

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 images: 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.




Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

2.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

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](#)



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

4.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

5.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

12.5.1.2: B. The Einstein Cross

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

1.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

2.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

3.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

4.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

5.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

6.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

12.5.1.3: C. Several Arcs

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

1.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

2.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

3.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

4.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

5.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

Login

6.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

Login

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](#)

This page titled [12.5: Wrapping It Up 12 - Measuring Gravitational Lenses](#) is shared under a [CC BY-NC-SA](#) license and was authored, remixed, and/or curated by [Kim Coble, Kevin McLin, & Lynn Cominsky](#).

- [12.5: Wrapping It Up 12 - Measuring Gravitational Lenses](#) by [Kim Coble, Kevin McLin, & Lynn Cominsky](#) is licensed [CC BY-NC-SA 4.0](#).