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Release of the WSO–UV Software tools to attend the call for the Core Scientific Program.

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Abstract

In October 2018 there will be a fist call for the Core Scientific Program to the WSO–UV observatory. In order to attend the needs of the appliers to that call, we present a set of tools including a simulator for the instrumentation of the mission (WSO–UV Simulator) and an Exposure Time Calculator (ETC). The WSO–UV space observatory, to be launched in 2023, will provide with slitless, long-slit and echelle spectroscopy with the WSO–UV Spectrographs (WUVS) and high resolution images and low resolution spectra with the Field Camera Unit (FCU). The Core Scientific Program of the WSO–UV observatory will include the key scientific research projects driving the development of the mission. In order to guarantee that possible preparatory observations are carried out on due time before launch, the first call to the core program will be open 4 years before the launch. We developed a set of tools to support the astronomers attending this call and made them available through the Remote Proposal System (RPS) web site.

1 Introduction

The World Space Observatory – Ultraviolet (WSO–UV) [4] scientific payload consists of a 170 cm primary space telescope, equipped with instrumentation for imaging and ultraviolet spectroscopy in the 115 to 315 nm range. The WSO–UV will be placed in geosynchronous orbit in 2023 by a Proton launcher becoming the first 2-m class ultraviolet observatory flown into High Earth Orbit (HEO). The telescope feeds two main instruments: WUVS for long-slit and echelle spectroscopy and the FCU for imaging and slitless spectroscopy. WUVS includes two high resolution echelle spectrographs to observe point sources in far UV (VUVES, working in the range 115-175 nm, $R \approx 50,000$) and near UV (UVES, working in the range 175-310 nm, $R \approx 50,000$) and the Long-Slit Spectrograph (LSS, $R \approx 1,000$; range 115-310 nm). FCU includes a far UV channel (115-176 nm) based on CsI Micro Channel Plate (MCP) detector

with a Complementary Metal-Oxide-Semiconductor (CMOS) readout and a near UV channel (115-1,000 nm) with a cooled Charge Coupled Device (CCD).

In October 8th, 2018 will be opened the Call for Proposals for the WSO–UV Core Program; This is a special call for scientific projects requiring preparatory observations. In order to support the users attending this call, we have developed a set of tools to ease the preparation of proposals to the Call. This tools, accesible via the Remote Proposal System web site (https://wsorps.ucm.es), include the WSO Simulator and the Exposure Time Calculator.

2 WSO–UV Software tools

In the following sections 2.1, 2.2 and 2.3 it is briefly described the available tools for any user willing to submit a proposal to the WSO–UV Scientific Core Program requiring preparatory observations.

2.1 Remote Proposal System

The web interface to the Remote Proposal System (see Fig. 1) provides access to proposals submission, but also provides with some tools to generate these proposals. The RPS requires login to the system in order to add a proposal, including information of the Principal Investigator (PI) and co-investigators (CoIs). Once the abstract, list of observations and justification files have been submitted, a PDF file is generated with the information of the proposal, and sent to PI, CoIs and WSO–UV Time Allocation Committee (TAC).

2.2 WSO–UV Simulator

This section provides a brief summary of the information on the overall characteristics of the simulator built to pre-evaluate the performance of WSO–UV instruments. The WSO Simulator allows to evaluate the instrumental performance of the instruments in terms of noise source response, data quality, and number of counts detected for different types of configurations and observing parameters. Although the WSO Simulator provides with the scientific data outcome of each of the channels of WUVS and FCU, the LITE version of the simulator accessible via RPS web site only generates images for the FCU instrument. The full version of the simulator will be made available for the WSO–UV Spectrographs (WUVS) in a near future.

The WSO–UV Simulator (WSOSim) has been implemented as a further development of the PLATO Simulator (PLATOSim) [1]. PLATO is a medium-class space mission approved by the European Space Agency, aimed to find and study extrasolar planetary systems with emphasis on the properties of Earth-like planets in the habitable zone around solar-like stars [3]. PLATOSim is an end-to-end software tool developed at the Institute for Astronomy at KU Leuven for the validation of the noise level requirements of the PLATO mission. This software tool has been designed to be easily adaptable to similar types of missions [2],

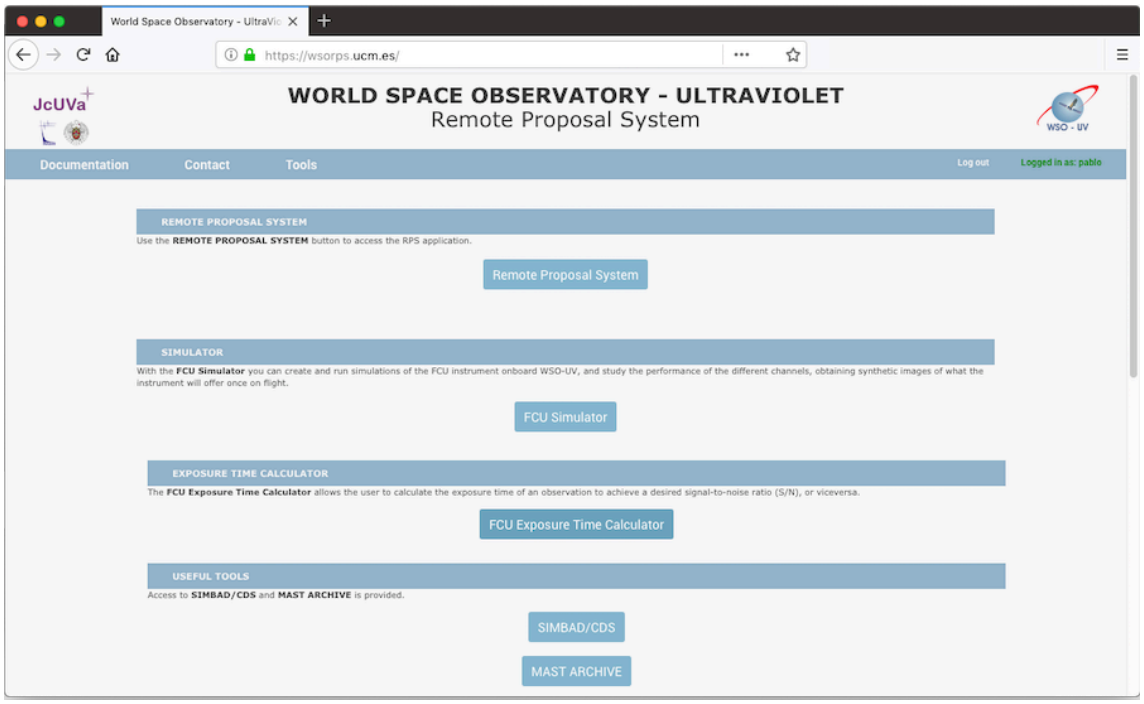

Figure 1: Caption of the WSO–UV Remote Proposal System and its available tools.

and probe of this is that has been employed in both PLATO and WSO–UV Simulators. PLATOSim is open source and available at the PLATO Simulator web site.

The WSO–UV Simulator is open source and have been developed in C++ programming language to be used under Linux platforms. WSOSim generates sets of realistic images of the foreseen observations by including models of the detector and its electronics, the telescope optics, the stellar field, the jitter movements of the spacecraft, exposure time, number of images and all important natural noise sources. Inputs to WSOSim are the equatorial coordinates of the astronomical sources in the field of view, their magnitudes, and the characteristics of the optics and detection chain. WSOSim output includes time-series of the instrument observation and the photometric analysis of the sources in the generated images, their magnitude, and an estimate of the noise level.

The full version of the simulator is accessible via command line, although there is a work in progress to develop a web interface devoted to ease the modification of the input parameters. The complete functionality of the simulator is mainly intended to be used by the WSO–UV Science Control Center and Instrument Team.

2.3 Exposure Time Calculator

For a certain observation, the ETC web interface provides with estimations of the signal to noise ratio or exposure time (in seconds) for the two channels of the FCU. This software tool takes as input the available filters for each channel and the spectral energy distribution

(SED) of the selected source. The SED can be given as a flat continuum, a black body, a spectral line, a Kurucz model or an uploaded spectral file. Further details on the usage of the ETC can be found on the documentation available in the dedicated page at the RPS web site. The ETC for the WUVS instrument in under development.

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References

[1] Marcos-Arenal, P., Zima, W., De Ridder, J., Aerts, C., Huygen, R., Samadi, R., Green, J., Piotto, G., Salmon, S., Catala, C. & Rauer, H. 2014, Astronomy & Astrophysics, 566, A92

[2] Marcos-Arenal, P., Zima, W., De Ridder, J., Huygen, R., Aerts, C. 2014, Space Research Review, 2, 19

[3] Rauer, H., Catala, C., Aerts, C., et al. 2014, Experimental Astronomy, 38, 249

[4] Shustov, B., de Castro, A. I. Gómez, Sachkov, M., Vallejo, J. C., Marcos-Arenal, P., Kanev, E., Savanov, I., Shugarov, A., Sichevskii, S. 2018, Astrophys Space Sci, 363, 62