

Near-IR Spectral Variability of Young Stars

Stephanie Zajac¹, Dr. Josh Eisner², & Dr. Alexander L. Rudolph¹

¹Dept. Of Physics, California State Polytechnic University, Pomona (Cal Poly Pomona); ²Steward Observatory, The University of Arizona

Kellogg Honors College Capstone 2011

Young stars exhibit photometric variability across the electromagnetic spectrum, including in the visible and infrared regions. Time-variable mass accretion rates may cause some of the observed variability, although other mechanisms, such as star spots or structural changes in the circumstellar disks, provide alternative explanations. Spectroscopic observations provide a means to probe accretion via diagnostic emission lines, and to probe the ratio of stellar-to-circumstellar flux via veiling of stellar absorption lines. While spectroscopic variability in the optical range has been previously investigated, variability in the near-IR has not been as thoroughly explored. We have undertaken a project to track the spectral variability of young stars in the near-IR. Using the 90-inch Bok telescope on Kitt Peak, we observed about 40 young stars with FSpec during two 5-night runs separated by one month. As this project continues, in order to extend the timescales covered by our data, we will survey the same targets under similar circumstances in the summer of 2011. Ultimately, we hope to follow a sample of about 100 young stars with 5-night observing runs every month of the year. Here we present initial results showing Brackett gamma Hydrogen line emission for one source.

Observing

Data for this ongoing survey was collected from Steward Observatory's 90-inch Bok telescope at Kitt Peak, Arizona, using FSpec, a cryogenic long-slit near-IR spectrometer with a NICMOS3 256x256 array, and a 600 lines/mm diffraction grating, allowing for observation of K-band spectral features. Observing runs spanned five nights each in May and June 2010. The 5-night runs allow for detection of spectral variability on a 24-120 hour time scale, and the 30-day gap allows for detection of variability on a 30-day time scale. Future observing runs are planned for May and June 2011.



Results

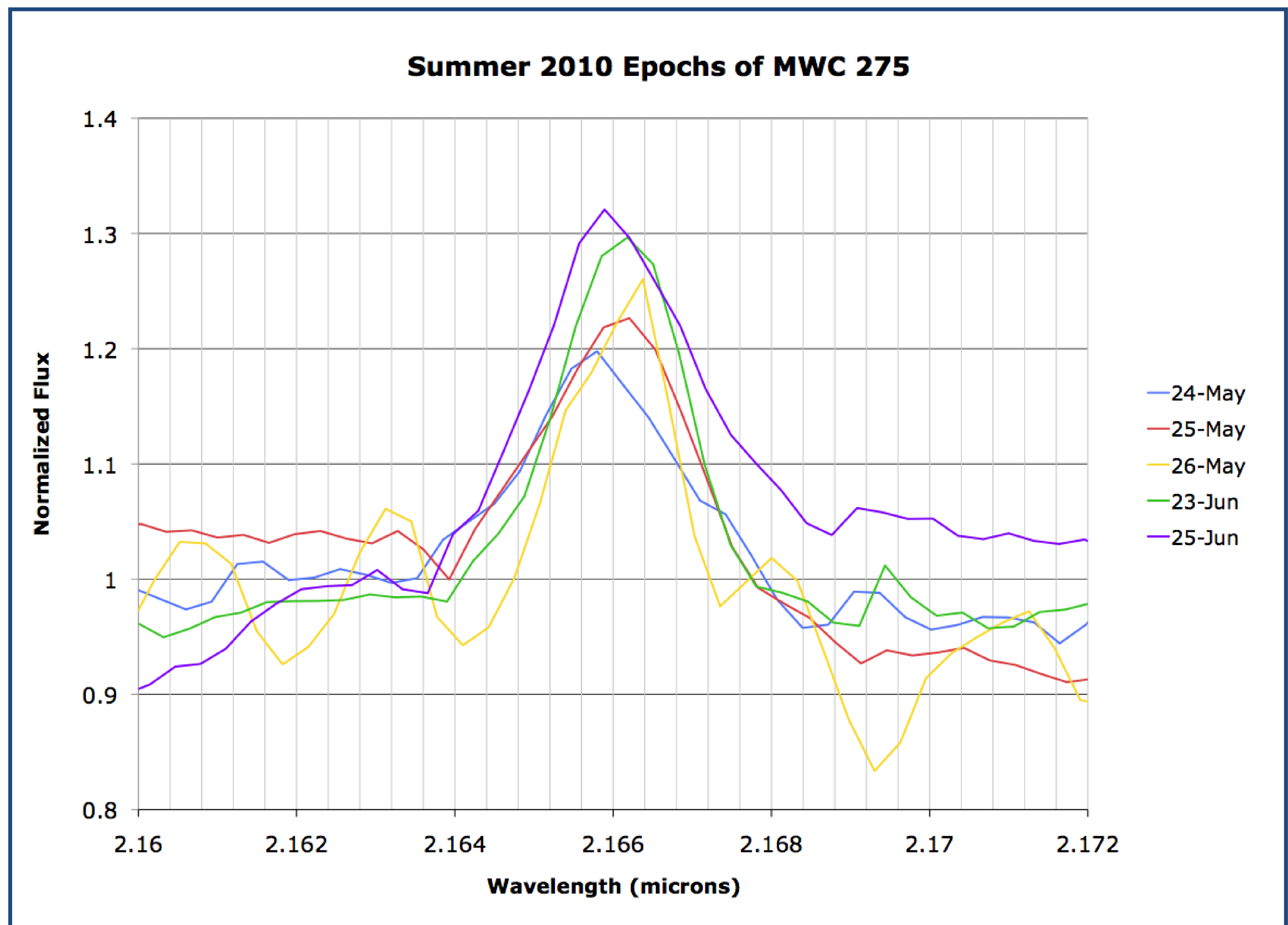


Figure 1: Preliminary reduction of five epochs of the spectrum of MWC 275. The observed variability in the line profiles likely reflects variation in the stellar accretion rate, one of the mechanisms proposed to explain the spectral variability of young stars.

What's Next?

Continue monitoring of sources on target list, expand target list to include more stars, continue with data reduction, refine reduction pipeline. Analyze line profiles in Brackett-Gamma region, analyze the K-band veiling. Compare results with models for star and disk variability.

CAMPARE

The California-Arizona Minority Partnership for Astronomy Research and Education (CAMPARE) is an NSF-funded 5-year partnership between the Astronomy program at Cal Poly Pomona (CPP) and the University of Arizona Steward Observatory. Its main goal is to increase the number of undergraduate students from under-represented minority groups (including women) attending Astronomy Ph.D. programs and pursuing careers in Astronomy and Space Science. The core activity is a summer internship program at the University of Arizona Steward Observatory for Cal Poly Pomona students. Stephanie Zajac was one of the first students to participate in this program in the summer of 2010.

Acknowledgements

Special thanks is given to the National Science Foundation and CAMPARE for supporting this research, and to my advisors, Dr. Josh Eisner and Dr. Alex Rudolph, for their patience and encouragement.

This material is supported by the National Science Foundation under Award No. AST-0847170, a PAARE Grant for the California-Arizona Minority Partnership for Astronomy Research and Education (CAMPARE). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

