Spitzer Space Telescope Research Program for Teachers and Students: Young Stars in the Witch Head Nebula (IC 2118)

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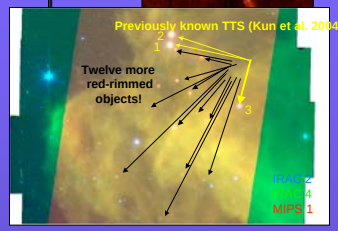
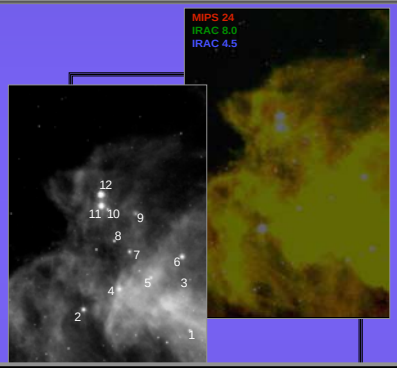
The Spitzer Space Telescope Teacher Program is a collaboration between the Spitzer Science Center and the National Optical Astronomy Observatory. Through the program, twelve teachers were selected to submit observing proposals for time on the Spitzer Space Telescope. The Young Stars in IC 2118 Project was awarded 62 minutes of Director's discretionary observing time to study a small region of IC 2118 (the Witch Head Nebula), a star forming region of small-mass stars embedded in their natal cloud. The five teachers involved in this project met at the Spitzer Science Center in August and September 2005 to analyze the data received from IRAC and MIPS observations. Six high school students participated in these visits, and several more are analyzing data at their home schools. We are making tri-color images to identify structure in the interstellar medium (ISM), Spectral Energy Distributions to identify cluster members, and color plots to determine their stage of development, thereby estimating their ages. We are working toward adapting lessons that can use software that is readily available in public schools to do the data analysis. As teachers develop lesson plans for these activities, they will apply them in their science classes and provide professional development on infrared astronomy and the use of astronomical data to other teachers through in-service training around the country. Dr. Luisa Rebull from the Spitzer Science Center mentors the team. Please see our companion poster, Spuck et al., on Thursday (#185.07) for our science results using these data.

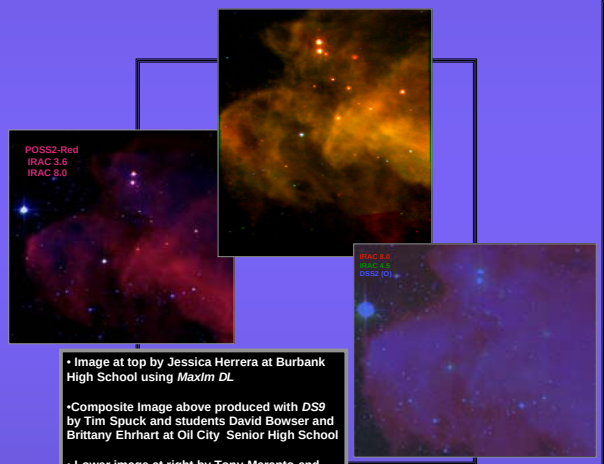


With a few minutes of Spitzer time we have QUADRUPLED the number of (suspected) young stellar objects here! We'll need more optical data to understand the triggered star formation, but we're on the way. (In this 3-color mosaic, the stars that are bright at 24 microns appear red-rimmed because MIPS' resolution is broader than IRAC's.)



Tony Maranto and students Michael Greer, John Preis and Philip Weston at Phillips Exeter Academy produced the color image above with the image stacking and math functions of *Image J* in an effort to distinguish Class I, II, and III stars visually.

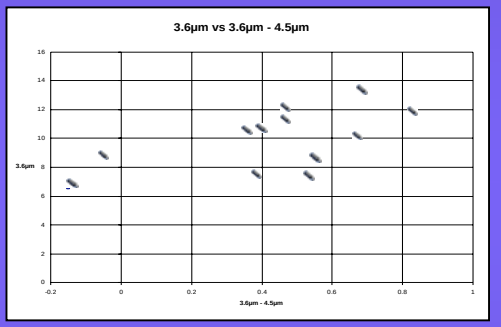
The grayscale on the left identifies the classes of 12 stars in the image:
Class I (7, 10)
Class II (3, 5, 6, 8, 9, 11, 12)
Class III (1, 2)
Flat-Spectrum (4)



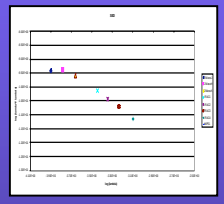
• Image at top by Jessica Herrera at Burbank High School using *MaxIm DL*

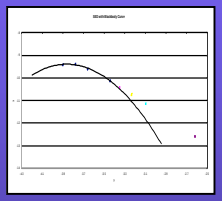
•Composite Image above produced with *DS9* by Tim Spuck and students David Bowser and Brittany Ehrhart at Oil City Senior High School

• Lower image at right by Tony Maranto and students Michael Greer, John Preis, and Philip Weston, at Phillips Exeter Academy using *Image J*



Babs Sepulveda, teacher in Stockton, CA, organized the data to generate color-color plots for our 12 stars. We wrote an Excel spreadsheet to take the fluxes from the point sources in the data and convert them into the correct units for color-color plots and spectral energy distributions (SEDs). We will be using this software and these data as part of our classroom lessons.



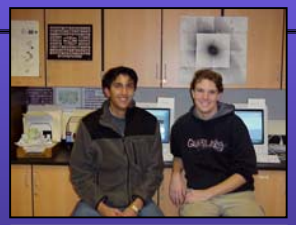


Theresa Roelofsen, teacher at Bassick High School, Bridgeport, CT, created the SEDs shown here using Microsoft Excel, and fit a blackbody curve to the data. She has also written a teacher-student handbook that explains how to use this readily-available software to process science data in the classroom.

Interested educators learn about infrared light and use of Spitzer data through workshops given by Spitzer teachers.

David Bowser and Brittany Ehrhart from Oil City , PA, are shown working in Pasadena at the Spitzer Science Center. They are now getting optical images of two of our twelve stars to get shorter wavelength data. Tim Spuck, their teacher and the Team Leader of our project, wants to use this data to extend our black body curve.

Jessica Herrera, San Antonio, TX, interviewed SSC Director Dr. Tom Soifer for a story segment about authentic research in the science classroom for Texas Public Radio. Her interview, as well as interviews of Jessica and teacher Cindy Weehler, will be featured on station KSTX in San Antonio.



Nikhil Sharma and Andrew Hughes from Stockton, CA, used Microsoft Excel with teacher Babs Sepulveda to make color-color plots, including the one shown at top right.

Perhaps the most important thing that we've learned during this process is that scientists don't look like this…!

We acknowledge support from the NASA/NOAO Spitzer Space Telescope Observing Program for Students and Teachers and from the Teacher Leaders in Research Based Science Education Project. The TLRBSE Project is funded by the National Science Foundation under ESI 0101982, funded through the AURA/NSF Cooperative Agreement AST-9613615. NOAO is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under cooperative agreement with the National Science Foundation.