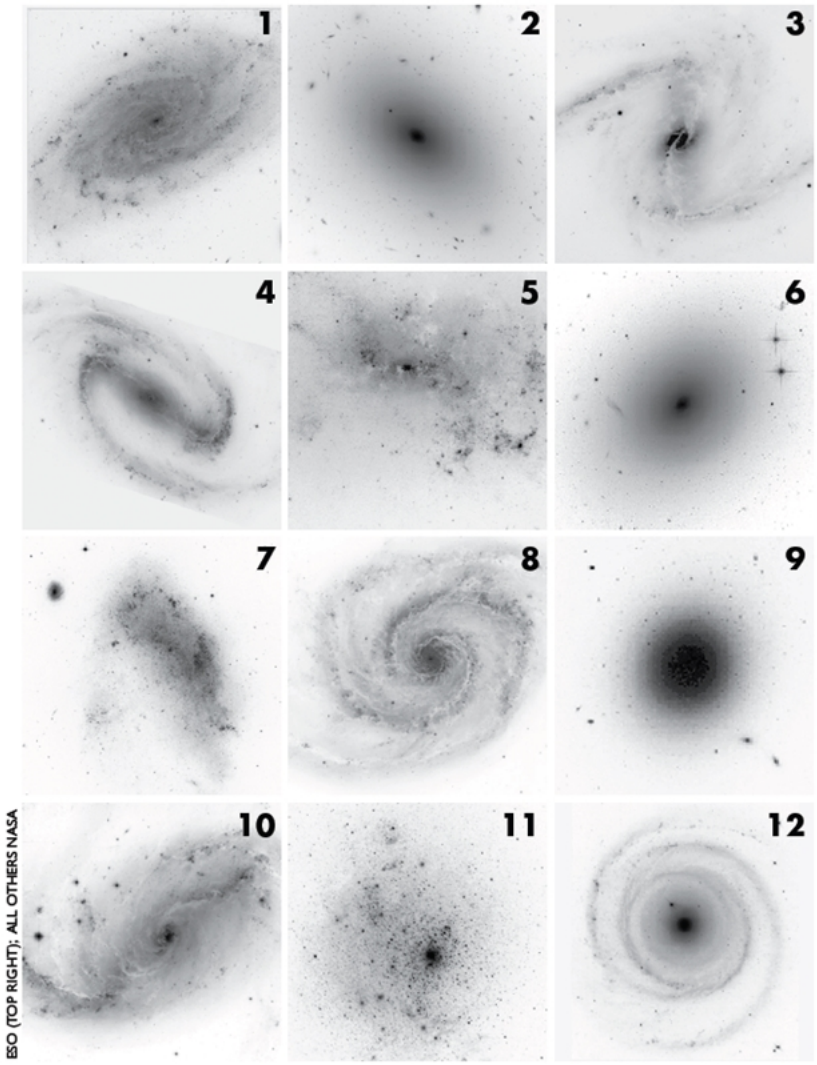
1. Different galaxy types

In the following chart, invent your own galaxy types and provide a description of these galaxy types and three examples for each one. Fill in the following table.

Galaxy Type (name)	Galaxy Type (drawing)	Defining Characteristics (write a short description, provide enough detail so that anyone could use your scheme)	Three Examples (give 3 grid coordinates)
1			
2			
3			
4			

2. How do astronomers classify galaxy types?

Astronomers have developed their own classification scheme for galaxies, based on the galaxy shape (often called "morphology").The definitions of the main galaxy types are listed below. Use these definitions to place the 12 galaxies shown in the above figure into their commonly-used categories. Fill in the table below.



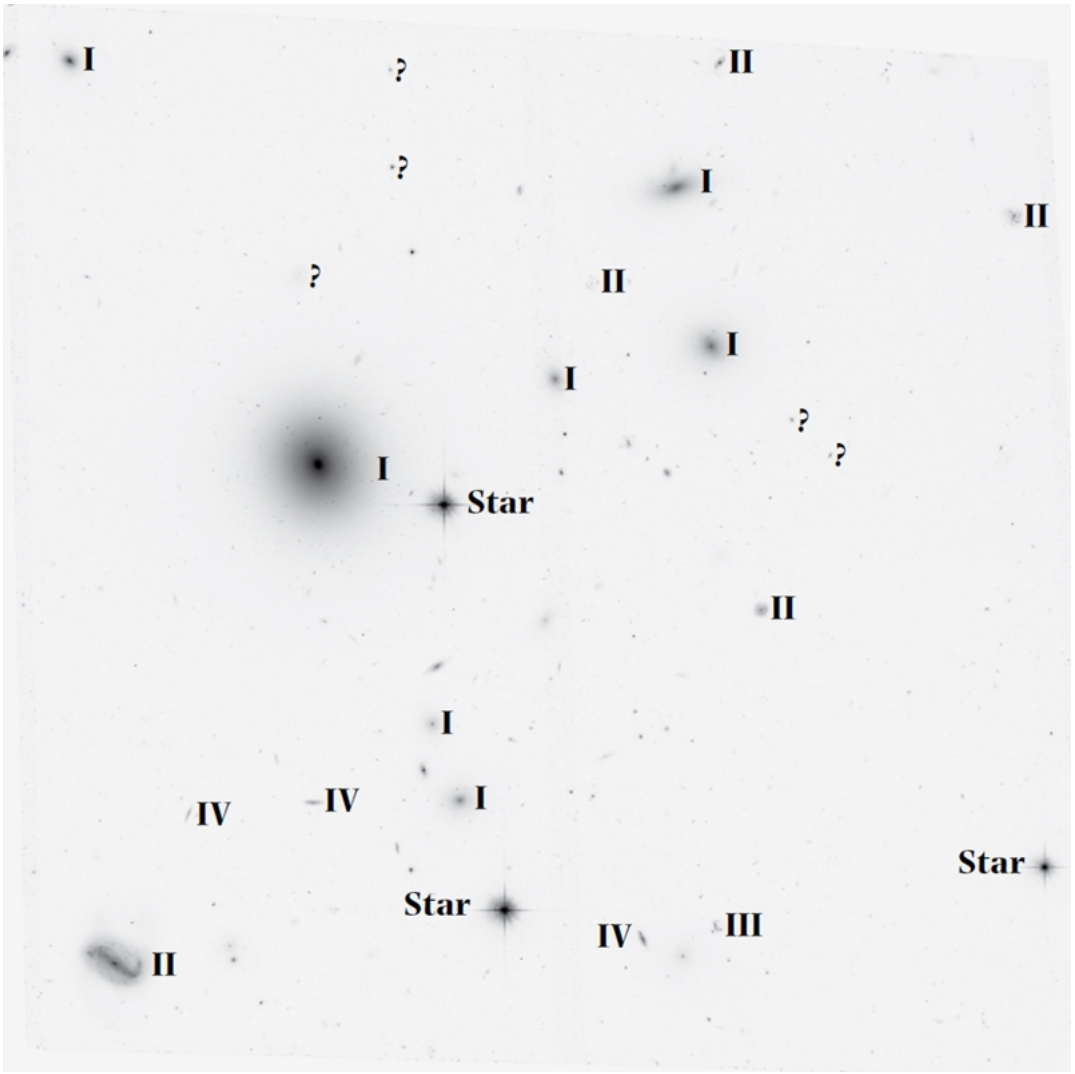
- **Elliptical (E)**: galaxy with a spherical or elliptical shape (like an American football); it has no flat disc or spiral arms.
- **Lenticular (S0)**: galaxy with a smooth, flat disk shape without spiral structure; often hard to distinguish from ellipticals.
- **Barred Lenticular (SB0)**: same as above, but with an elongated (barred) nucleus (galaxy centre).
- **Spiral (S)**: galaxy with a flat disk shape, with notable spiral patterns in the outer disk; also contains a large bright central bulge.
- **Barred Spiral (SB)**: A special type of spiral characterised by an elongated nucleus with the spiral arms springing from the ends of the bar.
- **Irregular (IR)**: an oddly shaped galaxy that doesn't fit into any other category.

Morphology	Image Numbers (3 each)
E/S0/SB0	
S	
SB	
IR	

Coma cluster of galaxies

3. Identify and count galaxies

Use the image below and guidelines to help decide how to identify and count the galaxies.



Guidelines:

- **I)** Ellipticals or Lenticulars: it can be hard to tell these apart. If you know it's either an E or S0 / SB0, it is okay to guess between these two.
- **II)** Spirals and Barred Spirals: it can be hard to tell these apart. If you know it's either an S or SB, it is okay to guess between these two.
- **III)** Irregular galaxy.
- **IV)** Uncertain: an edge-on view of a galaxy that could possibly be an S0, SB0, S, SB, or IR. There are too many possibilities, so do not count these.
- **Star)** any object that has 'crosshairs' sticking out of it is a foreground star in the Milky Way galaxy, so do not count these.
- **?)** Don't count small, faint objects like these that are too hard to classify.

How many galaxies did you identify?

Coma cluster of galaxies

Using the images “Galaxies Cards” A-D, count the types of galaxies seen in each image. Count the number of galaxies of each morphological type and write down the number in the correct spot in the table.

Galaxy Card	E	S0 /SB0	S	SB	IR/INT
A					
B					
C					
D					

4. Galaxy environments

The table below shows the different properties for different types of galaxy environments.

Galaxy Cluster	**Large and dense**	**50 to thousands**	**3**	**2 to 10 Mpc**	**10^{14} to 10^{15} solar masses**
Galaxy Group	**Small and dense**	**less than 50**	**6**	**1 to 2 Mpc**	**10^{13} solar masses**
The Field	**Large and deserted**	**very few**	**0**	**Voids, can be larger than 100 Mpc**	**< 10^{10}**

In the previous step, Galaxy Cards images A and C show the dense central core of the Coma Cluster, and images B and D show galaxies out in the field. (NB Astronomers sometimes use the term "field" to mean the area outside galaxy clusters.) Fill in the table below using the numbers you wrote down in the table from step 5 of the activity.

Coma Cluster

Morphology→	E Ellipticals	S0 & SB0 Lenticulars	S & SB (sum both together) Regular and Barred Spirals	Total (E+S0+SB0+S+SB)
Image A				
Image C				
Sum Total From A + C	(e)	(f)	(g)	(h)

The Field

Morphology→	E Ellipticals	S0 & SB0 Lenticulars	S & SB (sum both together) Regular and Barred Spirals	Total (E+S0+SB0+S+SB)
Image B				
Image D				
Sum Total From B + D	(i)	(j)	(k)	(m)