

## Extrasolar Planetary Systems Gedanken Lab

An *extrasolar* planet, or *exoplanet*, is a planet beyond our own Solar System that orbits a completely different star. As of July 2008, 307 exoplanets have been “observed” by scientists.

Although most of these exoplanets can not be visually seen, scientists can observe the effects they have on the stars they orbit. For example, since most of the exoplanets are huge (about the size of Jupiter) it is possible to see the star they orbit wobble. Through careful observation of the wobble, it is possible to predict the relative size and distance of the planets orbiting the star.

### For more information...

...about Extrasolar Planetary Systems, visit NASA's Jet Propulsion Laboratory website “PlanetQuest.”

From 1996 to 2007, the following data was collected about exoplanets orbiting the star 55 Cancri. The data has been arranged in order of the date the exoplanet was discovered. Please note that the names of exoplanets are based on the star they orbit (in this case 55 Cancri) followed by a letter (like “b”).

Exoplanet	Period of Orbit (d)	Mean Orbital Radius (AU)	Discovery Date
55 Cancri b	14.66	0.118	1996
55 Cancri c	44.28	0.24	June 13, 2002
55 Cancri d	5360	5.9	June 13, 2002
55 Cancri e	3	0.04	August 31, 2004
55 Cancri f	260.8	0.738	November 2007

You are working on a team that is trying to analyze this data. You are lucky that there are five planets that have been confirmed for this extrasolar planetary system, since more data increases your accuracy. The only difficulty is that because of the size of the values you will need to **ignore the data for exoplanets 55 Cancri d and f** for this lab. Recently your team collected data about another possible exoplanet (tentatively called 55 Cancri g) in this extrasolar planetary system. The data for 55 Cancri g is that it has a period of 24 days and an orbital radius of 0.19 AU

You must keep the following in mind while writing up your lab report.

1. Your lab write up will **not** have an equipment list or procedure. The technology and equipment used to collect the data shown here is beyond the scope of Physics 20.
2. In the “Analysis” section you will use a suitable averaging technique to create a **linear** graph based on the data for the three confirmed planets. You must make sure that you have adjusted the original data so that you have a linear relationship.
3. You will then **use your graph** to calculate a value that will allow you to confirm whether or not 55 Cancri g is a possible exoplanet in this extrasolar planetary system. There are several ways you can solve this part of the lab and still have a correct answer.
4. When you are completing the “Sources of Error” section, make sure to calculate a percent error that allows you to compare the three confirmed exoplanets as one group to the value you have for 55 Cancri g. The exact values you compare here depend on how you completed the analysis.
5. Your “Conclusion” must contain a statement as to whether or not 55 Cancri g could possibly be an exoplanet in this extrasolar system.