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AHS Students Find Evidence of Dark Matter

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From left (front row) students Kevin Xu, Cece Graff, Jenny Dickhaus, and Sabine Loos; (back row) Dr. Natalia Connelly from Hamilton College in New York and Anderson High School science teacher Jeff Rodriguez.

Pouring over Hubble Space Telescope images, four Anderson High School students patiently observe and calculate the luminosity and the mass of distant galaxies as they investigate strange effects predicted by Albert Einstein nearly a century ago.

A prediction of relativity, gravitational lensing is an effect which causes light from a galaxy hidden from view to produce a ring or false images around a visible galaxy. Of course the alignment between the telescope and the two galaxies has to be just right.

Due to the technology and observational techniques available at the time, Einstein did not think that the lensing effect was something that could be observed. However, the Hubble Space Telescope has opened the world's eyes to many

astronomical possibilities including those theorized by great minds.

So far the students' calculations have shown that the lensing galaxy must be surrounded by a large percentage of dark matter. Because dark matter cannot be seen, it is only detectable from its gravitational effects on visible matter.

The Anderson students' work is made possible thanks to a grant from the Space Telescope Institute. The grant was authored by AHS science teacher Jeff Rodriguez and his colleague from Hamilton College in New York, Dr. Natalia Connelly.

Dr. Connelly, an astronomer working with other Hubble telescope collaborators, has done a lot of work studying supernovas as cosmological distance indicators. She and Mr. Rodriguez became acquainted by way of Dr. Connelly's husband, Brian, who is an AHS graduate. Brian is currently a physicist at the University of Pennsylvania.

The research allows the students to use the same software as astronomers in analyzing images from the Hubble space telescope, Mr. Rodriguez said. "We are looking specifically at images which show strong lensing effects predicted by Einstein and general relativity."

Students interested in the research project had to submit applications to Mr. Rodriguez and Dr. Connelly. The Anderson student researchers are seniors: Kevin Xu, Jenny Dickhaus, Sabine Loos, and Cece Graff. They all four viewed the research project as a unique opportunity to gather practical experience in research, computer technology, and website design.

Jenny and Sabine both called the project a good opportunity. And if she chooses astronomy as a major Jenny said, "This experience would help." Sabine said she's not certain what she wants to do in college but engineering is a consideration. The experience with the lensing project could help expand her options. "I've definitely learned a lot more about computers," she added.

"The research skills they are learning will transfer to any college degree program," Mr. Rodriguez added.

Cece said that the project fit with several of her interests. She likes astronomy, enjoys computer programming and is also interested in photography. "I like it. It's interesting," she said. "The research part is frustrating."

"They're learning that getting answers may not always be easy and takes a significant amount of work," Mr. Rodriguez said.

For Kevin, the web design and computer aspects were all appealing. He plans to major in computer programming at college. "Many colleges use the Linux operating system," he said. The system they used for the project was very similar to that of Linux which he enjoyed.

Mr. Rodriguez emphasized that the research experience was invaluable. "They are looking at and doing the same type of work as post doctoral students – as high school students. It raises the bar for what they're doing."

The summer research portion of the project recently concluded. During the fall, the students will continue the work by building a website dedicated to teaching others about gravitational lensing and their research. Their work can be found at <http://www.glaspl.info>. They will also work to develop a formal presentation and/or a science fair project based on their work.

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