Press Release

Max-Planck-Institut für extraterrestrische Physik

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View of the night sky with more than 250 eyes

New observing instrument ready for installation

End of May, the VIRUS-W spectrograph of the Max Planck Institute for Extraterrestrial Physics and the University Observatory Munich was completed and is now ready for installation at the McDonald observatory in Texas. Its field of view, spectral coverage and resolution makes the instrument ideally suited to study star and gas motions in nearby spiral galaxies.

Images of astronomical objects are not only beautiful and impressive but also an important source of information for astronomers. In addition to imaging cameras, scientists also use instruments called spectrographs, which disperse light into its constituent colours. The spectra obtained in this fashion help to determine for example the chemical composition of stars and gas or their velocities.

The VIRUS-W spectrograph was specifically designed to observe nearby spiral galaxies. Its relatively large field of view combined with a high spectral resolution makes it ideally suited for this purpose. Operated in the high resolution mode, it will allow scientists to study the bulk motion of stars in spiral galaxies down to velocity dispersions (σ) of only about 20 km/s. The second, medium resolution mode was developed for studying the chemical composition of galaxies. The field of view of the spectrograph will be about 150x75 arcseconds, which means that the kinematically very interesting central regions of spiral galaxies can be studied in just one or two exposures. Depending on its apparent brightness and size on the sky, a galaxy can then be observed in just a few hours.

The actual spectrograph is mounted on an optical bench – basically a table – and is connected to the telescope with a fibre optic cable. From the focal plane of the telescope the light is guided through 267 glass fibres, with 150 micrometres inner diameter, to the optical components, which disperse the light into the different wavelengths. The main elements of the spectrograph are two holographic gratings, which can be swapped as necessary. Holographic gratings are particularly efficient and produce only a very small fraction of stray light.

“This bench mounting makes the instrument very robust; the direction, in which the telescope is pointing for an observation, has no influence on the measurement,” explains Maximilian Fabricius, who developed and built VIRUS-W for the most part. “After all, we are talking of about 500 kilograms that you would need to manoeuvre for each new pointing of the telescope.” Ensuring mechanical and optical stability is a big challenge for instruments directly mounted on the telescope.

In addition, with this mounting the spectrograph can be fitted to other telescopes much more easily. “Since VIRUS-W is connected with the telescope simply with optical fibres, for each new telescope only the relatively small end piece of the fibre bundle has to be adapted,” says Fabricius. This makes VIRUS-W a mobile instrument; further observations are planned with the

MDM observatory at Kitt Peak in Arizona and the future 2.1-metre Fraunhofer telescope on the Wendelstein mountain in Bavaria.

“One of the advantages of modern 2m-class telescopes is the feasibility of long observation runs,” says Niv Drory, who is studying galaxy formation and evolution in various projects. “While on an 8m or 10m-class telescope you get typically only a few nights of observing time, on a 2m-class telescope a project might get several dozen nights of observing time per year. Moreover, smaller telescopes have a larger field of view, which in our case is an added bonus.” The large field of view and high resolution of VIRUS-W therefore opens a new window onto the exploration of star and gas kinematics in nearby galaxies, shedding light on their evolutionary history.

VIRUS-W is the refined version of a similar instrument being developed for an ambitious survey at the 9.2-metre Hobby-Eberly Telescope of the McDonald observatory in Texas. The VIRUS instrument, which will consist of some 150 individual spectrographs, will blindly survey 420 square degrees of the whole sky (about 1000 times the size of the moon) over the course of three years starting in 2012. A prototype of these spectrographs, VIRUS-P, is operating at the smaller 2.7-meter Harlan J. Smith telescope of the McDonald observatory since 2007. In a pilot survey of local spiral galaxies over 30 nights, this prototype impressively demonstrated the capabilities of this instrument. With its relatively low spectral resolution, however, VIRUS-P is not suitable to study stellar motions – or kinematics – in spiral galaxies.

The first observations with VIRUS-W at the Harlan J. Smith telescope in West Texas are planned for the end of June. Apart from studies of spiral galaxies by the scientists at the Max Planck Institute for Extraterrestrial Physics and the University Observatory, other research groups can then apply for using the instrument as well.

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Images

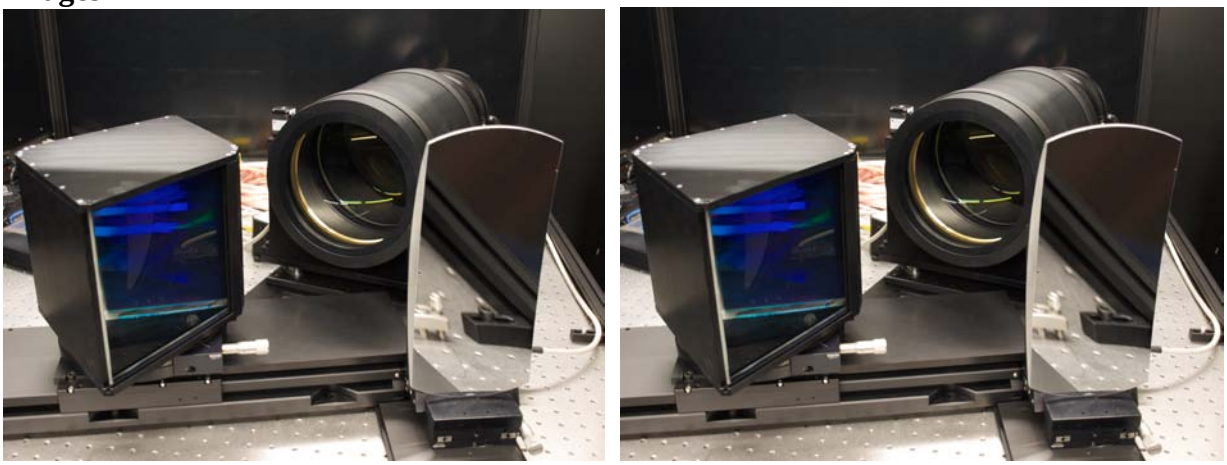

Fig. 1: The VIRUS-W spectrograph on the optical bench from two different perspectives. The light from the optical fibres first shines onto the (curved) collimator mirror and is then reflected onto the high resolution grating (in the angular black box; the low resolution grating has not yet been installed). The dispersed light spectrum is then recorded with the cooled CCD-camera (in the round casing).
Image: M. Fabricius, Max Planck Institute for Extraterrestrial Physics/University Observatory Munich

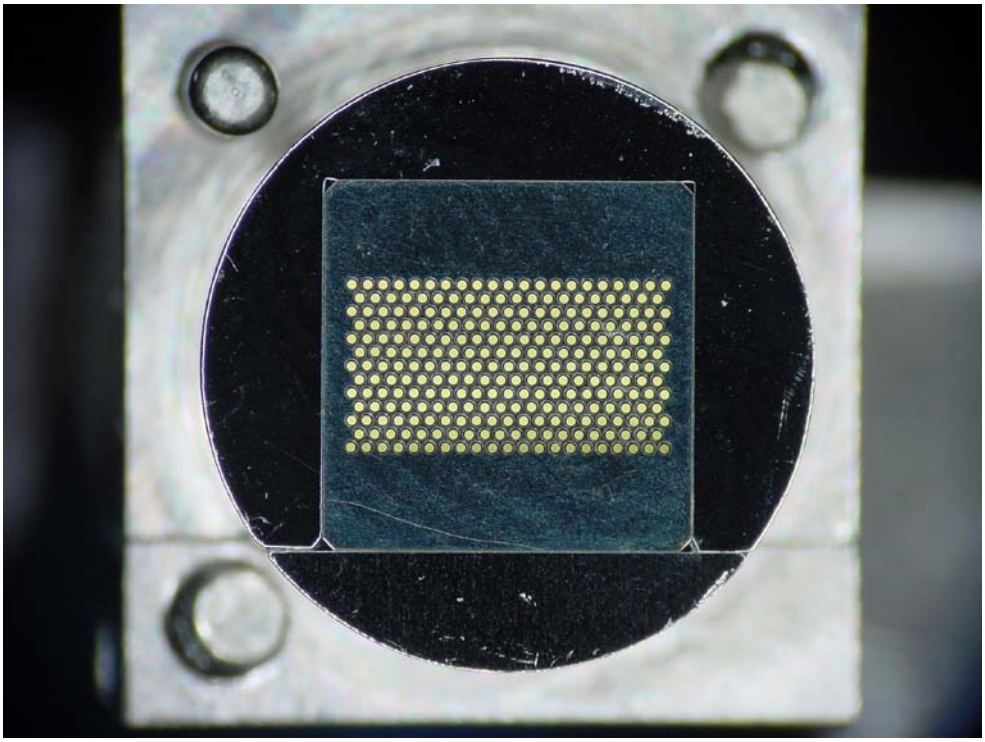

Fig. 2: Assembly of the optical fibres of VIRUS-W in the focal plane of the telescope.
Image: M. Fabricius, Max Planck Institute for Extraterrestrial Physics/University Observatory Munich

MPE web pages: http://www.mpe.mpg.de/main.html