

QUINQUECENTENARY OF NICOLAUS COPERNICUS A REPORT

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Talks delivered at the Copernicus celebrations in Poland are briefly reported.
A bibliography with annotations is attached.

The father of the heliocentric system, Nicolaus Copernicus, was born on 19th February 1473 at Torun (Poland). The 500th birth anniversary of this great astronomer was celebrated all over the world last year on national and international level; in fact 1973 was declared the Copernican Year.¹ An Extra-ordinary General Assembly of the International Astronomical Union (IAU) was held on Sept. 4, 1973 at Warsaw in which a commemoration lecture on *the Astronomy and Cosmology of Copernicus* was delivered by Prof. Owen Gingerich, President of the IAU Commission 41 on History of Astronomy.

Prof Gingerich gave a beautiful presentation especially of his findings from his examination of about a hundred copies of Copernicus *De Revolutionibus* which were possessed by renowned astronomers of the sixteenth/seventeenth century, for instance, Erasmus Reinhold, Tycho Brahe and Kepler. As a matter of fact Gingerich is the first to use modern computers to analyse the planetary positions of the years 1503-04. By comparing the calculated planetary positions with those deduced from the Alfonsian tables Gingerich discovered the existence of discrepancies between the Alfonsian predictions and what must have been actually observed at that time. By examining unpublished tables and notes of Copernicus on the year of the great conjunction Gingerich found that Copernicus was "fully aware of the discrepancies between the tables and heavens"². However, according to Gingerich, this calculational "defect in the ancient geocentric astronomy" was not an "adequate ground for introducing a new system" for Copernicus. According to Gingerich's assertion the legend, that the complexities of the Ptolemaic theory of epicycles-on-epicycles, as is commonly assumed, have been the motivation for introducing a simplified system, has been "put to rest by the use of modern electronic computers". Having dwelt on the technicalities of the Copernican astronomy and taking recourse to the evidence as collected by him from the examination of the afore-mentioned annotated copies of Copernicus' book, Gingerich concluded that "it is precisely the neat, orderly and elegant organisation of the heliocentric system that Copernicus found pleasing to the mind and which led to his cosmology". This short summary of Prof Gingerich's main thesis cannot in fact do justice to his exhaustive, lucid and illuminative lecture which was illustrated by about three

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and a half dozen interesting slides. The author hopes very much that this lecture as well as the talks of other speakers (briefly mentioned in the following) will soon be published in volume III of the *Studia Copernicana : Colloquia Copernicana*, published by the Polish Academy of Sciences, Warsaw.

The highlight of the quinquacentenary celebrations was the *Colloquia Copernicana*, held at Toruń (Poland) from Sept 5-12, 1973. These Colloquia were organised by the Polish Academy of Sciences in cooperation with the International Union of History and Philosophy of Science, UNESCO and the IAU. The opening ceremony of the Colloquia took place on Sept 5, 1973 in the Planetarium at Olsztyn (Poland).³ At Toruń,⁴ the scientific programme of the Colloquia was organised in the form of four symposia, namely

- (i) The Astronomy of Copernicus and its Background
- (ii) Man and Cosmos
- (iii) The Reception of the Heliocentric Theory
- (iv) Copernicus and the Development of Exact and Social Sciences.

Symposium I

This Symposium was inaugurated by the Rector of the Copernicus University at Toruń. Speaking in fluent French he welcomed the participants of the Colloquia. In his address he especially mentioned the name of E. Zinner, one of the greatest German astronomers and research workers on Copernicus and regretted that on that day he was no more, the man who by his classic work⁵ initiated a new direction in Copernican researches

The introductory review paper of the first session of this symposium was read by W. Hartner (Director, Institute of History of Science, University of Frankfurt who is considered to be one of the few authorities on medieval European, Islamic and even Chinese astronomy. In his paper, Hartner was concerned mainly with the Islamic antecedents of Copernicus.⁶ He began his talk by a quotation from Abū-Naṣr Ali (Al-Bīrūnī's teacher, eleventh century) about the planetary "elliptical" orbits. According to Hartner, Abū-Naṣr refuted the two natural motions of Aristotle, i.e. the rectilinear (finite) and circular (infinite), and he talked about some kind of ellipses although in ambiguous terms. Hartner wondered why Ibn Al-Haytham and Al-Bīrūnī could not notice the inconsistency of the Ptolemaic lunar theory, since lunar evection could not be explained by the hypothesis of perfect uniformity. In this connection Hartner also mentioned one of his earlier papers in which he discussed similarities of Peurbach's and Al-Zarqali's (Azarquiel's) and Ibn Al-Samh's elliptical motion.⁷ According to him there were many Islamic astronomers who were interested in the idea of elliptical motion, although they did not wish to renounce Aristotle altogether. Hartner then discussed especially the works of Quṭbuddīn, Ibn Shāṭir, and Naṣīruddīn Ṭūsī. Finally he projected two diagrams, one from Copernicus' and the other from Naṣīr Al-Ṭūsī's work, which everyone saw to be identical even in the lettering.⁸ Hartner propounded the thesis

that there should be some mode of transmission of Islamic astronomy to Copernicus, which has yet to be discovered.⁹

The next paper of Miss G. Rosinska (Cracow) on the Islamic Tradition in Cracow was therefore very appropriate. Miss Rosinska is collecting a bibliography of Arab astronomical works which could be extant at that time at the Cracow University and she is also studying the work of Cracow astronomers to look for the reception of Arab astronomy. She is of the opinion that most probably Cracovian (models of) astronomy could be thought of as the link between the Arab and Copernicus' astronomy. According to her preliminary investigation her hypothesis seems to be true for the Lunar Theory.

David A. King (Cairo) presented a short survey of the Islamic Astronomical Tables, which in his opinion are based on complicated trigonometrical formulas. Besides that, King said, that the Muslim astronomers also tried to simplify the use of the planetary equation table based on the Ptolemaic model. Such tables have in fact many many thousands of entries. King suggested that the accuracy of these tables should now be worked out and the achievement of the Arabs should be re-estimated in the light of the new findings.

The last two papers in this session were read by W. Petri (Munich); Earth's rotation in the *Āryabhaṭīya* and by S. N. Sen (Calcutta): Indian Planetary Theories of Ancient and Medieval Times.¹⁰ Prof. Petri pointed out that whereas Āryabhaṭa's rotation of the earth was a part of his geocentric universe, Copernicus coupled it with a heliocentric model. However, heliocentricism was accepted as a reality only since Kepler and Newton in the sixteenth/seventeenth century.

In the second session of this Symposium which was devoted to the Astronomical Traditions of the Middle Ages there were several interesting papers. By examining the various astronomical book (codices) and curricula of the medieval Europe, Prof. Olaf Pedersen (Denmark) classified the principal stages of medieval Latin astronomy as follows: Up to the eleventh century the antique astronomical tradition was continued. Only the contact with the Muslim world created a new interest in astronomical instruments and tables. Later, as various translations of *Almagest* were available, astronomy became quite a respectable subject in the syllabi of the Latin universities and even computational astronomy became a field worthy to be pursued. According to Pedersen the clue to the critique and therefore reform of the ancient astronomy is to be sought in the growing interest in the studies of primary sources and in the humanistic-philosophical trends of the time.¹¹

The philosophical background of Cracow in the fifteenth century was treated very aptly by R. Palacz (Poland), while Z. Horský talked on the role of Neo-platonism. The former emphasized especially the philosophies of Albertus of Brudzewo and of Ibn-Ruṣḥd whose criticism of the Ptolemaic system was particularly well-known to the Cracovian scholars. On the other hand Horský talked about the Neo-platonism of Ficino and Callimachus.

The third session of this Symposium: Copernicus' Astronomy, began with an invited review paper by Prof. E. Rosen (U.S.A.)—the famous translator of "Three Treatises" of Copernicus, who is also editing the works of Copernicus in U.S.A. on *The Achievement of Copernicus*. In his view the greatest contribution of Copernicus was the recognition of the true "position" of our earth in the cosmos, i.e. the realization of the dimensions of our solar system. In fact Copernicus did not seek recognition for himself as father of the heliocentric system, since he quoted Greek sources. It might well be that he was himself not conscious of the far-reaching consequences of his own work.

Another important paper of this session was read by N.M. Swerdlow (Chicago) who spoke about Copernicus' derivation of the Heliocentric Theory, on which Copernicus himself did not say anything at all. Swerdlow put forward the hypothesis that by means of a special transformation, given by Regiomontanus, which Copernicus performed on an eccentric model for the inferior planets, he got his system. This special transformation is very similar to the one which, on being carried out on Regiomontanus' model for superior planets, leads to the model of Tycho Brache. Swerdlow presented several convincing evidences for his thesis, especially a page from the Uppsala notes. On these very notes Dr. J. Dobrzycki (Incharge of the Copernicus Section of the Polish Academy of Sciences) then read a very instructive paper.

Symposium II

This Symposium was organised in cooperation with UNESCO. It was inaugurated by the president of the Polish Academy of Sciences Prof. W. Trzebiatowski and the Deputy-Director General of Unesco Dr. James Harrison. In the morning session the following papers were contributed :

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| B. Suchodolski (Poland) : | Man in Cosmos and Man on Earth |
| T. Araki (Japan) : | Man and Cosmos |
| J. Werle : | Scientific Perspectives of Space Flights |
| L. Siedow : | The Ideas of Copernicus and the Evolution of Mechanics. |

In the afternoon session E. de Gortari spoke on "La logique celeste de Copernicus", S. K. Runcorn on the Physics of Moon followed by a discussion which was initiated by B. Lesnodorski. The various talks were delivered either in French or in English, were more or less of general interest and were of popular nature. The attendance in the spacious recently built very beautiful hall of the Copernicus University at Torun was scanty. The scholars attending the Colloquia were not impressed by this Symposium at all.

Symposium III

This Symposium on The Reception of the Heliocentric Theory consisted of two sessions. It began with two invited review papers : P. Rybicki (Poland)—

The Reception of Copernicus' Theory : Misunderstanding and Real Consequences from the Sociological Viewpoint, and by P. Costabel (Paris) on the Actual State of Research on the Reception of the Heliocentric Theory. Rybicki discussed in detail the two stages of the reception of a scientific theory: "Theory" as a working (methodological) model and theory as a representation of the real structure (of some part) of the physical world. Actually this latter ontological aspect of a theory is the main hurdle in its being accepted by the society in general and the time period needed for a full reception depends on the philosophical disposition of the time. This philosophical tradition, as Barbara Bienkowska (Poland) observed in her paper: Some remarks on the Reception of the Heliocentric Theory from the sixteenth to the eighteenth century, was nothing but the antique heritage: the physics of Aristotle, the astronomy of Ptolemy and the Bible, of course. The heliocentric theory was fully accepted only when the "traditional authorities" were completely defeated and collapsed. That the reception of heliocentrism is still a very rich theme for research was stressed further by Prof. Costabel in his afore-mentioned review paper. He pointed out especially that the role of heliocentrism in the elaboration of the celestial mechanics at the end of the nineteenth century is not without diverse ambiguities. According to him the difficulties of Copernicus' epoch were not confined to the religious and philosophical issues involved but they were also due to theoretical problems, namely the relativity of movement, infiniteness of space, empty space vs. matter. In short, the new cosmology has not been worked out in all its complexities which is only now possible to do in the context of the present day science and also because of the progress of the historical method now.

The author of this report would like to point out that a lot of work on the "reception" has been done in various countries and the contributions of the various scholars have been published in the series : *Studia Copernicana: Colloquia Copernicana* vols. I and II, published by the Polish Academy of Sciences, Warsaw.¹²

Symposium IV

In this last Symposium which was devoted to Copernicus and the Development of the Exact and Social Sciences several scholars from various countries, especially from Germany¹³, took part. The themes of the papers presented were quite wide, but all of them rather specialised. So for the sake of brevity we confine ourselves in the following to just listing the various headings of the talks, viz. :

D. Herrmann (Berlin) : The Copernicus Biography by G. Ch. Lichtenberg.

H. Wussing (Leipzig) : Copernicus' connections with Leipzig.

S. Hoyer (Halle) : On the stand taken by the German Reformers on the Book of Copernicus.

G. Jackisch (Leipzig) : Copernicus and the Newtonian Mechanics.

F. Herneck (Berlin) : N. Copernicus and his world-view as reflected in Humboldt's Cosmos-lectures.

- H. U. Sandig (Dresden) : Existence of a Reference Frame—The Basis of the Work of Copernicus and Kepler.
- A. A. Michailov (Pulkavo, USSR) : Investigations of Proofs of Earth Motion.
- F. Krafft (Mainz) : Copernicus Retroverted ; Copernicus as Consummator of Antique Astronomy.
- W. Krajewski (Poland) : Copernicus and Galileo against Aristotle.
- A. Kempfi (Poland) : The audience of Copernicanism in the life time of N. Copernicus.
- C. Vasoli (Italy) : Copernicus and his Studies in Italy.
- F. Barone (Italy) : Copernicus and Galileo.
- S. Bachelard (France) : The Introduction of Copernicus' Astronomy in the Mechanics of Descartes.

REMARKS

The various talks and papers presented in the Colloquia are supposed to be published in a volume of the series *Studia Copernicana* and will be available most probably at the end of this year. It will be worth mentioning that there are two centres at which Copernicus research is being pursued very actively, namely

- (1) Copernicus Section, Polish Academy of Sciences,
Nowy Swiat, Warsaw (Poland)
(Director : Dr. J. Dobrzycki)
- (2) German Copernicus Research Centre,
German Museum, Library, Munich (West Germany)
(Director : Dr. H. Nobis).

Besides, a census of Copernicus "De Revoutionibus" is being collected by the IAU Commission 41 : History of Astronomy. The author of this report will appreciate very much, if printed copies of Copernicus' book are looked for in the university and city libraries by the readers of this report and any information regarding the existence of this book is communicated to him.

Normally in such a report no appeal of any kind is published. However, the author of this report has an inner urge to call upon all the historians of science to think about the following :

History of Astronomy¹⁴ in particular and history of science in general are being pursued at various institutions in the Western countries. For instance, in the universities of Germany, USA and USSR (to name a few) one comes across full fledged departments of history of science and technology. The springing up of such departments after World War II especially is due to the realization that science and technology are the main force behind the shaping of the destiny of mankind. Are we, the inhabitants of the developing countries, conscious of this fact ? It is time that science is given its due share in the development of our own culture.

This is only possible, of course, when we, the scientists in India, take "our own" history seriously. Only then the role of science and therefore our own contributions to the social development of our culture can be made clear to the new generation. The historical treatment of major scientific concepts and especially of revolutions in science can bring to the forefront the scientific method and is also the *sine qua non* for showing that science has a continuity and tradition of its own. One can expect rightly that only the realization of this tradition inspires the young men and women and inculcates in them a spirit of inquiry so much needed in the young generation of our country. The author feels that in this respect many organisations and institutions in India, for instance, the Indian Association for the Cultivation of Sciences (Calcutta), the UGC or the Indian National Science Academy (New Delhi) could contribute much by encouraging research, sponsoring and/or instituting special lectures on the history of astronomy in particular and of science in general.

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NOTES AND REFERENCES

- ¹ See the report of the Indian celebration by S. M. R. Ansari in Information Circular of Comm. 41 of I.A.U. No. 23, December, 1973. p. 6.
- ² Gingerich, O. *The Astronomy and Cosmology of Copernicus*, preprint of the Lecture, 1973. Subsequent quotations are from this preprint (The author wishes to thank Prof. Gingerich for providing him a copy of his lecture).
- ³ The city of Olsztyn got its importance because Copernicus was twice its administrator in the years 1516 and 1521. During his stay there he was also engaged in astronomical research which was in fact a continuation of his work started at Frombork which he administered and where he spent the last 30 years of his life. In the castle of Olsztyn on the gallery wall the astronomical table of Copernicus' solar observations is still to be seen. The castle is today a museum especially for some of the astronomical instruments of his time.
- ⁴ Copernicus was born at Toruń. His house at 17, Kopernika Street, built in 1350, is still well-preserved and is a museum mainly for various printed editions of *De Revolutionibus* and for his other writings. When he was 18 years old, Copernicus left Toruń to study at the Jagellonian University in Cracow.
- ⁵ Zinner, E. *Die Entstehung und Ausbreitung der Copernicanischen Lehre* (Erlangen, 1943).

- ⁶ See also : Ansari, S. M. R. Arab Antecedents of Copernican Method, (Paper presented in the Seminar on *Copernicus and Astronomy* held at New Delhi, Feb. 19-20, 1973). *Indian J. Hist. Sci.*, 9(1), 1974.
- ⁷ Hartner, W. The Mercury Horoscope of Marcantonio Michael of Venice (a study in the History of Renaissance Astrology and Astronomy) in *Vistas in Astronomy*, Ed. A. Beer, vol. 1, 84-138, 1955, esp. p. 109 ff.
- ⁸ ——— Trepidation and Planetary Theories, Common Features in Late Islamic and Early Renaissance Astronomy. *Atti dei Convegni (Accademia Nazionale dei Lincei)*, Nr. 1, 609-629, 1969 (Rome 1971). In this remarkable talk which Hartner delivered at the International Convention on "Orient and Occident in Middle Ages: Philosophy and Science" (held at Rome—Florence, 9-15 April, 1969) he has presented "ideas, methods and devices conceived in Late Islam and found again in the European Renaissance". In fact he mainly compares in this paper the ideas of Nasiruddin Tusi and Qutab al-Din, as given in *Tadhkirā fi 'ilm l-hay'ā* and *Libros del Saber* respectively, with those of Copernicus and Peurbach as given in *De Revolutionibus* and *Thoricæ Planetarum* respectively.
- ⁹ For the influence of Thābit work upon Copernicus astronomy see Moesgaard, K. P., Thābit ibn Qurra between Ptolemy and Copernicus—an Analysis of Thābit's Solar Theory, preprint (University of Aarhus) May 30, 1973. Moesgaard has tried to show in his paper how Thābit in his works *On the Solar Year* and *On the Motion of the Eighth Sphere* tried to solve the problem of long term variation of the Ptolemaic "constants": the obliquity of the ellipse, the tropical solar year and the per century rate of eastward stellar motion as reckoned from the vernal equinox. Moesgaard claims that evidence can be brought to show that "Copernicus was aware that in so doing (i.e. solving the above mentioned problem) he would complete a building the foundation of which had been laid by Thābit", (p. 26 of the preprint), published in *Arch. Hist. Exa. Sci.*, 12, 199, 1974
- ¹⁰ See also Sen, S. N. : Epicyclic Eccentric Planetary Theories in Ancient and Medieval Indian Astronomy, (paper presented at the Seminar on Copernicus and Astronomy, held at New Delhi, Feb. 19-20 1973) *Indian J. Hist. Sci.*, 9(1), 1974.
- ¹¹ It is noteworthy that the basic tenet of neo-platonism of the fifteenth century was the identification of the sun with God. It is today known that at Cracow University in Copernicus' times the most famous adherent of the Italian neo-platonism was Philip Buonacorsi called Callimachus who was a friend of Copernicus' uncle, Bishop Lucas Watzenrode. It is said that the father of the sun cult, Marsilio Ficino, sent Callimachus his books *on the Sun and the Light*, published in Florence in 1489, It is assumed that the young Copernicus must have known Callimachus personally and might have read Ficino's book also. At one place in his book Ficino writes that the sun was created first and that it is in the centre of the heavens. See Kristeller, P. O. *The Philosophy of M. Ficino*, New York 1943. Ficino's works (*Opera Omnia*, Basel 1576, Turin 1959) have been edited by Prof. E. Garin (Florence). cf. Kuhn, Th. *The Copernicus Revolution*, Harvard University Press 1957, esp. p. 129/130.
- ¹² See also Dobrzycki, J. *The Reception of Copernicus' Heliocentric Theory*. D. Reidel Publ. Co. Dordrecht, 1973.
- ¹³ From East Germany (German Democratic Republic) two memorial volumes on Copernicus have been published in 1973 by Akademie Verlag, Berlin. One is the *Festschrift* at the occasion of the 500th Birth Anniversary celebrations of Copernicus, edited by the Copernicus Committee of the Academy of Sciences of GDR. The second is the collection of essays (Ed. J. Herrmann) on the world-view of Copernicus and the Copernican system. The author of this paper intends to publish a review of these volumes shortly. He is grateful to the secretary of the GDR delegation for putting at the disposal of the author these volumes.
- ¹⁴ See the announcement regarding it on the following page of this issue.