Observational programme of the August 11, 1999 total solar eclipse

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Abstract. In this paper a programme for observation of the total solar eclipse of August 11, 1999 is presented.

Key words: solar eclipse – observational programme

1. Participating Institutions

The Belgrade observational programme for the total solar eclipse of August 11, 1999 will be supported by (preliminary list):

Astronomical Observatory, Belgrade, Volgina 7, Yugoslavia,
Astronomical Observatory, Timisoara, Piata Axente Sever 1, Romania,
INFIZ–Institute of Physics, Zemun, Pregrevica 118, Yugoslavia,
Institute of Physics, Zemun, Pregrevica 118, Yugoslavia,
Faculty of Physics, Belgrade, Studenski trg 16, Yugoslavia,
Institute of Physics, Novi Sad, Trg D. Obradovića 3, Yugoslavia,
Institute of Mathematics, Belgrade, Knez Mihajlova 35, Yugoslavia,
Faculty of Mathematics, Belgrade, Studenski trg 16, Yugoslavia,
Federal Hydrometeorological Institute, Belgrade, Birčaninova 6, Yugoslavia,
Public Observatory, Belgrade, Gornji grad 16, Kalemegdan, Yugoslavia,
Petnica Science Center, Valjevo, P.B. 40, Yugoslavia.

2. Experiments, goals and equipments

The observational programme of the eclipse of August 11, 1999 will consist of the following experiments:

1. Photographic observation of the partial phases of the eclipse. Based on the measured relative positions of the lunar and solar disks during the partial phases of the eclipse, the longitude correction of the Sun and the Moon, as well as the correction of dynamic time scale can be determined. These data are useful for the investigation of the variation of the Earth rotation and determiming the solar diameter. For this experiment we prepared a portable altazimuth refracting telescope (~10 cm aperture, ~1 m focal length) and a camera for the photography of partial phases of the eclipse. The camera and a chronograph will be connected to a recorder, to log the time of exposure. The same or similar equipment could be used for the photographic observation of coronal polarization during the totality phase *(Experiment 7)*, by adding a rotating polarization filter (with three or more fixed angular positions) to the photographic camera.

2. CCD observation of the partial phases of the eclipse. The aim of the CCD observations of the partial phases of the eclipse is the same as in *Experiment 1*. We plan to prepare a portable refracting telescope ($\sim$6 cm aperture, $\sim$0.5 m focal length) for CCD observations of the partial phases of the eclipse. For this purpose the Santa Barbara ST-6 and ST-8 CCD cameras will be used with different broad-band and interference filters.

3. Flash spectrum observations around the Balmer jump. From the variations of the Balmer jump and of the continuum emission coefficient in the solar chromosphere depending on height, the electron density and temperature variations will be determined in relation with height. For the Balmer jump observation a portable slitless spectrograph (grating with 150 lines/mm) is in preparation. We plan to take spectra with a 30-50 Hz cadence during the flash spectrum. To achieve this, we will purchase or rent a fast CCD or Reticon camera and a fast PCI bus frame grabber will be used. A standard light source will be used for the calibration of the spectra. The calibration of the spectrograph will be performed by observing a terrestrial source. The design of the spectrograph tube and the grating orientation during the second and third contact have already been developed.

4. Flash spectrum observations around the H_8 (λ388.905 nm) and He λ388.865 nm lines. Using high resolution (R$\geq 5 \times 10^4$) flash spectra of H_8 and He lines obtained with a high speed camera, the relative abundance of He to H in spicules will be determined. From this part of the spectrum (using a suitable pair of lines) the height of the beginning of the FIP (First Ionization Potential) effect could also be determined. For the flash spectrum observations around the H_8 (λ388.905 nm) and He λ388.865 nm lines, we will use a Czerny-Turner spectrograph (grating of 1200 lines/mm) with an equipment similar to that described in *Experiment 3*, or a photocounting device. The use of a Fabry-Perot interferometer as a dispersing element is also under consideration. For solar tracking we plan to purchase (or borrow) a siderostat or coelostat. The other obvious option is to use a portable refracting telescope ($\sim$25 cm aperture, $\sim$2 m focal length) and a fiber optic to feed the sunlight to the fixed spectrometer.

5. Flash spectrum observations around the MnI λ 539.47 nm line. From high resolution (R=10^5) spectroscopic observations (with a high speed camera) of the transition from the photospheric spectrum to the chromospheric one around the MnI λ 539.47 nm spectral line, the existence and relative intensity of this line's chromospheric component will be determined. Namely, this photospheric line shows an unusually high variation that is correlated with the solar activity cycle. In order to explain this behaviour of the MnI line, we introduced several hypotheses. One of them is that the observed variation of photospheric absorption line is caused by the variation of the chromospheric emission component. This experiment will test this hypothesis. For the flash spectrum observations around the MnI λ 539.47 nm line, an equipment like the one in *Experiment 4* will be prepared.

6. High resolution spectrometry of the solar limb. It is planed to observe the transition of the photospheric into chromospheric spectrum in order to obtain the changes of line profile of Na D_1 or D_2 line with high spectroscopic and time resolution. The aim of this experiment is to examine the behaviour of the absorption lines at second and third contact. For observation we will use a portable refracting telescope (Meade, 25 cm aperture, 2 m focal length). Sunlight will be fed to a Fabry-Perot interferometer by means of a fiber optic cable.

7. Photographic observations of the linear polarization in the inner solar corona. Using a photographic technique, the two-dimensional distribution of the degree and angle of the linear polarization in the corona will be determined. The electron density and its spatial distribution in the corona will derive from these observations. For observations of coronal polarization, a photographic camera with a rotating polaroid attached to an altazimuth refractor (f=85 cm, D=6 cm) has been prepared. Testing of the camera on the Moon is in preparation.

8. CCD polarimetric observation of the corona with low angular resolution. The aim of the low angular resolution polarimetric observation is to find the integrated polarization of the corona. These data, together with similar data obtained during previous solar eclipses, will be used to investigate of the correlation between the integrated polarization of the corona and the phase of solar activity. We will use a small portable altazimuth refractor telescope ($\sim$6 cm lens diameter, $\sim$43 cm focal length) for the observations of the integral polarization of the corona with the CCD camera. The camera will be tested in lunar observations.

9. White-light photography of the solar corona. The aim of this experiment to participate in an international programme for monintoring the coronal transients along the totality path. For observations portable Maksutov cameras (62 cm lens diameter, 50 cm focal length) will be used.

10. CCD or photographic observations of the solar corona in H_α line. The purpose of this experiment is to search for H_α structures in the solar corona. The observations will be done by using H_α filter having the passband between 0.3 nm and 0.5 nm. The corona up to about two solar radii above the limb will be recorded photographically and with a CCD camera.

11. Determination of the limb-darkening parameters. By comparison of theoretical and observed integral intensity variations during the partial phases, the limb-darkening parameters will be determined. For observations equipment similar to that in *Experiments 1 and 2* will be used.

12. High spatial resolution radio observations of the Sun during the partial phases of the eclipse. Using the occultation method, a high angular resolution radio map of the corresponding part of solar disk will be obtained. From this the fine structure of radio emission will be studied. For high spatial resolution radio observations of the Sun during the partial phases of the eclipse, the old solar radiotelescope system (three dishes) of the Belgrade Astronomical Observatory will be repaired and brought back in the operation.

13. Investigation of solar and terrestrial radiation. The monitoring of solar short wavelength and terrestrial long wavelength radiation, as well as the atmospheric pressure, temperature and humidity, before, during and after the solar eclipse by automatic devices, will provide information about the behaviour of basic meteorological parameters under the influence of the solar radiation.

14. Radio diagnostics of the ionosphere during the totality of the eclipse. The measurement of phase and amplitude of radio waves in the VLF range during the totality of the eclipse will be attempted.

15. Determination of Na abundance in the lunar atmosphere. The equipment used in *Experiment 6* will be employed during the partial phase of eclipse for high spectral resolution observation of Na D_1 or D_2 line profile in order to determine the Na abundance in the lunar atmosphere. Observations very near to the lunar limb will be used for getting simultanously the lunar and solar Na line profile, while from observations further from it will provide the solar comparison Na line profile.

3. Locations

We intend to observe the solar eclipse at following locations (the geographical longitude (l) and latitude (b) of observational sites and experiments are introduced as well):

1. Szombathely, Hungary, (l=16° 10′, b=47° 15′), exps: 1, 2, 9.
2. Kiskunhalas, Hungary, (l=19° 45′, b=46° 30′), exps: 1, 2, 7, 8, 9, 10, 11.
3. Belgrade, Yugoslavia, (l=19° 45′, b=46° 30′), exps: 1, 2, 11, 12, 15.
4. Djala, Yugoslavia, (l=20° 15′, b=46° 10′), all experiments.
5. Timisoara, Romania, (l=16° 10′, b=47° 15′), exps: 1, 3, 9.
6. Kamen Brjag, Bulgaria, (l=27° 55′, b=43° 15′), exps: 1, 2, 3, 7, 8, 9, 10, 11.

In Yugoslavia an observational camp will be organized at village Djala for professional and amateur astronomers.

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