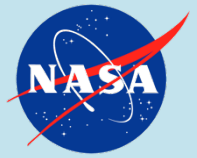




# WISE-Identified

# Young Stellar Objects in BRC 38



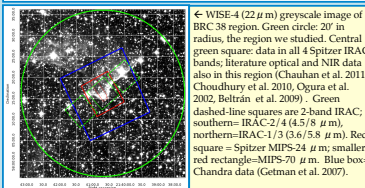
John C. Gibbs<sup>1</sup>, Luisa M. Rebull<sup>2</sup>, Wendi B. Laurence<sup>3</sup>, Robert J. Marshall<sup>4</sup>, Michael A. Murphy<sup>5</sup>, Laura Orr<sup>6</sup>, Christi J. Whitworth<sup>7</sup>, Anna Burton<sup>1</sup>, Taylor Corris<sup>1</sup>, Sean Goodey<sup>1</sup>, Stewart McGinnis<sup>1</sup>, Connor Laurence<sup>8</sup>, Olivia Aschman<sup>5</sup>, Robin Kikuchi<sup>5</sup>, Jonathan Prather<sup>5</sup>, Lee Whitley<sup>5</sup>, Chad Billings<sup>6</sup>, Caleb Mader<sup>6</sup>

<sup>1</sup>Glencoe High School (Hillsboro, OR), <sup>2</sup>Caltech (Pasadena, CA), <sup>3</sup>Portland State University (Portland, OR), <sup>4</sup>Carnegie Science Center (Pittsburgh, PA), <sup>5</sup>Ravenscroft School (Raleigh, NC), <sup>6</sup>Ukiah High School (Ukiah, OR), <sup>7</sup>Pisgah Astronomical Research Institute (Rosman, NC), <sup>8</sup>Treasure Mountain Junior High School (Park City, UT)



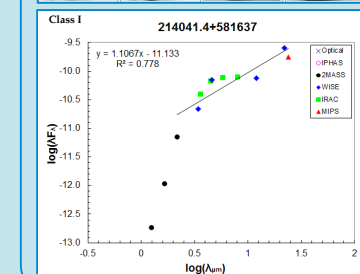
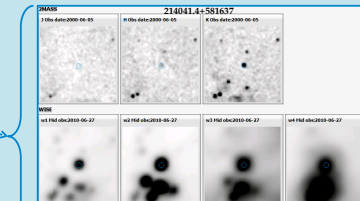
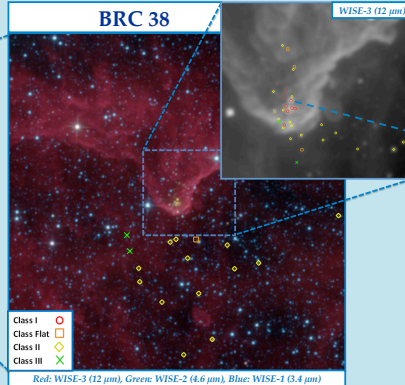
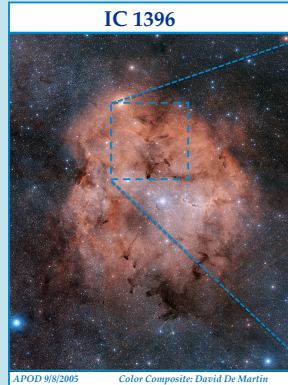
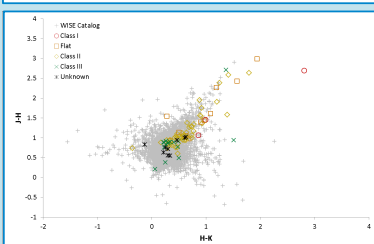
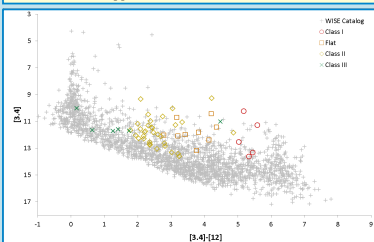
Bright rimmed clouds (BRCs) are dense clumps of gas and dust within HII regions at the edges of molecular clouds. While BRCs are dark, their rims are optically bright due to illumination by nearby O or B stars. We used data from the Wide-field Infrared Survey Explorer (WISE) to expand the search for YSOs to a 20 arcminute radius from the center of BRC 38, located in the north of the molecular cloud IC 1396. Using an updated version of the IR color selection scheme developed for the WISE catalog by Koenig et al. (2012), we identified objects having IR colors consistent with those of YSOs. Our work adds several new YSO candidates to the list of YSOs in and near BRC 38 and newly identifies IR excesses for many of the previously identified YSOs in the region. Support is provided for this work by the NASA/IPAC Teacher Archive Research Program (NITARP), which receives funding from the NASA ADP program and the IPAC archives.

## REGION OF STUDY

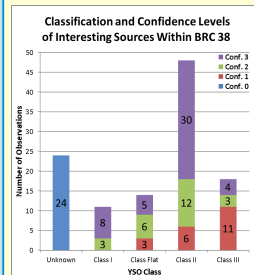


## METHODS

Nearly 7000 sources were detected in the area of BRC 38 using the data from the WISE archive and available literature. A series of color cuts were completed reducing the number to 115 interesting sources that were identified as either as previously known YSOs (79), sources having a measured WISE infrared excess (10), or both (25). Further evaluation of the sources was done through SED and image inspection in all available bands POSS through WISE. Determination of YSO classification was based on the slope of the SED and matched to their positions on color-magnitude diagrams and color-color diagrams. All sources were given a confidence score based on the quality and quantity of images and available data, as well as the types of previous studies done. For all previously identified sources we also compared our results to the results of other studies done in BRC 38 to further support the YSO identification.



## RESULTS

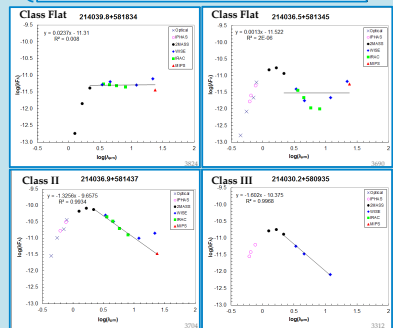


Confidence	Unknown	Class I	Class Flat	Class II	Class III	Total
Conf. 3	*	8	5	30	4	47
Conf. 2	-	3	6	12	3	24
Conf. 1	-	0	3	6	11	20
Conf. 0	24	-	-	-	-	24
Total	24	11	14	48	18	115

RATIOS OF YSO CLASSES IN BRC 38 AND BRC 34 LOCATED IN IC 1396					
	Class I	Class Flat	Class II	Class III	Total
BRC 38 (Conf. level 3)	8 (~17%)	5 (~11%)	30 (~64%)	4 (~9%)	47
BRC 34	1 (~7%)	1 (~7%)	8 (~57%)	4 (~29%)	14

## Summary of new and previously known sources by class and confidence level

Class I	Class Flat	Class II	Class III
<b>Eleven (11) sources identified as Class I</b> <ul style="list-style-type: none"> <li>8 sources with confidence 3                             <ul style="list-style-type: none"> <li>1 new source</li> <li>7 previously known</li> </ul> </li> <li>3 sources with confidence 2                             <ul style="list-style-type: none"> <li>1 new source</li> <li>2 previously known</li> </ul> </li> </ul>	<b>Fourteen (14) sources identified as Flat Class</b> <ul style="list-style-type: none"> <li>5 sources with confidence 3                             <ul style="list-style-type: none"> <li>1 new source</li> <li>4 previously known</li> </ul> </li> <li>6 sources with confidence 2                             <ul style="list-style-type: none"> <li>1 new source</li> <li>5 previously known</li> </ul> </li> <li>3 sources with confidence 1                             <ul style="list-style-type: none"> <li>All previously known</li> </ul> </li> </ul>	<b>Forty Eight (48) sources identified as Class II</b> <ul style="list-style-type: none"> <li>30 sources with confidence 3                             <ul style="list-style-type: none"> <li>3 new sources</li> <li>28 previously known</li> </ul> </li> <li>12 sources with confidence 2                             <ul style="list-style-type: none"> <li>2 new sources</li> <li>10 previously known</li> </ul> </li> <li>6 sources with confidence 1                             <ul style="list-style-type: none"> <li>1 new source</li> <li>5 previously known</li> </ul> </li> </ul>	<b>Eighteen (18) sources identified as Class III</b> <ul style="list-style-type: none"> <li>4 sources with confidence 3                             <ul style="list-style-type: none"> <li>All previously known</li> </ul> </li> <li>3 source with confidence 2                             <ul style="list-style-type: none"> <li>All previously known</li> </ul> </li> <li>11 sources with confidence 1                             <ul style="list-style-type: none"> <li>All previously known</li> </ul> </li> </ul>



Please visit the companion poster 249.03 about our educational experiences. (Laurence, et al. : Extending the invitation: Supporting learners as they move from gateway experiences to participating in astronomical research.)

