12.5: Wrapping It Up 12 - Measuring Gravitational Lenses

Learning Objectives

- You will be able to put the above concepts together to determine the mass and the level of complexity of the geometry of the lens for various systems.

In this activity, you will be working with images and data from the CASTLES survey, a collaboration between the Harvard Center for Astrophysics and the University of Arizona. The team used HST to obtain high-resolution optical and infrared images of 100 gravitationally lensed systems.

12.5.1: Part I: Determining the Masses **of Lenses**

You will be analyzing three image: a double quasar, an Einstein cross, and an image with several arcs. For each of these images, you will need to

- determine the ratio of the distance between the lens and observer to the distance between the lens and source.
- determine the Einstein radius from the image.
- use this information to compute the mass of the lens.
- determine what type of object the lens might be, from the mass of the lens.

Play Activity

12.5.1.1: A. The Double Quasar

The first image for you to analyze is a double quasar known as SBS0909+523.

1.

2.

3. Using the mass calculator, enter your values for the Einstein radius (θ_E) in radians, the distance from the observer to the source (D_{SO}), and the ratio (D_{LO}/D_{LS}) to determine the mass of the lens.

Play Activity

4.

5.

12.5.1.2: B. The Einstein Cross

The next image for you to analyze is an Einstein cross known as Q2237+030.

1.

2.

3.

4.

5.

6.

12.5.1.3: C. Several Arcs

The final image for you to analyze is known as SDSS1004+4112.

1.

2.

3.

4.

5.

6.

12.5.2: Part II: Determining the Complexity of Lenses

Rank the following CASTLES images based on the complexity of the lens. Use the pull-down menus to order them, 1 being the least complex lens and 4 being the most complex lens.

Play Activity