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New Spectroheliograph at Manila Observatory

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A combination solar spectroheliograph and spectrograph, newly installed in the Philippines at 8-h East longitude is described. The rotatable vacuum spectrograph follows an Ebert design, consisting of a plane grating and two mirrors. These off-axis mirrors are figured sections of one single mirror form and function as collimating and camera mirrors. The spectrograph system matches the $f/24$ Gregorian-type telescopic quartz mirror system of 30.5-cm clear aperture, fed by 41-cm coelostat mirrors. The grating drive is wholly within the tank. Spectroheliograph scans are with fixed slits but with a moving image and moving plate or filmholder. Slit jaws are of stainless steel and form slits 76 mm long. Dispersion is 2.75 Å/mm in the first order. An 8.3-cm × 10.8-cm plateholder receives the spectrogram or spectroheliogram image. Visual monitoring and 35-mm photographs of the solar image at the entrance slit are made through an Hα Halle monochromator. A typical spectrogram and spectroheliogram are shown.

The Manila Observatory has recently set into operation a solar research instrument, located on the campus of the Ateneo de Manila University, at 121°04′15″ East longitude and and 14°38′40″ North latitude. This is a solar telescope, with spectrograph and spectroheliograph attachments and of vertical design in order to bring the light normally through the stratified air, with the least distortion. Figure 1 is a scale drawing of the principal parts of the installation without the coelostat and telescope secondaries. All optics, external to the spectroheliograph proper, are of fused quartz. Quartz gives a minimum of distortion from the heating of the solar rays. Figure 2 is a photograph of the secondary mirrors of the telescope.

A set of 41-cm coelostat mirrors feeds the 30.5-cm clear aperture telescope, which is an off-axis parabolic Gregorian system, with alternative secondaries. One mirror 203 mm and another 76 mm in diam form a 70-mm and a 210-mm image, respectively, at the entrance slit of the spectrograph. There part of the light beam goes through the slit formed by stainless steel slit jaws. Only one each of the jaws of the entrance slit and of the exit slit is adjustable by a micrometer screw. The micrometer adjustments are on opposite sides of the center line, because of image reversal at the exit slit. There are focusing and rotational adjustments for both the entrance and exit slits. The jaws which can be adjusted for parallelism run in spring-loaded ball bearing races. The circle of confusion introduced by the curved field of the Gregorian system is well below the 1 sec of arc seeing disk which obtains under best local atmospheric conditions.

A field lens, to image the secondary of the telescopic system into the grating, serves as the seal for the vacuum tank, at the entrance slit. An identical quartz lens is the seal just before the exit slit and counteracts the magnifying action of the entrance lens. Two off-axis 28-cm parabolic mirrors, with a common axis, form the collimating and camera mirrors at the bottom of the spectrograph tank. The grating is a plane replica, 152 mm × 203 mm, from Bausch & Lomb, with 600 lines per mm and a tested resolution in the first order of 105,000. The grating has 120,000 lines. A tank-shaped design was chosen for the spectrograph, because of its intrinsic torsional stability. Walls are of 8-mm thick steel plates. It was decided to evacuate the tank, because of the superior resolution obtained from optics in a vacuum, and especially to protect the grating from the deleterious effects of fungus.

The tank has been provided with suitable ports and an inner ladder. A 2-hp(1500 W) motor and a rotary piston vacuum pump, capable of reducing from atmospheric pressure to a few mm of mercury pressure in 20 min, are attached to the side of the tank. Normally, the tank is kept at between 5 mm and 10 mm of pressure. The pump is equipped with an oil flow solenoid for automatically shutting off the line, in case a power shutoff would allow oil otherwise to be drawn into the vacuum tank. In order to obviate the need for the many mirror surfaces of an image rotator, the whole tank is rotatable on a centering bearing and a series of roller bearings. The tank is further supported by three positioning rollers, attached to a heavy iron ring, placed on the second-floor level of the encircling solar building. It was not felt advisable to sink the tank into a pit.

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