A Light Pollution Laboratory Exercise for Introductory Astronomy Students

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Abstract Light pollution is a problem for many professional and amateur astronomers. Although simple measures can be taken to provide light at night without polluting the sky, many are uneducated about lighting options. The laboratory exercise presented here covers the principal issues involved in light pollution. In addition to learning about light pollution, students learn about the nature of light emission from both terrestrial and celestial objects.

1. Introduction

Light pollution is a major problem for both professional and amateur astronomers. In recent years outdoor lighting has proliferated due to a public perception that more light at night equates with increased safety. Unfortunately, much of the outdoor lighting used is unshielded and inefficient, thus contributing to light pollution. Many people choose to use unshielded outdoor lighting due to a lack of education about light pollution.

Discussions with students and public visitors to area planetaria and observatories indicate that most people are unaware of the issues pertaining to light pollution. In order to educate students about light pollution a laboratory exercise has been developed to investigate issues related to light pollution. This exercise has been developed over the last several years at the University of North Texas and at Richland College.

2. Laboratory exercise

The laboratory exercise begins with an interactive slide show featuring slides showing the effects of light pollution as well as examples of well-shielded lighting. The basis of this slide show is the light pollution slide set produced by the Astronomical Society of the Pacific (available from the ASP or from Sky Publishing). The basic slide set is augmented with slides of local outdoor lighting.

Following the slide show, students complete an exercise involving calculations of sample electric bills for areas on campus lit by shielded and non-shielded lighting. This exercise illustrates the economic advantages of properly-shielded lighting.

Students next study emission light sources using spectroscopes. After sketching the spectra of several gases commonly used in outdoor lights or found in celestial sources, students go outside with hand-held spectroscopes to analyze lights on or near the campus. Then, students look through telescopes at several celestial objects with and without a commonly available light pollution filter sold to many amateur astronomers. By noting which objects have better contrast using the filter, students can learn which objects emit light primarily in the bandpass region of the filter.

Finally, students are asked to drive around the city during the following week to look at what locations have shielded lights and unshielded lights. Students are also asked to observe what areas appear to have the most even lighting.

3. Conclusions

Most students complete the laboratory exercise with the feeling that they have learned a lot about light and light pollution. Many students have indicated that they believe that this laboratory exercise is one of the most interesting and useful laboratories of the semester. It is hoped that these students will remember the issues involved with light pollution long after the class when they have occasion to have an influence on a decision to install outdoor lighting. Light pollution cannot be combated effectively if the public is not even aware of its existence.