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The US NGO GMOS Data Reduction Cookbook: Version 2.0

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The twin Gemini Multi-Object Spectrographs (GMOS) are among the most subscribed capabilities at the International Gemini Observatory. In 2016, the National Gemini Office (NGO) released the first version of the GMOS data reduction cookbook to guide users in GMOS data reduction with the Gemini IRAF routines. The cookbook included an introduction to the instrument and its observing modes, a description of specific data structure, and detailed instructions for data reduction for the individual GMOS modes, with examples and tutorials.

In the future the majority of GMOS Gemini data will likely be reduced with the Python-based DRAGONS routines that are already available for Imaging mode and are under development for all GMOS modes. In the interim, users rely on IRAF/PyRAF to reduce their GMOS data.

We analyzed the needs of the users and realized that there was a great deal of interest in a guide to GMOS data reduction with IRAF/PyRAF, as seen in the volume of traffic directed to the GMOS Data Reduction Cookbook web page through the US NGO Portal (Figure 1). The US NGO therefore made it a priority to revise and maintain user access to GMOS data reduction with IRAF/PyRAF by updating the cookbook.

The new version (v2.0) of the cookbook is now available online. All parts of the document have been updated and for all of the GMOS modes — Imaging, Long Slit Spectra, Long Slit Nod and Shuffle, Multi-Object Spectra, and IFU Spectral Images.

The GMOS cookbook improvement and modernization process has been multipronged. The cookbook has a new

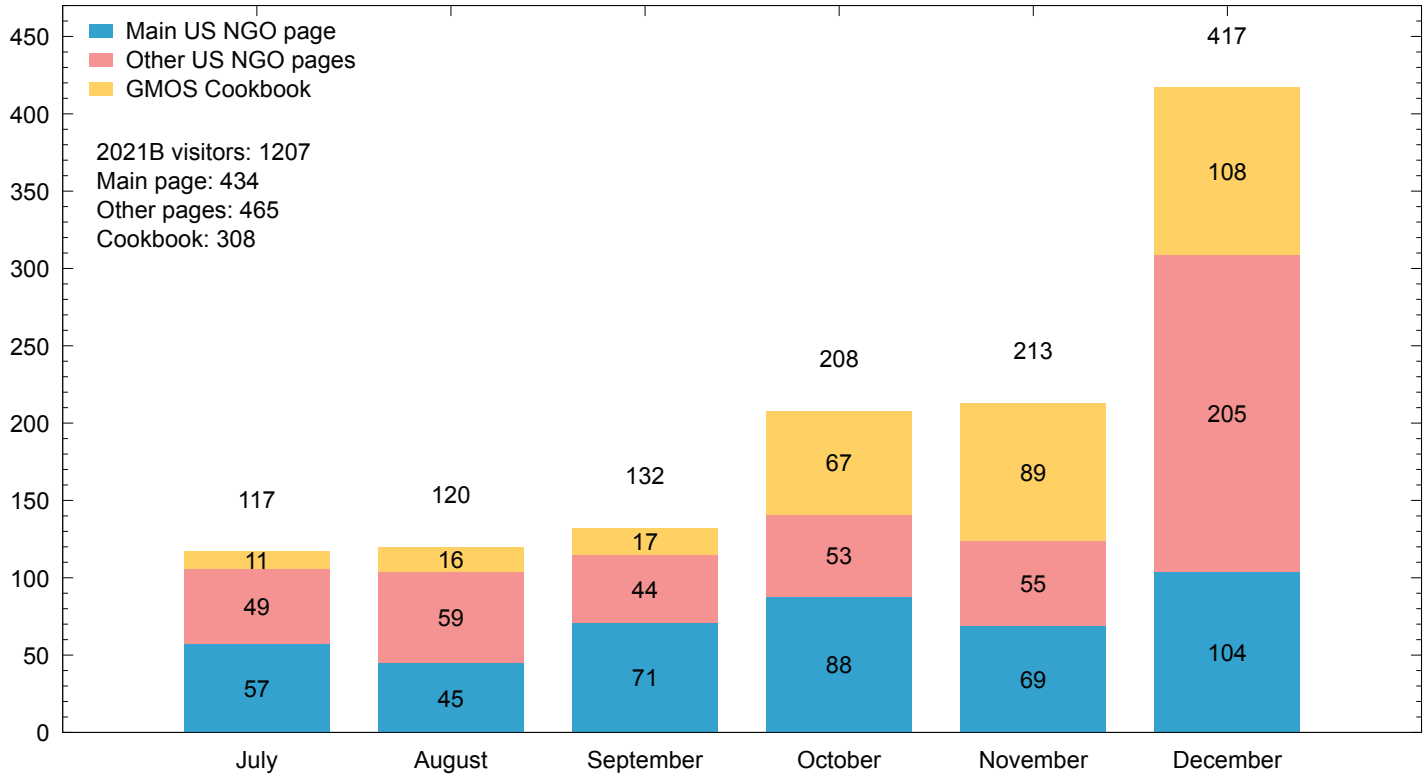

Figure 1. The number of unique visitors to the US NGO Portal during Semester 2021B, by month. The block colors refer to specific sections of the Portal. The GMOS Cookbook in particular has seen a great deal of traffic. The Portal is accessed by the entire Gemini community. *Credit: US National Gemini Office*

look, a new address, and updated processing tutorials. We have completed the following revision steps:

(1) *We revised the five existing PyRAF processing cookbooks (i.e., the cookbooks for the individual GMOS modes) by verifying that the code is compliant with the latest software provided by the observatory (including native astroconda installation and version 6.1.28 of the virtual machine with the Gemini IRAF packages).*

(2) *We moved the cookbook to a GitLab repository, allowing for version control and real-time collaboration.*

(3) *We improved the overall clarity.*

The GMOS cookbook consists of a general section describing the instrument (including its observing modes, the data properties, and general reduction issues) and five individual PyRAF tutorials.

The tutorial modernization portion of the project involved analyzing the existing documentation for the five PyRAF processing tutorials to correct errors and determine areas that could benefit from further explanation. For example, code was added to help users reproduce the outputs featured in the tutorials (Figure 2). The improvement portion of the project involved verifying that every line of code listed in the individual mode cookbooks would run without crashing, solving any line order issues in the code, and correcting

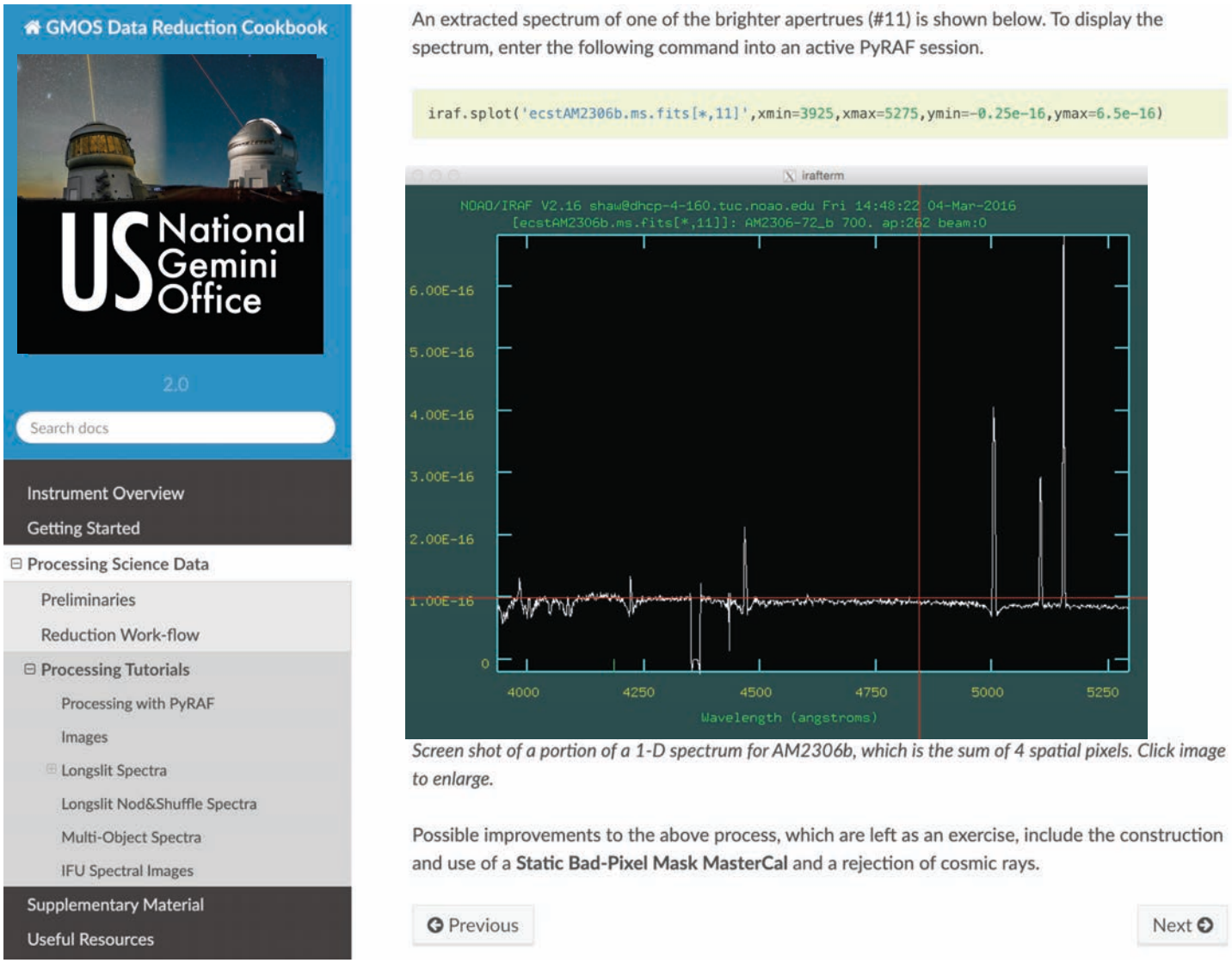

Figure 2. An example of code added to the Reduction of Long-Slit Spectra with PyRAF that users can use to verify that they have successfully reduced their data. *Credit: US National Gemini Office*

punctuation to avoid errors. We added informative and warning boxes as appropriate throughout the tutorials.

We also corrected grammatical errors and punctuation. Broken links that resulted from the retirement of the noao.edu domain were updated. Any updates to the pages and changes to the code are automatically published on the new website.

We revised the cookbook's text to improve the overall clarity of the instructions and added informative notes. We inserted a box on the main cookbook web page with information on the v2.0 release and a link to the "Getting Started" section, which in turn has been updated with the latest software instructions. We added a prominent box in this section, with software installation procedure links for all available products (astroconda/PyRAF and the Gemini Virtual Machine). We corrected the broken links and updated the instructions and references to bring the cookbook up to date. We also revised the supplemental materials and resources.

We plan to keep abreast of any software issues and changes and revise the cookbook periodically so users can have a seamless experience when reducing their GMOS data.

The US NGO welcomes suggestions from the GMOS user community! Please contact us at usngo@noirlab.edu or via our Twitter account. Visit our Users Support Portal for information on the US NGO and links to important information on our activities.

A view of the partial lunar eclipse of 19 November 2021 as seen from Kitt Peak National Observatory. This image captures the eclipse above the Nicholas U. Mayall 4-meter Telescope in the Arizona-Sonoran Desert of Arizona and despite being dimmed in the eclipse, the Moon still brightens the dome of the Mayall telescope with a red glow. *Credit: KPNO/NOIRLab/NSF/AURA/R. T. Sparks*

Gemini South, one half of the International Gemini Observatory, is seen here with its laser guide star in action. Both of the Gemini telescopes use laser guide stars to provide data for the calibration of their adaptive optics systems. *Credit: International Gemini Observatory/NOIRLab/ NSF/AURA/T. Slovinský*