



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

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Project Title A Galaxy Ablaze from Afar: Spectral Energy Observations of S5 0716+714	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this projects was to construct a Spectral Energy Distribution (SED) diagram of blazar S5 0716+714 using images from the Spitzer Space Telescope, ground based optical telescopes, and a radio telescope. Two cameras on the Spitzer Space Telescope were used: the Multiband Imaging Photometer for Spitzer (MIPS) and the Infrared Array Camera (IRAC). Once the SED was made, a portion of the radiation was modeled and analyzed.</p> <p>Methods/Materials Before the SED could be constructed, light curves were needed to confirm that the target did not significantly change between the two Spitzer observations. To do this, we needed to reduce all of the optical ground based images to plot the magnitude, or brightness, over time. Imaging software was used to find the brightness of the target for a particular picture, which was then graphed and modeled compared to standard stars in the image using graphical analysis software. Once the light curves were constructed, the SED data points were then reduced. Spitzer images were reduced at the Spitzer Science Center on the Cal Tech campus with the guidance of a professional astrophysicist.</p> <p>Results An unusual bump was seen in the SED located in the MIPS infrared data points. This bump could be attributed to added heat in addition to the synchrotron radiation. This bump was mathematically modeled, which was used to calculate the approximate temperature of the added heat. The temperatures were inconsistent due to different suggested redshifts, which could only be estimated.</p> <p>Conclusions/Discussion Two different explanations can be given for the added heat seen in the MIPS data points on the SED. First, it could be heat coming from the torus surrounding the black hole in the blazar. Second, it could be heat coming from the surrounding stars in the host galaxy. To determine which of these explanations is correct, a more accurate model of the bump is needed. To make the model more accurate, more data points are needed. This can be accomplished through a second use of the MIPS camera on Spitzer, which would also allow us to determine whether the bump is consistent with mutiple observations. A Proposal is being written to use the MIPS camera again, as well as the Infrared Spectrometer (IRS) to determine a more accurate redshift, allowing us to find a more precise temperature for the bump.</p>	
Summary Statement The Spitzer Infrared Space Telescope and ground based telescopes were used to take images of a galaxy with a black hole at its center, which were graphed to determine the amount of energy distributed over the wavelengths of light.	
Help Received Jeff Adkins wrote proposal to use Spitzer; Dr. Mark Lacy instructed us on how to reduce Spitzer images; Steve Rapp contributed the radio data point used on the SED; Frank Pino, Vivian Hoette, Mike Harms, Jerome Hudson contributed images of the target	