19. THE USE OF THE ELECTRONIC COMPUTER FOR THE URGENT PUBLICATION OF ASTRONOMICAL MATERIAL

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Abstract. A system is described for processing scientific information with automatic type-setting of tabular text.

Modern astronomy would be very different if it were not for electronic computers. Automatic programming methods, universal algorithmic languages, and the wide availability of electronic computers have simplified as much as possible the process of preparing a programme for a particular problem and carrying out the necessary calculations. Electronic computers are used to provide ephemerides for the members of the solar system, to study the orbital evolution of comets, minor planets, and meteor streams over time spans of centuries and more, etc.

After solving such problems it is necessary to present the results in printed form to observers and research workers. However, a considerable time elapses between completion of the calculations and publication of the results, mainly on account of the type-setting that is necessary. Monotype and linotype equipment also have the drawback that preparation of the punched paper tape that carries type-setting information requires visual inspection of the original text, and errors inevitably appear.

Modern technology makes it possible to set information in type directly from the computers. However, malfunctions in the computer or computer-controlled typewriter can result in errors. Proofreading is still necessary, and considering the great amount of data in such annual publications as *Astronomicheskij Ezhegodnik* and *Efemeridy Malykh Planet*, this is a laborious and time-consuming job.

This is why it is impossible in practice to print urgent information, such as ephemerides or lists of observations of newly discovered bodies at the time it is needed.

At the Computing Centre of the Institute for Theoretical Astronomy we have developed a system for processing scientific information with automatic type-setting of tabular text.

The system comprises the following:

(1) The BESM-4 electronic computer with 8192 words (of 45 bits) of highspeed access memory, 16 384 × 8 words of buffer memory on magnetic drums, and 2 000 000 words of buffer memory on magnetic tapes;

(2) an electronic 'conversion' unit;

(3) monotype type-setting equipment, with controlled programme. Additional memory on magnetic discs may also be incorporated.

The initial information is introduced into the electronic computer in some standard way, i.e., from punched cards, punched paper tape or magnetic tape, or from another computer. The first function of the computer is to reduce the input information to a form in which it may be fed into the programming system utilized. The second

function is to print out the astronomical results in the normal manner. This print-out is used for any checking we may wish to make of the final printed material.

The third function of the computer is to prepare the output information. This information contains the astronomical results, any additional literal or numerical information that is required, commands for controlling the operation of the type-setting equipment, and it is carried on standard punched paper tape.

The 'conversion' unit is an independent electronic logical system. Input information for this consists of the output information from the main computer and some auxiliary commands. An electronic device controls the reading of this input, and it stops in the case of malfunction or detection of an error.

The preliminary information processing unit then removes the auxiliary commands (which are required only for the reading and checking), and forms and stores the remainder. The information converting unit then converts from the computer code to a special code used by the units that operate the type-setting equipment.

The newly coded information is punched on 31-channel paper tape. It is compared line by line with the input information, and the machine stops if an error is detected. When any necessary corrections have been made the 31-channel tape is used for controlling the operation of the type-setting equipment. Final checking of the pre-liminary print-out from the computer can be made if desired.