

Galaxy Classification

ASTR 1020

Name:

Overview

In this activity, you will explore all possible morphological types of galaxies, how galaxy properties change as you move between morphologies, and how a galaxy's color can describe galaxy properties and evolution.

Objectives

After completing this activity students will be able to:

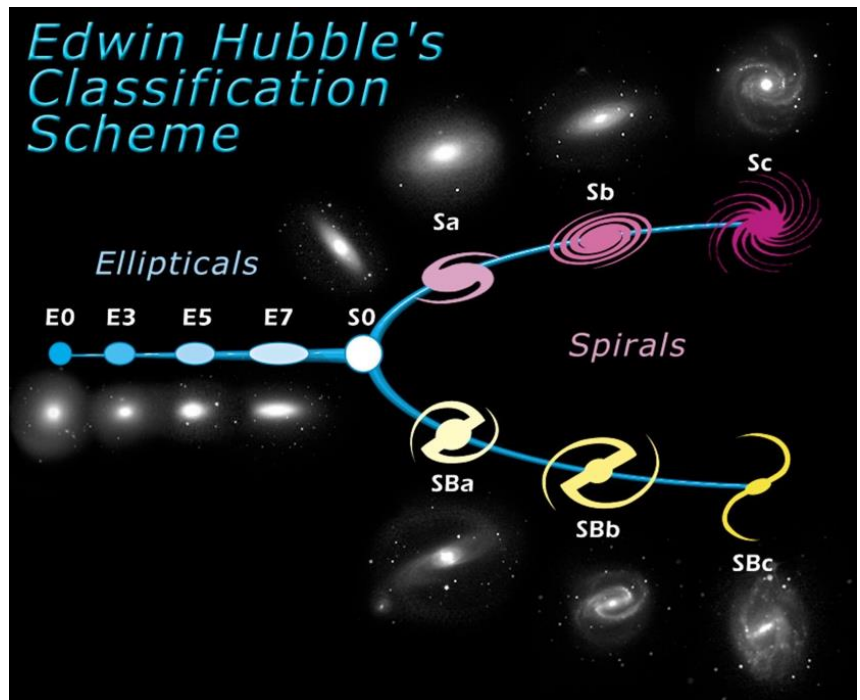
- Describe Hubble's Tuning Fork and how galaxies are classified
- Identify and classify the different types of galaxies
- Describe how astronomical images are produced, how CCD cameras work, and how and why filters are used

****Note:** If a question is labeled “**THOUGHT QUESTION**” we are looking for you to show critical thinking/justification in your answer, not a “correct” answer**

Definitions

Here are some terms from lecture that we will be using today in lab:

- **Morphology** – the description of the shape of a galaxy, i.e. spiral, elliptical, etc.
- **Hubble's Tuning Fork** – organizational scheme for galaxies based on their photometric appearance
- **Companion** – the term which applies to a secondary galaxy that is in gravitational interaction with the main galaxy in question
- **Jet** – a focused beam of ionized material, usually moving at velocities near the speed of light



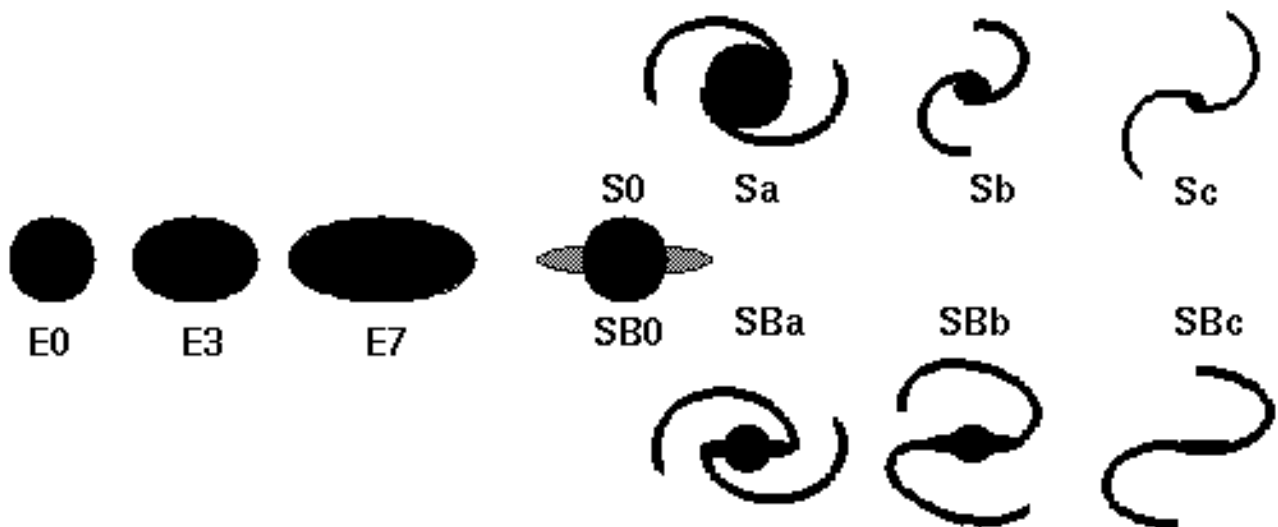
Part 1. Galaxy Classification

The main goal of this lab is to look through images of galaxies and identify which type of galaxy each is. One major tool used to identify galaxies is Hubble's Tuning Fork. Edwin Hubble worked extensively on galaxies in the early 1900s trying to understand how they changed over time. Through this work he noticed that there were two main types of galaxies: elliptical and spiral. Some spiral galaxies have central bar-like features in their center, and these are classified as "barred spirals." Hubble then developed his tuning fork, shown in Figure 1, where the handle contains elliptical galaxies and the fork shows spirals the top and barred spirals at the bottom.

THE TUNING FORK IS NOT AN EVOLUTIONARY PATH!

The S0, or lenticular, galaxies are a bit different. They have morphological properties of both ellipticals and spirals. S0 galaxies have very large central bulges, like ellipticals, and very small, faint disks with no spiral arms (almost like spirals). Irregulars (Sm; not shown) are a class of galaxy that do not fall under any standard morphology. They have no clear structure and appear highly disorganized in shape.

Figure 1: A simple schematic of Hubble's Tuning Fork



Go to the following galaxy image database:

<http://www.astro.gsu.edu/lab/website/labstuff/classification.html>

Here you will find images of galaxies that have a known classification. The links to these galaxies are at the top, images show to the left. The unknown galaxies have links at the bottom and will show on the right.

1. Use Hubble's Tuning Fork and the reference images in the database to classify the morphology of each unknown galaxy image (numbered 1-20) to the best of your ability. You will need to note for each galaxy whether or not there is visible spiral structure, rings, and/or bars. You will also need to note the presence of any other notable features, such as companions, jets, etc. Record your answers in Table 1.

Table 1: Hubble Classifications

#	Ring?	Spiral?	Bar?	Other	Hubble Type
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Part 2. Questions

2. What type of galaxy has more young stars, gas and dust – elliptical or spiral? Where in the galaxy is the dust seen?

3. What type of galaxy appears to have more old, red stars and fewer young blue stars – elliptical or spiral? In *both* galaxy types, where are the old, red stars typically seen?

4. Given what you now know about the different types of galaxies, what is an S0 (lenticular) galaxy? i.e., a young, newly formed galaxy, a middle aged/older galaxy, something else? Explain your answer.

5. **THOUGHT QUESTION:** What type of event(s) do you think would have happened to cause the odd shapes of irregular (Sm) galaxies?

6. The color images of galaxies use 3 main colors – blue, red, and yellow – what physical characteristics of galaxies do these correspond to?

7. Many galaxies, when observed directly through a telescope, do not appear as beautiful and colorful as the color images that you have seen. Where do the colors in these images come from?

8. **THOUGHT QUESTION:** In your own words, describe how the galaxies change as you move down the fork, i.e. what are the changes in the galaxies' properties as you look at different subtypes?