Project 18: Reading Strategies

Article Analysis

You are about to read a newspaper article entitled "Discoveries Support Belief in Existence of Earth-like Planets". The article was found in *The Ottawa Citizen* on Friday, September 8, 2006 on page A11 (you will use this information for your bibliographical reference).

1. **Before your read the article, do the following**:
   Sort the twelve words provided in the word bank of the worksheet and write them in the appropriate boxes entitled *People*, *Places/Times*, *Problems*, and *Outcomes*. Write any words you have never seen before in the box called *Unknown Words*. Use a dictionary and thesaurus to determine the meaning of these words. Write the definitions in you own words and hand them in with your worksheets. Under *Gist Statement* write your prediction of what the article is about. Finally, come up with three questions which you would like to discover about the article as you read it. Record these questions in the *To Discover* section.

2. **Read the article carefully**. As you read, use highlighters (two different colors) to identify what details you find **important** (central to the meaning of the article) and what you find **interesting** (to you, personally). Record these in the *What's Important, What's Interesting* table.

3. Using your completed *What's Important, What's Interesting* table, write one paragraph which summarizes the important information provided in the article and write another paragraph that explains what you found to be interesting in the article. When writing your paragraphs, pay close attention to spelling, grammar, and sentence and paragraph structure.

4. Write a paragraph which answers the following questions:
   Was your prediction (*Gist Statement*) accurate? Can you now answer your *To Discover* questions? What would you have liked the article to include that it didn't?

5. Hand in all you work. Include a proper bibliographical reference for the newspaper article (look at page 23 of your agenda for the proper format).

Discoveries support belief in existence of Earth-like planets

Friday, September 8, 2006

By The Ottawa Citizen

A trio of discoveries announced this week involving planets around other suns, or exoplanets, is raising expectations of the first sighting of an Earth-like world around another star.

The findings -- including the discovery by an Ottawa native of an exoplanet 500 light years away using telescopes smaller than those used by most backyard astronomers -- are helping astronomers pinpoint their fevered search for distant, rocky Earth-sized planets.

In the most dramatic of these findings, a team of U.S. scientists is predicting that many distant solar systems include rocky planets, but we're just not able to see them yet.

The study focuses on a type of planetary system unlike our solar system that contains giant gas planets called "Hot Jupiters." These are Jupiter-sized planets but are located very close to their star, even closer than Mercury is to our sun. Until now, many astrophysicists believed the formation of these massive near-sun planets ruled out the presence of nearby rocky ones, assuming the rocky material would be "vacuumed up" in the formation of the giant.

But the researchers behind new computer simulations of these developing Hot Jupiter solar systems conclude that more than one-third of about 200 giant planet systems recently detected outside our solar system could contain Earth-like planets.

And, say the researchers, their results -- published in today's issue of the journal Science -- indicate many of these distant worlds would be in their stars' "Goldilocks" zone, an area where it's not too cold or hot for liquid water to exist. These planets, they say, could be covered in deep oceans of liquid water. Oceans, they go so far as to say, that would be capable of supporting life.

"I think there are definitely habitable planets out there," says Sean Raymond, a research associate at the University of Colorado's Laboratory for Atmospheric and Space Physics and lead author of the Science study. "But any life on these planets could be very different from ours. There are a lot of evolutionary steps in between the formation of such planets in other systems and the presence of life forms looking back at us."

Sara Seager, a Canadian exoplanet hunter at the Carnegie Institute in Washington, D.C., says the computational models used in this research "have many uncertainties" -- scientific code for "they should be taken with a large grain of salt." But, says Ms. Seager via e-mail, "The models are extremely useful because they make testable predictions." They tell astronomers where, amidst the billions of stars, to look for Earth-like bodies.

At present, ground- and space-based telescopes are only sensitive enough to spot relatively large exoplanets. The astronomy community is eagerly awaiting the launch of a series of new space-based planet hunting telescopes -- the European COROT project and NASA's Kepler Mission -- in the next several years that will be able to spot much smaller, Earth-sized planets. But in the meantime, a team of astronomers is celebrating its low-tech, shoestring-budget planet-spotting.

Yesterday the team, including Canadian David Charbonneau, a professor of astronomy at Harvard University, announced the discovery of a Jupiter-size exoplanet 500 light years away in the constellation Draco. What's as amazing as the planet, named TrES-2, is that they found this needle in the cosmic haystack using a network of three tiny telescopes, each one a 10-centimetre telephoto camera lens rigged to various amateur astronomy components.

"They're quite a bit smaller than those used by amateurs," says Mr. Charbonneau, who attended Ottawa's Merivale High School and did his first sky surveys on local summer Scout canoe trips. He says that TrES-2 will be visible in the night sky to Ottawa-area amateur astronomers on Sept. 10.

The automated telescopes are located in California, Nevada and the Canary Islands and called the Trans-Atlantic Exoplanet Survey (TrES); hence the planet's name, the second found by the network.

The Hubble telescopes are programmed to stare at a patch of sky over several months. The researchers then used software to sift through the mountain of data looking for minute, periodic dips in the brightness of any of the thousands of stars in the observed star field. A star's slight dimming indicates the presence of an exoplanet that's transiting -- passing directly along the line of sight between the star and the Earth.

"When TrES-2 is in front of its star it blocks off about one half per cent of the star's light, an effect that we can observe with the TrES telescopes," says Mr. Charbonneau.

The TrES-2 find and computational modelling study of Hot Jupiter solar systems emphasize the convergence of technology and astrophysical theory that are pushing astronomers ever closer to spotting Earth-like planets.

"We are witnessing the exoplanet field move from census-taking to physical characterization. The transiting planets are the only ones we can physically characterize," says Sara Seager. Based on the star-dimming effects and other analysis, astronomers can calculate the exoplanets' size, mass and also composition.

The big question for exoplanet hunters is not only when we'll spot a rocky, Earth-sized planet for the first time, but when we'll be able to directly image this exoplanet. To date, all exoplanets have been detected using indirect methods, like the transit technique. Yesterday, astronomers were given a tantalizing taste of a direct exoplanet spotting when an international team of astronomers reported they'd captured a direct image of one of the smallest objects ever seen around a distant sun.

At 12 times the mass of Jupiter, this massive object orbits 19.5 billion miles (31.4 billion kilometres) from its star, or 200 times the distance from the Sun to the Earth.

"We are able to detect it because it's far enough from the glare of the star that it orbits," says Kevin Luhman, a researcher at Penn State University and leader of the team that found the object, called CHRX 73 B.

Amidst the currently heated astronomical community debate on the definition of a planet, Mr. Luhman says that he believes the object Hubble photographed is a brown dwarf -- not a massive planet, but a failed star, one that never accreted enough material to ignite a thermonuclear reaction.

But, says Jaymie Matthews, a UBC astronomer and science leader of the Canadian Space Agency's MOST-satellite, at present Canada's leading exoplanet research tool, "What it shows is

that we're pushing our threshold in terms of what we can image close to a distant star. Don't hold your breath for video footage of an alien Earth showing continents and city lights. But do expect to see exoplanetary astronomers on TV within a few years jumping with glee at the first discovery of an exo-Earth."

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Amateur astronomers can learn to observe transiting exoplanets at: http://www.aavso.org/observing/programs/ccd/transitsearch.shtml .

For specifics of how amateur astronomers can spot TrES-2 on the sky, see: http://www.astro.caltech.edu/~ftod/tres/tres2.html .

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PROJECT 18: READING STRATEGIES RUBRIC

Criteria	R (below passable achievement)	Level 1	Level 2	Level 3	Level 4
Knowledge key features vocabulary		shows limited understanding of the key features of the article shows limited ability to determine the meanings of unknown words	shows some understanding of the key features of the article shows some ability to determine the meanings of unknown words	shows considerable understanding of the key features of the article shows considerable ability to determine the meanings of unknown words	shows thorough understanding of the key features of the article shows a high degree of ability to determine the meanings of unknown words
Thinking/Inquiry predictions distinguishing between main ideas and supporting details questions		shows limited ability to make reasoned predictions about the article shows limited ability to distinguish between the main ideas of the article and the supporting details limited ability to formulate appropriate questions which predict article meaning.	shows some ability to make reasoned predictions about the article shows some ability to distinguish between the main ideas of the article and the supporting details some ability to formulate appropriate questions which predict article meaning.	shows considerable ability to make reasoned predictions about the article shows considerable ability to distinguish between the main ideas of the article and the supporting details considerable ability to formulate appropriate questions which predict article meaning.	shows a high degree of ability to make reasoned predictions about the article shows a high degree of ability to distinguish between the main ideas of the article and the supporting details a high degree of ability to formulate appropriate questions which predict article meaning.
Communication clarity		limited use of clear and concise language	some use of clear and concise language	considerable use of clear and concise language	thorough use of clear and concise language
Application language conventions reading strategies		limited use of proper language conventions and bibliographical reference limited ability to apply the recommended reading strategies	some use of proper language conventions and bibliographical reference some ability to apply the recommended reading strategies	considerable use of proper language conventions and bibliographical reference considerable ability to apply the recommended reading strategies	thorough use of proper language conventions and bibliographical reference thorough ability to apply the recommended reading strategies

Graphic Organizer: What's Important, What's Interesting

Name: _____

What's Important	What's Interesting

Title of Selection: _____

Word Bank:

researchers	planets	discoveries	professor
constellation	computational models	astronomers	formation
habitable	indirect	telescopes	debate

People	Places/Times	Problems

Gist Statment...

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Outcomes	Unknown Words	To Discover
		1. 2. 3.