



NITARP Lesson Plans: Bite-Size Pieces of Authentic Science Research Experiences

<http://nitarp.ipac.caltech.edu/>



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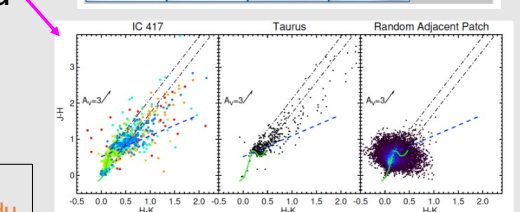
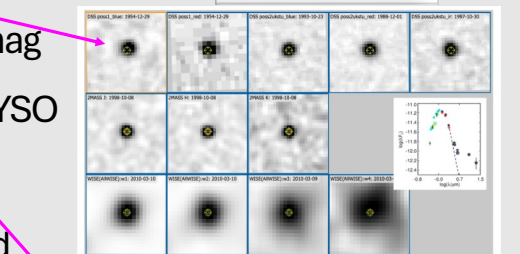
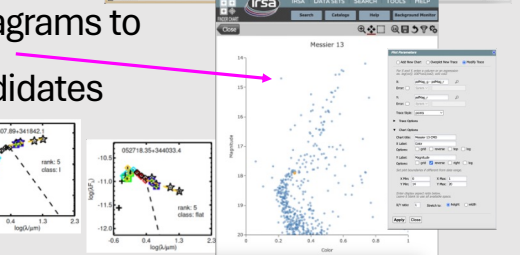
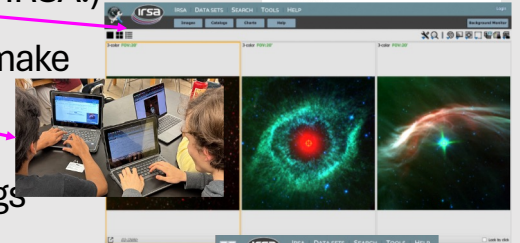
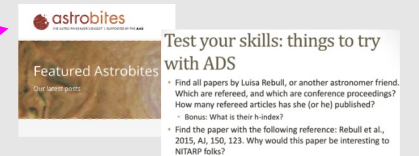
The NASA/IPAC Teacher Archive Research Program (NITARP) partners small groups of (largely) high school educators with a research astronomer for a year-long authentic research project. We know based on educational research and surveys of the participants that the NITARP experience subsequently positively influences participants' science teaching. One thing that is missing from the NITARP experience is the production of concrete, sharable lesson plans based on skills learned during NITARP, specifically lesson plans that might be distributed within and beyond NITARP alumni. NITARP alumni are diverse, representing schools that are large/medium/small, urban/suburban/rural, public/private; settings ranging among middle school/high school/community college/museum/ informal ed; physics/astronomy/earth science/chemistry/math/computer science teachers; in classrooms (quarter, semester, year-long)/ clubs/ dedicated research classes/ individual mentoring contexts. Therefore, **even the same individual concept may need several different implementations to work in these wildly different environments.** We have embarked on an effort to take a "typical" rich NITARP experience, break it into "bite-size" pieces, and develop at least one lesson plan based on each piece that will work in at least a few of these environments. This work addresses the gap in the literature of "exploring how teachers adopt or translate the curriculum or instructional approaches advocated in the PDP [professional development program]" (Luft & Hewson, 2014, p. 903).

Rebull et al. (2023, AJ, 266, 87) combined work from two NITARP teams (2015 and 2020/21), and archival data from 2MASS, Spitzer, WISE, UKIDSS, Gaia, IPHAS, PanSTARRS, MSX, AKARI, and Herschel. Largely using tools hosted at IRSA, this team explored candidate young stellar objects (YSOs) from the literature and identified new YSO candidates in this region, IC417. There are 710 YSOs and candidate YSOs in the final catalog, 503 of which are in the higher quality bins. There is no evidence for an age spread in the "braided" region in the center/left of this image, consistent with literature assertions that the trigger for star formation came from 'above' in this image.



Take that IC417 study as scaffolding:

- Pick a region & check the literature
- Find data (largely, not exclusively @IRSA!)
- Use IRSA tools to explore images, make multi-color images
- Use IRSA tools to assemble catalogs
- Make color-color and color-mag diagrams to explore clusters or select YSO candidates
- Make SEDs
- Explore images of point sources
- Make more color-color and color-mag diagrams to explore distribution of YSO candidates
- Are the YSO candidates so selected likely good YSOs?



The plan is to collect the materials we develop into one central place, probably <https://vmcoolwiki.ipac.caltech.edu/>, which is where we have placed the materials developed by other teams in NITARP (and its predecessor) since 2005.

This work was conducted as part of the NASA/IPAC Teacher Archive Research Program (NITARP), which receives funding from the NASA ADAP program. We acknowledge the many additional teachers and students who worked on our many teams that therefore contributed their time and energy to NITARP experiences in both large and small ways.



Color-color diagram of IC417, compared to Taurus (known YSOs) and a random patch of sky near IC417 (no YSOs but same data as IC417). All of the mid-to-high quality (green/cyan/blue) YSOs look more like Taurus than the random patch of sky. Many of the lowest quality (red/orange) YSOs are in ...suspicious places. (Symbol colors in IC417 panel corresponds to YSO quality; colors in "random patch of sky" plot correspond to point density. Solid green is ZAMS; dashed line is T Tauri locus.)

Some of us in summer 2023!