Carl von Ossietzky Universität Oldenburg

Studying observational astrophysics using robotic telescopes

T. Hoffmann[1], J. Kunz[1], T. Plaggenborg[1], S. Harfst[1], E. Drolshagen[1], M. Gehlen[1], T. Ott[1], A. Rietze[1], N. Wassermann[1], and B. Poppe[1]

[1] *Carl von Ossietzky Universität Oldenburg, Germany*

Motivation

The University of Oldenburg is currently expanding its astronomical education program by means of recently secured state funding (see submission of Poppe *et al.* to this conference). The main focus is on the practical application of astrophysics by using robotic telescopes to perform observations that illustrate the acquired knowledge.

Methods

Students are given the opportunity to gain initial experience with robotic telescopes at the beginning of their studies. They submit observation plans to an online astronomy platform (e.g. Slooh.com), process the images obtained under guidance and present them to an audience. Building on this, students are offered observation evenings to see how the university's robotic telescopes work. In addition, some students may gain further insight by imaging Minor Planets and Near-Earth Objects (NEOs) with professional equipment (16“-Richey-Chrétien telescope (MPC code: G01) and 6“-Wide-field Astrograph).

Observation of NEOs

A main focus of the 16“ telescope lies on the confirmation of NEOs, that is why there are several time-slots during the night dedicated for capturing Minor Planets. The goal of these observations is to collect astrometric and photometric data for ephemerides calculations. If they meet certain standards, they will be submitted to the MinorPlanetCenter (MPC) of the IAU. Observations are planned with the help of the telescope’s control software KStars/Ekos, which was modified to this specific case with Python-scripts in order to retrieve the newest (known) orbital parameters and coordinates of the objects from the MPC. Commonly each object will be captured four times 60 seconds in a row and repeatedly 3 to 4 times per night, separated by at least one hour. In the mean time other observations can be made.

Afterwards, all the collected data will be analyzed for the movement of an object. The exact position and luminance of the object can be calculated by comparison with known stars around it with the software Astrometrica. The measurements will be checked by an operator and then sent to the MPC.

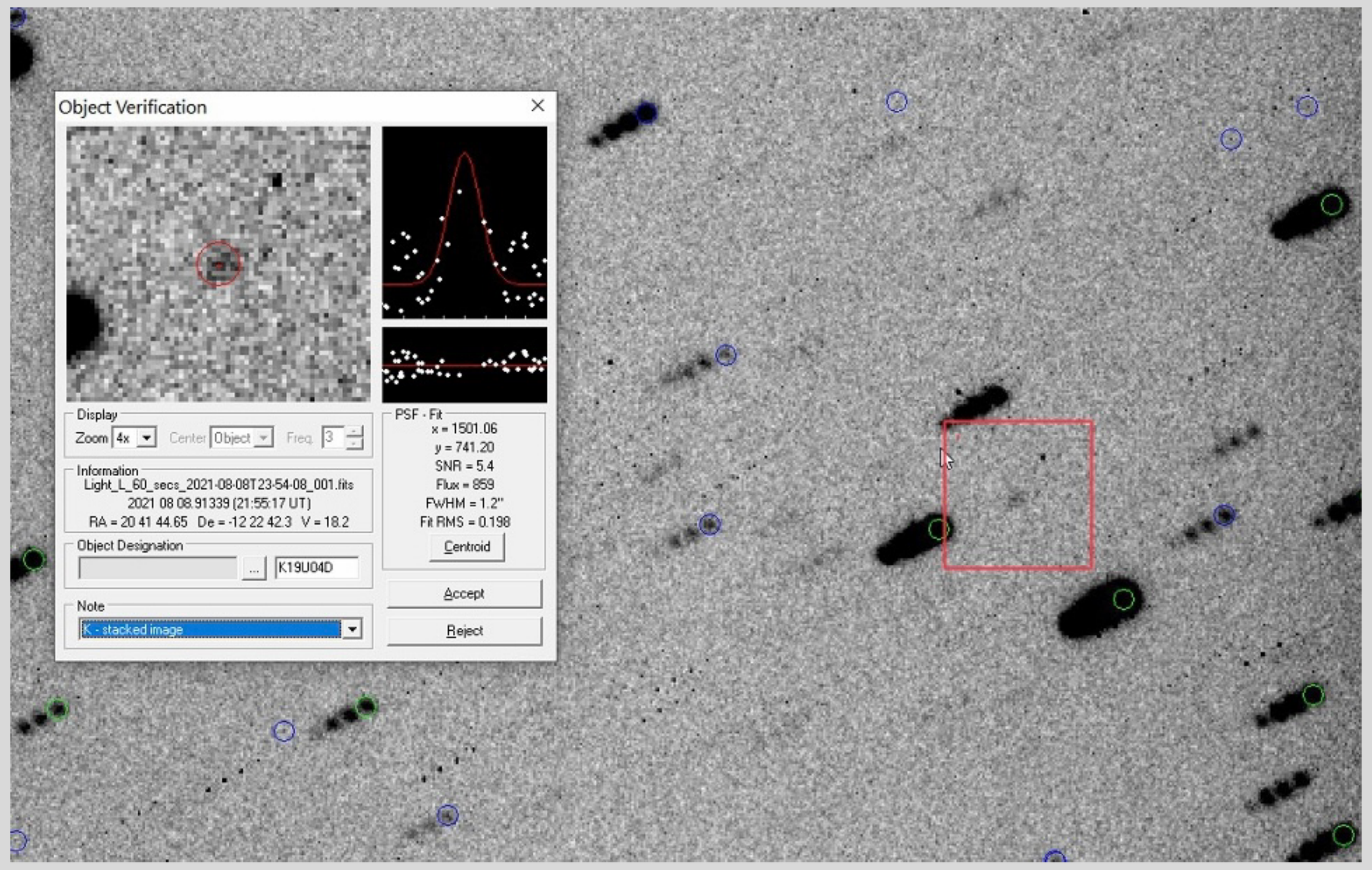

Fig. 1: Snapshot from Astrometrica with measurements for the NEO “2019 UD4”

Astrophotography

In addition, students will learn astrophotography techniques such as creating a color image from individual LRGB images along with calibration images, such as Dark-, Flat- and Bias-Frames. They are also encouraged to use narrow band filters for “false color“ images, best known from the Hubble Space Telescope, which helps to image deep-sky-objects in light polluted areas.

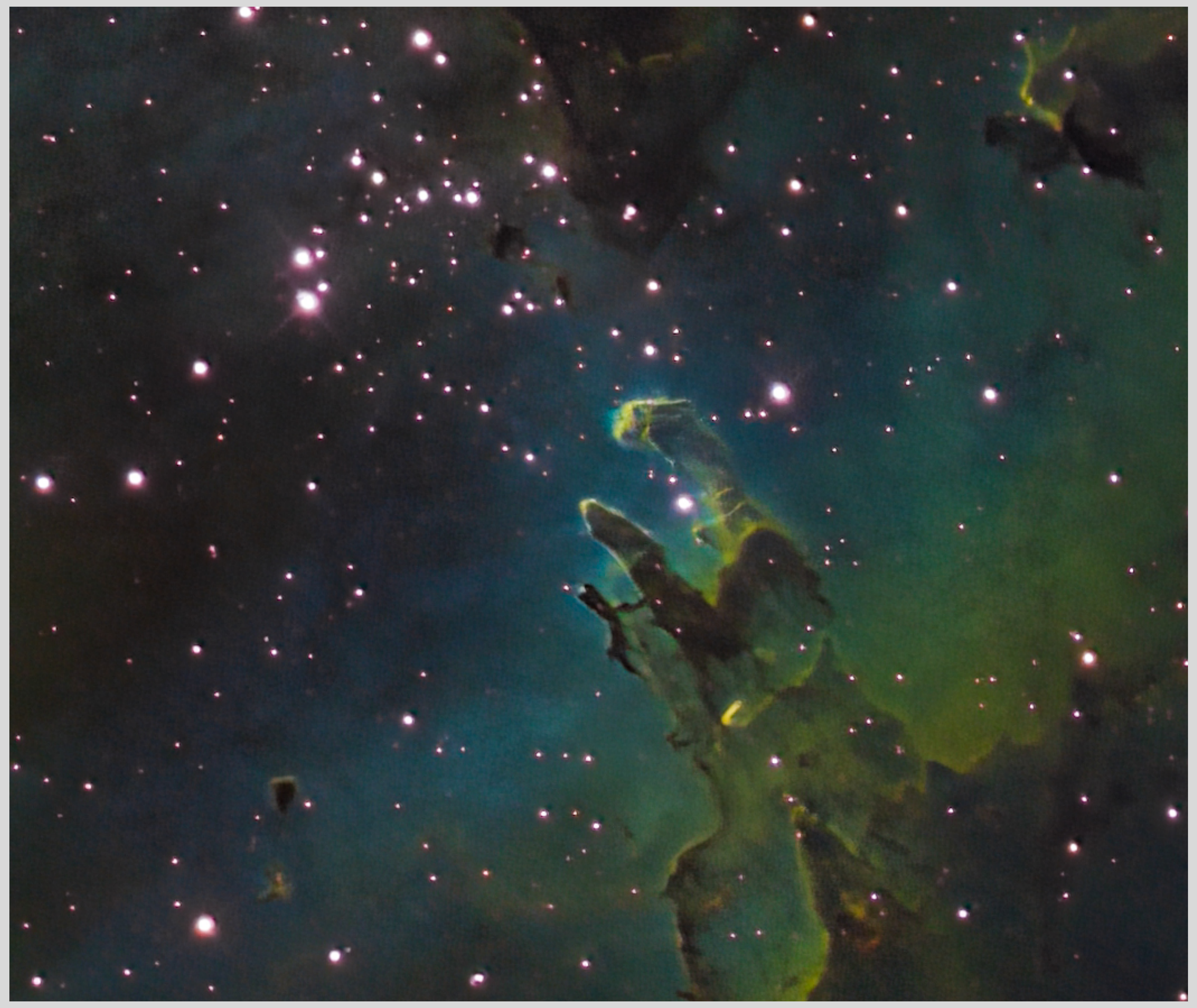

Fig. 2: “False-Colored” image of Messier 16 created with SII, Ha and OIII narrow band filters

Conclusions

All these opportunities enable students to get an insight into the work of an observational astrophysicist at an early stage of their studies. They earn practical experience, which they can also deepen in the context of additional seminars (see submission of Ott *et al.*) and theses.

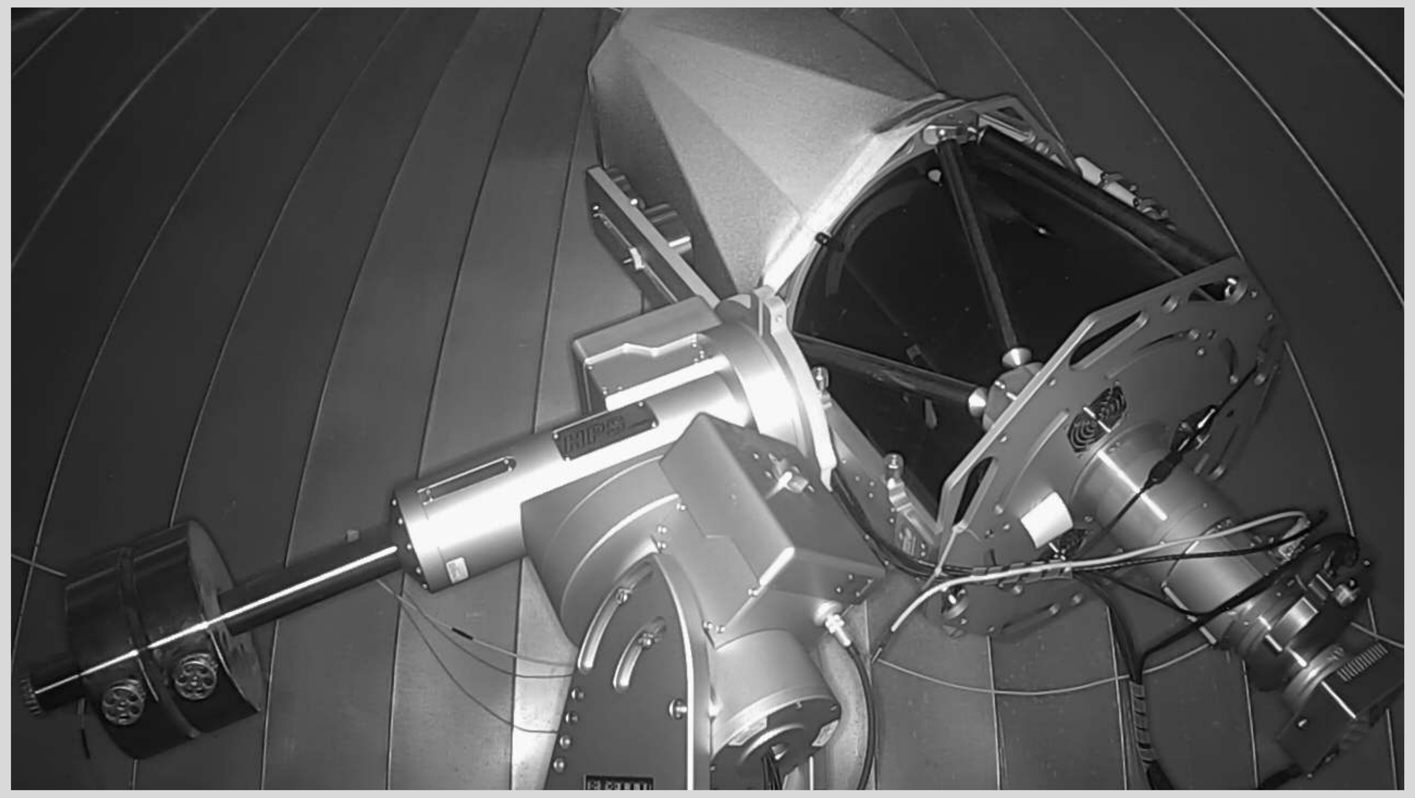

Fig. 3: 16” telescope (G01) in operation during night