

Experiencing Astronomy: Through a Student Learning Lens

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As a librarian I am interested in the experiences of undergraduate participants in academic research. Librarians study information systems and ways to assist others in most forms of information retrieval. In Fall Semester 2019, I had the opportunity to observe a research experience designed for undergraduate and high school students, offered by the Institute for Student Astronomical Research (InStAR) Seminar, Double Star Astrometry. IU East Assistant Professor Wes Tobin invited me to the seminar, with InStAR's Rachel Freed as the instructor and manager of the national online program.

I entered this experience as a new student, with little knowledge of the systems, nomenclature, or expectations of astronomy or astrometry. Librarians study information systems and ways to assist others in most forms of information retrieval. I have some general knowledge of the night sky, the sun, and planets, but the deep information and catalogs of astronomy and astrometry are new information systems to me. The reference list shown with the article is just the beginning of the collected information and observations of the study of the stars. The sciences of chemistry and physics provide ways to measure and understand the stars and universe.

Technology allows many complex formulas to be completed faster and without individuals manually demonstrating calculations. One way this helps in astrometry is in the concept of plate-solving, the use of telescopes, cameras, images, star databases (observations), and star analysis to develop a dimensional star map relating one star to many. The process sounds easy, I look at the night sky and see seasonal stars, some of them are named and in constellations. However, add some of these facts: constant movement of earth, the solar system, the galaxy, and the universe; the star databases created over time and by various individuals; multiple reference points from

the earth; and the vastness of the universe in relation to the earth, and the process is complex.

The study of double stars has been recorded and described since antiquity. These stars are now organized into three categories: Optical doubles; Visual binaries; Non-visual binaries. The double star catalogs generally include most observable optical doubles. Through telescopic observation some optical doubles become visual binaries by proving them gravitationally bound, which requires observations over time. Non-visual binaries are those double stars identified using other scientific measures. Plate-solving helps astronomers direct telescopic observations to reference the same objects over time and from a variety of devices.

The seminar provided the background and resources for the team to select a couple of optical double stars for further observation to add to the science to determine visual binary stars. The established seminar process included access to star databases and online information sources, access to telescopes and cameras for a series of images to measure double stars in relation to each other and compare to previous observations, a method of recording the team's observations, and the writing of an article for potential publication. This process follows proven, scientific practices.

The experience of learning new perspectives is what drew me to librarianship. The double-star seminar experience brings resources to my toolkit to help others. The astrometry seminar informs and extends my understanding of undergraduate research and the possibilities for students to become an astrometric scientist or a citizen-scientist discovering exo-planets.

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