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THE ORIGIN, AGE AND PERSPECTIVES OF THE WORLD ACCORDING TO THE 15TH CENTURY CRACOW ASTRONOMERS

The ideas on the age of the world, its origin and perspectives (also eschatological) were implicit in the lectures on astronomy delivered at Cracow university in the 15th and early 16th cent., as well as in the astrological predictions composed in that period. The collection of the astronomical (mathematical) and astrological manuscripts, testifying of the teaching in the 15th century Cracow, and now preserved in the Jagellonian Library as well as in other European collections, offers the possibility to study how various ideas on the subject, coming from various epochs, mostly from the 14th century, were faced by the 15th century astronomers[1]. The scope of my research, however, is neither a continuation of the views of historians on the influence on the 15th century Cracow of the 14th century cosmology struggling against astrology based on the concept of the 'great year', and thus on the concept of the 'cyclical time', nor I am interested in the other forms of the 'cosmological determinism', for, obviously, it had to be present in the 15th century university teaching; the ancient pagan 'cosmological determinism' was then even reinforced through the astrological texts coming from Muslim tradition[2].

What I am actually interested in is the phenomenon of the coexistence of two alternative cosmological visions, one scientific and the other magical. The first was based on mathematical astronomy with reference to the Aristotelian cosmology adapted to the requirements of the Christian faith, and the second on the heterodox

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source. Thus the question arises concerning the channels through which the heterodox, astrological doctrines on the nature of the physical world penetrated the quadrivial disciplines, officially Christian, and influenced the ideas imparted to students. One of these channels was the curriculum of the faculty of arts. In fact, astrology taught in accordance with it, and thus functioning at the level of fundamental university teaching, could contribute to the form of the views of the future astronomers, philosophers, and theologians concerning the origins and fates of the world. Another channel consisted in the astrological activity of the professors of astronomy. The astrological previsions-judicia, composed by them and preserved till now in the relatively large quantity, in the 15th century circulated in innumerable copies. Although their scope was practical and concerned the future circumstances of daily life, such as health, family, friends, harvest, money, journeys, religious, social and political events etc., they resulted from the specific vision of the world. The traces of general considerations concerning the origins of the world and the role of the heavenly bodies in all aspects of its history are found in the *Introductions* to the judicia, and also sometimes in the Conclusions to them. In these circumstances, when the problem of the origins and fates of the world appeared occasionally, it was considered with reference to the Pythagorean concept of nature, or concepts attributed by astrologers to Aristotle, Ptolemy, Haly Habenragel or finally to 'Pater Hermogenes' (Hermes). On the other hand, the origins of the world and the possible end of it (the end of the cosmos) had to be considered, above all, in relation to the biblical vision of the universe and in fact, the lectures are interlarded with references to the Bible.

Contrary to the ecclectic general views (divagations) often present in the Introductions to the judicia, the astronomical (mathematical) matter that constituted the core of predictions and served as the basis to the subsequent astrological interpretation, was treated in a scientific way. For instance, since the astrological considerations were referred to the 12 'houses' - the 12 portions of the ecliptic, mathematicians were concerned with the precision of the trigonometrical procedures aiming at the division of the celestial sphere. The mathematical problem of the 'houses' was the subject of profesional discussions by the mid–15th century. Regiomontanus contributed to its (practical) solution in his *Tabulae directionum profectionumque* (1467)[3].

In what follows, I will consider some texts that were obligatory in the teaching of astronomy and astrology in Cracow somewhere the mid–15th century, to begin with lectures delivered by Sandivogius de Czechel (1430) and Martinus de Premislia (1444–1445, 1450) and then by Albertus de Brudzewo (1482). Sandivogius is important here because of his quadrivial teaching in Cracow, including commentaries on arithmetic, optics, and on the *theorica planetarum*[4]. As for Martinus, he composed, during the first phase of his activity in Cracow, 1444–1445, the famous *Summa super tabulas (Alphonsi Regis)*, and in the second phase, after coming back to Cracow from his journey to Prague, Leipzig,

Bologna, and Hungary, the astrological prediction for the year 1451[5]. As for Albertus de Brudzewo, the author of the Commentary on the *Theoricae planetarum novae* by Georg Peurbach, and of the rules concerning the use of Regiomontanus' astronomical tables (*Canones tabularum Directionum profectionumque*) he concludes, in some way, the chain of the Cracow mathematical astronomers interested in astrology (Johannes de Glogovia, Albertus' contemporary, was active above all as astrologer).

The teaching of astronomy and astrology in the mid–15th century Cracow is marked by the use of the text books qualified as the best ones. The *Almagest* is referred to in lectures on astronomy delivered there in 1430 (but not systematically taught). Earlier, about 1412, there was a possibility to follow a systematic exposition of Ptolemy's astronomy at the university of Prague, and in fact, a certain Alexius de Polonia was there one of the most assiduous students of John Scindel[6]. The reception of Ptolemy's astronomy is accompanied by the reception of his astrology, included in the *Opus quadripartitum*. Both technical works, the *Almagest* and the *Quadripartitum*, transmit the vision of the universe build up on the Pithagorean concept of number that organizes cosmos according to the preestablished laws of harmony. The Platonic concept of the circular motions of the heavenly bodies is accompanied there by the Aristotelian concept of the world 'without beginning', in which the sublunar reality is subordinated to the celestial spheres. These ideas, incorporated in Ptolemy's scientific system, based on both observations and mathematics, and expressed through kinematical models of the universe, offering the (quasi!) perfect systematical exposition of the celestial mechanism, incited their author to celebrate the godly dignity of a mortal when he is able 'to contemplate the trajectories of the stars'[7].

In accordance with the Ptolemean model of the teaching of mathematical astronomy, adopted in Cracow, the astronomical lectures, delivered by masters like Sandivogius, Martinus, or Albertus, introduced students to technicalities, starting with the art of computation, then came the explanation of the use of the astronomical instruments, followed by the explanation of the kinematic models of the universe and of their arithmetical interpretation, and finally the use of the astronomical tables: the adaptation of them to a given meridian and to a given time. All that constituted the background to the professionally dressed astronomical *exordia* that were interpreted, subsequently, in accordance with the rules of astrology. Thus, astrology taught at universities, at least at universities provided with chairs of mathematics, depended on mathematical astronomy i.e. on the science based on observations and assuming the structure of the spherical trigonometry. Moreover, it depended also on cosmology and on physics: the 15th century astrology utilized the ancient cosmological concepts to justify its own ones. In fact, the Aristotelian cosmology, with its concept of the sublunar and above lunar world, was extremely useful to astrology. In that way, astrology presented

itself to scholars as dressed in the splendorous of both: mathematics, considered as the *scientia certissima*, and of the Aristotelian cosmology, considered as the dogma. This very special status of the astrological knowledge opened to it the ways to the quadrivial sciences.

Sandivogius of Czechel teaches, with reference to Aristotele's *De celo*:

"*...motus illarum rerum, sive corporum supracelestium, sunt nobiliores et perfecciores motibus corporum inferiorum et per consequens corpora celestia, videlicet septem planete de quibus astronomia et theorica planetarum considerat, sunt digniora et nobiliora corporibus inferioribus.* [...] *Recte natura exemit hoc corpus, scilicet celeste, a contrariis. Propter quod* [*Aristoteles*] *concludit quod non est alterabile neque augmentabile, nec generabile, nec corruptibile*"[8].

The two elements, namely the Aristotelian cosmology and mathematical astronomy, both functioning as natural sciences, were enriched in the course of time (thanks to the astrological literature) by the third element, heterogenous to them, which is, in fact, magical, "mystical", gnostic, and in any case irrational. The intrusion into the liberal arts of this element makes them fonction on a specific level, no more, or not only, in accordance with their status of the *scientiae naturales*. The first rate source that halps to follow the shifting of the quadrivial sciences from the natural level to the magical (or not only the natural) one is the astrological work of Ptolemy, the *Quadripartitum* used in the Latin tradition together with the Commentary by Haly. Following Ptolemy's attitude toward the relation between astronomy and astrology, the symbiosis of the technical astronomy with astrology is presented by Haly.

Haly's Commentary to the *Quadripartitum* constituted a sort of a „catechism" of the 15th century astronomers and astrologers. It functioned together with the preface by Egidius de Tebaldis, the translator from Arabic into Latin (*via* Castilian). Astrology is considered there as a noble science, related to God because of its subject and because of the special election of the astrologers by God who is the origin of all knowledge. Thus, it is suggested that "all sorts of knowledge are good since all knowledge is originated in God". Moreover,it is proved, with reference to Ptolemy's concepts of astronomy and astrology, that astrology is a *scientia*, first, and then that it is the *scientia quadrivialis*:

„*Dixit Egidius de Tebaldis lombardus de civitate Parmensi: Scire et intelligere gloriosum est, quia omnis scientia est a Deo. Deus illum valde diligit et elegit in quo posuit superioris scientie intellectum. Scientia vero superior est, procul dubio, ars astrorum, quia alie subiecte sunt sibi.* [...] *Et fundata est super principia certa, comprehendentia totum mundum. [...] Dubitatio non occurrit quoniam divina providentia disponente superiorum corporum inferiora omnia moveantur*"[9].

The penetration of these doctrines into university teaching is seen in Sandivogius' lecture. Sandivogius who quotes aboundly Haly's Commentary, states, in accordance with Aristotle, and partly in accordance with Haly:

„Ab ipsis enim corporibus celestibus tamquam ab insignioribus rebus omnes iste res reguntur inferiores [...] *testante Aristotele primo Metheororum.* [...] *Ex quo corrolarie sequitur quod corpus celeste est causa omnium inferiorum* [...] *et hoc est verum, capiendo corpus celeste pro orbe cum intelligencia*"[10].

The last part of Sandivogius' corrolarium, in which it is proposed to understand the Aristotelian heavenly body, the *orbis cum intelligencia* as the cause of the terrena – *causa omnium inferiorum*, even if it is placed in the context of the Aristotelian cosmology, it seems to be much closer to the doctrine of the Muslim astrologer, Haly Abenragel than to the Aristotle's doctrine. In fact, in the Commentary to the "*Liber Quadripartiti Ptholomei* [...] *de futuris in hoc mundo constructionis et destructionis contingentibus*" the standard text book on astrology, considered as the most authoritative in the university milieus, Haly states as follows:

"*Qui ergo se ingerit circa intelligentiam scientie sic sublimis, diligit Deum cognoscere, omnium creatorem, quia opus stellarum Dei est, et ipse [stelle] tamquam vicarie Dei, operantur quicquid accidit in terrenis*"[11].

Even if the Haly's term *vicarie Dei*, does not mean as much as the Sandivogius' expression: *corpus celeste est causa omnium inferiorum* (which includes the sense of causality) it means, however, much more than the purelly Aristotelian term *corpus celeste* understood as a heavenly body moved by an intelligence: *orbis cum intelligencia*. For, evidently, Aristotle's *Deus* and his *intelligentiae* – intelligences that move the *orbes celestes*, are not equal to Haly's *Deus, creator omnium* and his *vicarie Dei*.

Obviously, the diverse languages used by the two signal the essential differences between cosmologies represented by these authors. As for the Cracow lecturers, they seem not to have perceived the difference existing between the terminology used by Aristotle and the one used by Haly. Thus, they accept astrology, *bona fide*, as one of the quadrivial sciences, or even the quadrivial science *par excellence*. The astrological concept of the cosmos, once insinuated into the quadrivial teaching by means of the strange symbiosis of the magical (gnostic) thinking, the Ptolemean mathematical astronomy and, finally, the Aristotelian cosmology, becomes reinforced by the physical ideas of Ptolemy. Ptolemy, in fact, considers the influence of the heavenly bodies on the Earth to be in accordance with their sizes, and with the distances of the celestial orbs from the Earth. Consequently, the astrologers underline, with reference to Ptolemy's *Almagest*, the relation existing between the "physical parameters" of the heavenly bodies and the force of their influence exerted on the Earth.

This theme is present in Martinus de Premislia Introduction to his *Judicium anni 1451*. According to Martinus:

„Magis vero, ut dicit Ptolomeus primo Quadrupartiti, duo luminaria, puta Sol et Luna, ceteris in orbis inferioris elementis operantur. Sol quidem corporis sui magnitudine, ut ipse, ut demonstratur in Almagesti distinccione III et IV, sit

maior quam terra [...]. Luna vero distancie sue propinquitate. Virtutes eciam siderum, ut dicit Hali super primum Quadrupartiti Ptolomei, secuntur corporum suorum magnitudinem"[12].

As for the question concerning the end of the world, it is not clearly posed in Martinus' prediction. It was present, however, in other astronomical and astrological texts, for instance in Albertus' de Brudzewo lecture on the *Theoricae novae planetarum*, where Albertus states:

„*Hos autem orbes* [...] *primus Artifex adornavit tamquam lucernis fulgentissimis, deputavitque eis* [...] *diversas virtutes et opera, ne otio vilescerent, sed ut terram* [...] *eisdem virtutibus disponerent, proportionalique influxu eam fixe tenerent* [...] *usque in diem, quem ipse primus conditor voluerit*"[13].

The concept of the end of the world is inherent in the concept of its beginning. The beginning of the world in time is understood by the Cracow astrologers not in a mythical way, even if the ancient pagan doctrines are known and penetrate the quadrivial texts, but in the biblical one. And the biblical data on the beginning of the world seem to be "scienfifically interpreted" since the beginning of the creation is understood as an event, in some way, "historically datable" by means of astronomical procedures. As is known, the core of the mathematical astronomy, the sets of astronomical tables, begin usually with the chronological tables. In the Alphonsine tables, originated from Toledo and rearranged by the mid–14th century in Paris, the chronological tables that open the whole work refer to the epoch of the *Diluvium*. Martinus, in the *Judicium anni 1451* refers even to the ante-diluvial events, going as far into the past as the time of the creation of Adam, and (almost) to the time of the world creation:

"*Secundum* [*capitulum*] *De revolucionibus preteritorum* [*coniunccionum*] *incipiendo a coniunccione cuius virtute diluvium magnum factum fuit, que coniunccio fuit post creacionem Ade duobus milibus et viginti sex annis, quod diluvium factum fuit post coniunccionem nonagesimo primo anno, post creacionem vero Ade Millesimo 967 ...*"[14].

But, even if astronomers penetrate the mysteries of the cosmos and discover the kinematical (geometrical) principles of the appearance of the great conjunctions, together with the principles of the influence of these conjunctions on the sublunar world, their knowledge, based on the *principia certa, comprehendencia totum mundum*, is not infallible. Eventually all depends on God. Martinus admits the liberty of God, the Creator and the Ruler of the cosmos. He admits also the sovereignty of God in the impartition of his mercy. Actually, the *Judicium anni 1451* begins as follows:

"*Meretur iuste Omnipotentis Celsitudo in primis graciarum acciones suscipere, cuius misericordie super omnes prophecias mundi*".

And it concludes:

„...hec omnia Deus iuxta libitum suum reservare seu immutare potest, quorum omnium cause iam sunt prehabite"[15].

On the other hand, no traces of the eschatology of the redemptive history, nor of the millenarianism nor of the apocalypticism are found in the Cracow texts coming from the 15th century.

Notes

[1] As it results from the census of the manuscript sources, the astrological writings by the Muslim authors dominate in the collection of the quadrivial manuscripts used in Cracow, and in general the astrological subjects prevail on the astronomical ones, cf. G. Rosińska, Scientific Writings and Astronomical Tables in Cracow (XIVth–XVIth centuries), Wrocław 1984 (Studia Copernicana XXII). The question of determinism was considered i.a. by M. M a r k o w s k i : *Der Standpunkt der Gelehrten des späten Mittelalters und der Renaissance dem astrologischen Determinismus Gegenüber*, in: „Studia Mediewistyczne". XXIII, 1. (1984), 11–44.

[2] This is confirmed by the collections of texts preserved in the codices coming from the mid–15th century, for instance mss. BJ 1844, BJ 1854, BJ 1864, BJ 1918, BJ 1927, 1929.

[3] .J. D o b r z y c k i : *Tablice astrologiczne Jana Regiomontana w Krakowie.* (Astrological Tables of John Regiomontanus in Cracow. With an English Summary), in: „Studia Mediewistyczne" XXVI, 1. (1989), 85–92.

[4] G. R o s i ń s k a : *Sandivogius de Czechel et l'École astronomique de Cracovie vers 1430*, in: „Organon" 9 (1973) 217–229.

[5] G. R o s i ń s k a : *Traité astronomique inconnu de Martin Rex de Zurawica* in: „Mediaevalia Philosophica Polonorum", XVIII (1973) 165–166.

[6] Ms BJ 619, f.12r–272r. On f. Iv: *Anno domini 1412 currente in die sancti Martini hora ab inicio noctis 20 4 minutis ego A[ndree] J[ohannes] incepi legere Almagesti Ptholomei diebus festivis in scola medicorum in studio sancto Pragensi...* Cf. G. R o s i ń s k a : *Scientific Writings... op. cit.*, nr. 153 and nr. 299.

[7] Cf. F. B o l l : *Studien über Claudius Ptolemäus*, „Jahrbücher für Classische Philologie", Supplementband 21 (1894) 68–76. Cf. P t o l e m ä u s : *Handbuch der Astronomie.* Bd. I. Deutsche übersetzung und erläuternde Anmerkungen von K. M a n i t i u s . Vorwort und Berichtigungen von O. N e u g e b a u e r Leipzig 1963 [XXXII].

[8] Ms. BJ 1929 f. 90r.

[9] Ms. BJ 587 f. 1ra.

[10] Ms. BJ 1929 f.91v.

[11] Ms. BJ 587 f. 1rb.

[12] Ms. BJ 1918 f. 185r.

[13] *Commentariolum super theoricas planetarum Georgii Purbachii in Studio Generali Cracoviensi per mag. Albertum de Brudzewo diligenter corrogatum a. D. MCCCCLXXXII.* Ed. L. A. B i r k e n m a j e r , Cracoviae 1900,s. 3.

[14] Ms. BJ 1918, k. 188r.
[15] Ms BJ 1918 f.185 and f. 200r.

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PIĘTNASTOWIECZNI ASTRONOMOWIE KRAKOWSCY O POCZĄTKACH, WIEKU I PRZYSZŁOŚCI ŚWIATA

Artykuł dotyczy astronomii uniwersyteckiej w kontekście nauczania na wydziale sztuk wyzwolonych w ramach tzw. nauk "kwadrywialnych", obejmujących zasadniczo cztery nauki matematyczne: arytmetykę, geometrię, astronomię i muzykę (teorię harmonii opartej na proporcjach) ale także optykę oraz elementy fizyki i kosmologii Arystotelesa.

Postawiona w tytule kwestia traktowania przez astronomów krakowskich problemów, które wykraczały poza kompetencje astronomii matematycznej, jest pretekstem do podjęcia próby ukazania, w jaki sposób formacja astronomów w uniwersytecie była wynikiem ewoluującego w ciągu 15 stulecia zespołu podręczników (*corpus astronomicum*) oficjalnie określonego w „Statutach" wydziału sztuk wyzwolonych z 1406 roku. Stąd zwrócenie uwagi na różnice między *corpus astronomicum*, funkcjonującym z początkiem XV, a następnie w połowie i przy końcu tego stulecia. Wielorakie drogi (i bezdroża) rozwoju nauki, a także osobiste zainteresowania wykładowców, powodowały niekiedy podejmowanie przez astronomów problematyki kosmologicznej (filozoficzna interpretacja kosmosu) lub astrologicznej. W przypadku astrologii posługiwano się wynikami astronomii do celów pozaastronomicznych, a nawet pozanaukowych, wśród nich do celów nazywanych „praktycznymi", realizowanych w ramach magii i wieszczbiarstwa. Na interpretacji świata w sposób astrologiczny zaciążył autorytet Ptolemeusza (150 n.e.), autora *Almagestu* – wielkiej syntezy astronomii matematycznej, ale też autora *Opus quadripartitum*, klasycznej summy wiedzy astrologicznej.

W tym też kontekście sytuuje się zainteresowanie wiekiem kosmosu, jego początkiem, a także przyszłymi losami, łącznie z kwestią „końca świata" bądź rozpoczęcia „nowego cyklu". Było ono wynikiem wtargnięcia w sferę dociekań astronomicznych problematyki pozaastronomicznej, z zakresu kosmologii, będącej nauką filozoficzną oraz astrologii zwróconej ku wieszczbiarstwu. Przy tym astrologia, określana przez zainteresowanych jako *scientia quadrivialis* (sic!), torowała sobie systematycznie drogę do oficjalnego nauczania uniwersyteckiego.

W astronomicznych tekstach krakowskich, traktatach i komentarzach, problematyka kosmologiczna lub astrologiczna zwykle występowała we wstępach bądź w zakończeniach. Najczęściej miała charakter eklektyczny: oferowała zlepki teorii pochodzących od różnych tradycji: pitagorejskiej, platońskiej, neoplatońskiej, hermetycznej, a także zlepki różnych pod względem metodologicznym dyscyplin: astronomii matematycznej, filozofii, Objawienia chrześcijańskiego, a także teologii wypracowanej w kręgu Koranu.

W wykładach krakowskich są obecne w różnym stopniu wszystkie te wątki. W przypadku kwestii uważanych za zasadnicze, jak sprawa stworzenia świata w czasie, wolności człowieka, a przede wszystkim wolności Stwórcy, a więc wolnego decydowania o losach świa-

ta, w tym o jego końcu, dominuje wizja biblijna. Stąd, nawet przy podejmowanych próbach daleko posuniętego wstecz datowania świata – aż do epoki przed potopem, aż do stworzenia Adama – i to „metodami astronomicznymi" (opartymi na wyliczaniu tzw. wielkich koninkcji planet), nie wnioskuje się z przeszłości świata o czasie jego trwania w przyszłości.