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THE MASTER OF THE 1550 RADICES: JOFRANCUS OFFUSIUS

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Probably the most remarkable result of compiling a census of the sixteenth-century editions of *De revolutionibus* has been the discovery of several families of marginal annotations, each found in multiple copies of Copernicus's book.[1] The principal examples are the annotations made in Wittenberg by Erasmus Reinhold, the pre-eminent teacher in the generation immediately following Copernicus. His marginalia were disseminated into at least fifteen other copies of the book, including two sub-stemma, one from Johannes Homelius, his student who became astronomy professor at Leipzig, and the other from Paul Wittich, who found a set of Reinholdian annotations in one of the four copies of *De revolutionibus* that he had acquired.

Another group of eight first editions contains a totally different set of annotations, characterized (in seven of the copies) by planetary radices for 1550 handwritten at the bottom of all the relevant tables. Each of these books contains in common further annotations, written in the first person. "Ego reperi" and "puto" and "inveni" are among the phrases identically repeated (but in different hands) in each of these books. But more important, the top of f. 129 contains a long, sophisticated, comment on the position of the Moon, which comes at one of the most complex places in the entire book.[2] As we shall demonstrate, these books were all annotated in Paris in the mid-1550s by a previously unsuspected working group of students interested in the technical aspects of the new Copernican system.

When we examined these eight sets of annotations, there was no immediate clue as to which was the original. Only one of the copyists signed his book, although later owners did inscribe their names, and one title page claims "Ex libris C. Peuceri manu sua notatus". (Caspar Peucer was the successor of Erasmus Reinhold at the Wittenberg chair.)

The presence of the radices for 1550 strongly suggested that the original annotator was someone interested in compiling an ephemeris in the 1550s, and two relevant ephemerides came immediately to mind: Reinhold's for 1550 and 1551, and Rheticus's for 1551.[3] Since Reinhold's annotations were already well known, Rheticus seemed at first glance to be a logical candidate for the mysterious annotator, the "Master of the 1550 Radices". After all, Rheticus was an important astronomy teacher in Leipzig in the 1550s, and as Copernicus's only disciple, it appeared reasonable that some trace of his teaching should emerge in the census.

Another indirect clue appears in the first edition owned by Johannes Praetorius (1537–1616); at the back is an inscription reading, "Thaddeus Hagecius: I have received these from a certain person (Paul Wittich). Some

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errors of Copernicus" and the inscription goes on to epitomize the long comment found on f. 129 and another relating to f. 8, both of which are found in this family from the "Master of the 1550 Radices". Since Hagecius had well-known connections with Rheticus, this cryptic message gave a further hint that Rheticus might be involved. However, the comment on f. 129 that appears in each of these copies ends by saying, "Perhaps by [Copernicus's] order some inexperienced student carried out the calculation". Rheticus, as Copernicus's only student, would hardly have written such an indictment.

As we shall show, an ephemeris-maker from the 1550s was indeed a primary figure in the annotations, while Hagecius and Peucer play later, minor roles in the story; Rheticus and Reinhold were not involved at all. To facilitate our exposition, we here list the eight copies, together with later provenances:

CANDIDATES FOR PRIMARY COPIES

Edinburgh, Scottish National Library (in Paris until *c.* 1570; Hagecius/Wittich?)

Debrecen, Reformed Church Library (in Paris until 1559; Sambucus)

COPIES MENTIONING OFFUSIUS

Paris, Bibliothèque Nationale (always in Paris; Mesmes)

↳Paris, Observatoire de Paris (in Paris until *c.* 1580; Peucer)

↳Soissons, Bibliothèque Municipal (via Franciscan convent in Soissons)

DERIVATIVE COPIES

Norman, University of Oklahoma (via Italy?)

Ann Arbor, University of Michigan (in Paris until 1791)

Pisa, Bibliotheca Universitaria (closely resembles Ann Arbor copy, previous history unknown)

We shall refer to these copies by their present location, distinguishing the two in Paris by "Paris BN" and "Paris Obs". The initial clue in establishing the annotator was based on the fact that two of the copies were clearly derived from Paris BN, namely Paris Obs and Soissons, and each of these three contain *inter alia* the name of one Jofrancus Offusius, a German astrologer active in Paris around 1550, who is known almost entirely from his two books: his *Ephemerides* for 1557 and his posthumously published *De divina astrorum facultate* (Paris, 1570).[4] We therefore recognized early on that the shadowy Offusius had something to do with these copies, but we did not at first appreciate the extent of the annotations from him. There was, indeed, a critical clue: where an annotation on f. 59 of Paris BN reads, "per me", Paris Obs states, "per Jofrancum". A comparison of these two copies, made in 1984 with the actual books side by side, showed their close interconnection, and it seemed that the Paris Obs marginalia were largely (but not entirely) copied from Paris BN. According to this (somewhat faulty) interpretation, Paris BN contained the original first-person notes by Offusius, plus additional notes referring to Offusius in the third person added by an early

owner, Mesmes, whose name is inscribed on the title page together with the date 1552. Mesmes is independently known for his *Institutions astronomiques* (Paris, 1557), a beautifully printed but comparatively pedestrian vernacular introduction to astronomy.

In April 1992 we had occasion to look more closely at a microfilm of Paris BN, and soon concluded that nearly all the relevant notes in that copy were made by the same hand, that is, both the first-person and the third-person remarks. By this time we were aware that five other copies in the "Master of the 1550 Radices" series all had essentially the same first-person marginalia.[5] There was no longer any compelling reason to suppose that Mesmes had taken over Offusius's original copy, but rather, he must have made his own copy from the original without bothering to change the first-person references. Hence the question rapidly became, "Is the Master of the 1550 Radices's original copy among us, and if so, can it be identified?"

A comparison of Soissons and Paris Obs showed that they are derivative from Paris BN. A further investigation of the remaining copies showed that the Ann Arbor, Norman, and Pisa copies are derivative from either the Debrecen or the Edinburgh copy. (This is easily, if somewhat tediously, established from errors or omissions in the copying.) We thus concluded that Offusius was in fact the Master of the 1550 Radices, and we hypothesized (erroneously, as it turned out) that his original copy is the one now in Debrecen. To establish this scenario as plausible, we began to collect the fragments known about Jofrancus Offusius in an attempt to reconstruct the events of the 1550s.

According to Offusius's *Ephemerides*, he was a German working in Paris, and he had travelled the world in search of a true astrology. A note in several of these copies of *De revolutionibus* indicates that in 1550 he was in Seville.[6] John Dee, in a grumbling vanity press publication written in 1577, mentioned "one Joannes Franciscus Offhuysius" as being "here conversant with, and depending upon this our Brytan Mathematician, above a whole yere".[7] This must have been around 1552, for in 1548 Dee had gone on a prolonged trip to the Louvain (where he stayed two years), and then on to Paris and elsewhere on the Continent, returning to England in 1551; he shows in sidenotes a letter written from "van Offhuysen" on 30 October 1553. In one of his books Dee wrote a biographical note indicating that he, Cardano, and "Joannes Franciscus" were together at the house of the French consul in Southwark in 1552 or 1553.[8] Girolamo Cardano refers to Franciscus Offusius Geldrensis when discussing cipher codes in his *De rerum varietate* (Basel, 1557).[9] Finally, Pontus de Tyard, a sixteenth-century French astronomer, philosopher, and poet, mentions meeting Offusius in Dieppe, presumably in 1556.[10] Offusius's second book, *De divina astrorum facultate*, was published posthumously by his widow some years later, in 1570. That book is in itself quite interesting, as it deals with the question of planetary distances, a topic rather rarely addressed between *De revolutionibus* and Kepler's *Mysterium cosmographicum* of 1596. But apart from the marginalia and related manuscripts in the eight copies of *De revolutionibus*, there seems

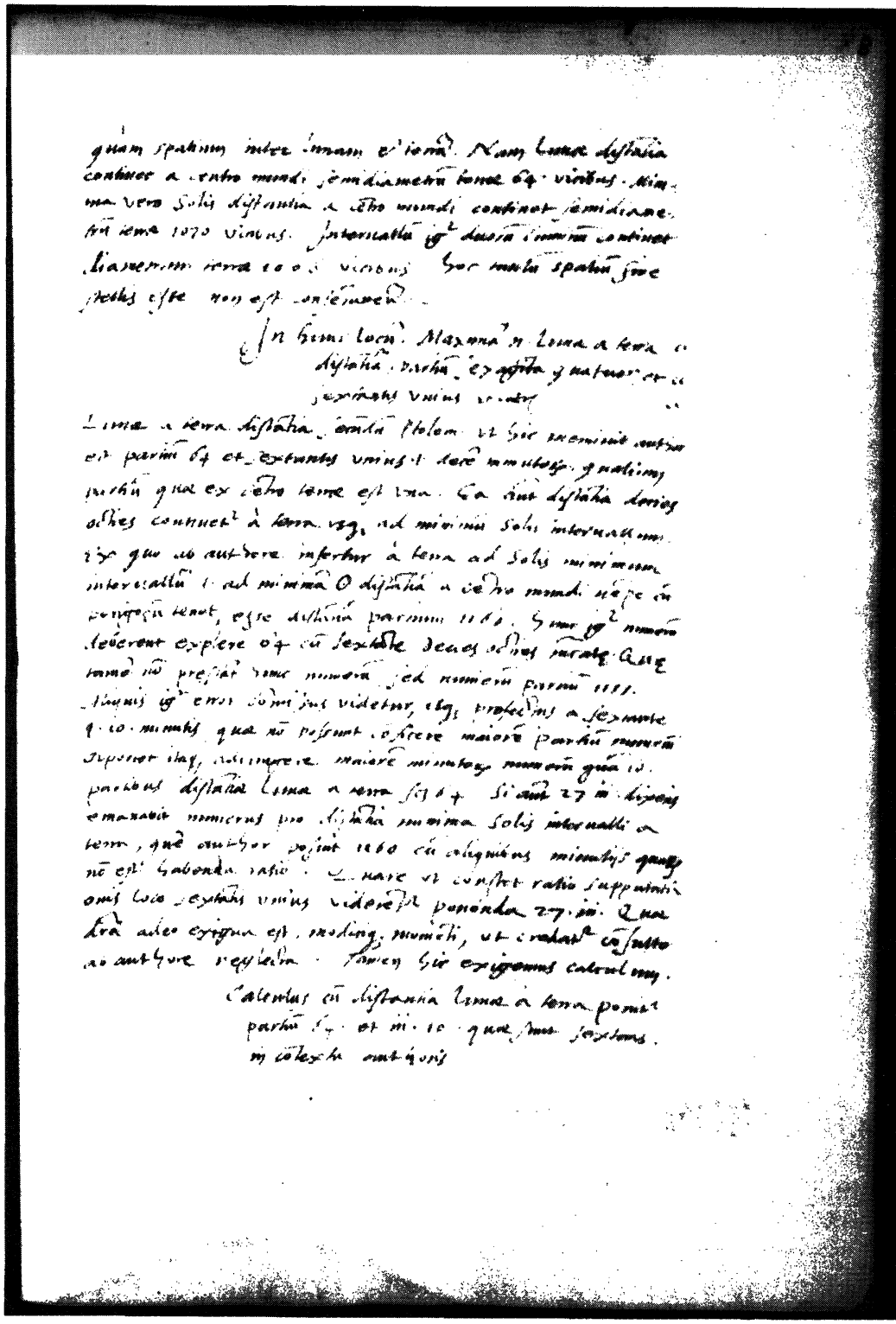


FIG. 1. A sample of Offusius's handwriting, f. 8 from the manuscripts appended to the Edinburgh *De revolutionibus*. On this page (not transcribed in our text) Offusius begins his commentary on the lunar and solar distances mentioned in I,10. Reproduced with permission of the Trustees of the National Library of Scotland.

to be no further information about Jofrancus. As for patrons, his *Ephemerides* has no dedicatee. We do not know the dates of Offusius's birth or death, although from the toponym ascribed by Cardano we can assume that he came of Geldern, a small Westphalian town in the Lower Rhine region; one of our annotated copies refers to him with another toponym, Vesalius, referring to Wesel, a slightly larger town on the Rhine a short distance from Geldern. The name Offhuysen could derive from another nearby town, Oberhausen. As for a university matriculation, he did not enroll at the Louvain, Cologne, Wittenberg, Leipzig, Cambridge, Oxford, or Basel.

Offusius's one identified student, J. P. Mesmes, must have been in contact with his teacher sometime between 1552, when he acquired his *De revolutionibus*, and 1557, for on f. 46, where he has copied a note relevant to 1548, he adds in another ink, "pro anno 1557 currente. Sic meus praeceptor Jofranciscus." The fact that Mesmes nowhere seems to mention Offusius in his *Institutions astronomiques* of 1557, whereas he lavishly praises Oronce Fine as the leading French astronomer, suggests that he came into the Offusian circle after he had sent his book to press. But Offusius himself seems to disappear from the scene after his contacts with Mesmes and after the publication of his *Ephemerides* in 1557.

The annotated *De revolutionibus* now in Debrecen was acquired by the sixteenth-century Hungarian polymath, Sambucus, who travelled widely in Europe in search of books and manuscripts for his large personal library. In particular, he visited Paris in 1559 and again in the winter of 1561–62.[11] For some time we speculated that Offusius had died around 1558 and that books from his estate such as his Copernicus were available for Sambucus to purchase.

It became clear, however, that the marginalia of the Debrecen book could not account for all of the annotations found in the various derivative copies. If Debrecen were an original Offusius holograph, it would be necessary to postulate the existence of other Offusian teaching notes or a more complete but unlocated copy. The only other volume in our survey not clearly derivative was the one in Edinburgh, which, for reasons to be explained, we associated with the Prague astronomer, Thaddeus Hagecius. The Edinburgh copy was unusual in that it contained a further 50 pages of notes bound at the end, in the same hand as the marginal annotations. A closer inspection of these manuscript notes suggested that they constituted an original holograph, as judged by the sort of corrections that only an author himself would be likely to make. Could the Edinburgh notes and manuscript appendix be the sought-for Offusian original? Ultimately we concluded that every line of evidence pointed to Edinburgh as the source of virtually all the other copied annotations, including those in the Debrecen copy; that is to say, no other scholar (apart from some minor additions by Mesmes) was involved. Furthermore, both the annotations in the Edinburgh *De revolutionibus* and the 50 pages of study notes about the book (Figure 1) are surely the work of Jofrancus Offusius, and they constitute a truly remarkable document for the early reception of the Copernican ideas.

Offusius as a Copernican

The fact that Offusius's notes are scattered throughout the entire *De revolutionibus* indicates his familiarity with Copernicus's ideas. But the most extraordinary witness to Offusius's attitude toward the new system is an extended passage in the astronomy lecture notes appended to his copy of *De revolutionibus*. There, with respect to I,5, he states:[12]

> Some have debated the mobility of the Earth. Now Copernicus took both the eighth sphere and the Sun as immobile, granting the motion to the rest of heavenly spheres. Several others considered the Earth to be a planet. A book by Archimedes, *The sand reckoner*, is extant, wherein he reported that Aristarchus of Samos taught this paradoxical doctrine that the Sun stays fixed and that the Earth revolves around it. Although many acute and perspicuous experts applied their talents to investigate the matter, yet we can judge that they did not intend to present it as decided. Now, our author presents his judgement and opinion well enough in the preface with these words:
>
> *Therefore I also, having found the occasion, began to consider the mobility of the Earth. And although the idea seemed absurd, nevertheless because I knew that others before me had been granted the liberty of devising whatever circles they pleased in order to explain the heavenly phenomena, I thought that I, too, would be readily permitted to test whether, by positing some motion for the Earth, more reliable demonstrations than theirs could be found for the revolutions of the celestial spheres.*
>
> Therefore, Copernicus does not arbitrarily assert the motion of the Earth (as it appears to many uninformed persons) but, from the hypothesis of the Earth's motion and from other suppositions, he infers and explicates what can be observed in the heavenly bodies and in their orbs. He also presents the method and sound rules for mathematical reasoning as well as the means of judging the phenomena or appearances and of calculating the motions of the heavenly bodies.

Offusius's positive attitude toward the new postulates echoes Copernicus's cited statement from the preface to Pope Paul III, and also the end of Book I, Chapter 11, where Copernicus says that he hopes to use the Earth's motion as a principle and hypothesis for explicating the other heavenly motions. The instrumentalist stance of the Osiander preface seems absent or highly muted in Offusius's discussion.

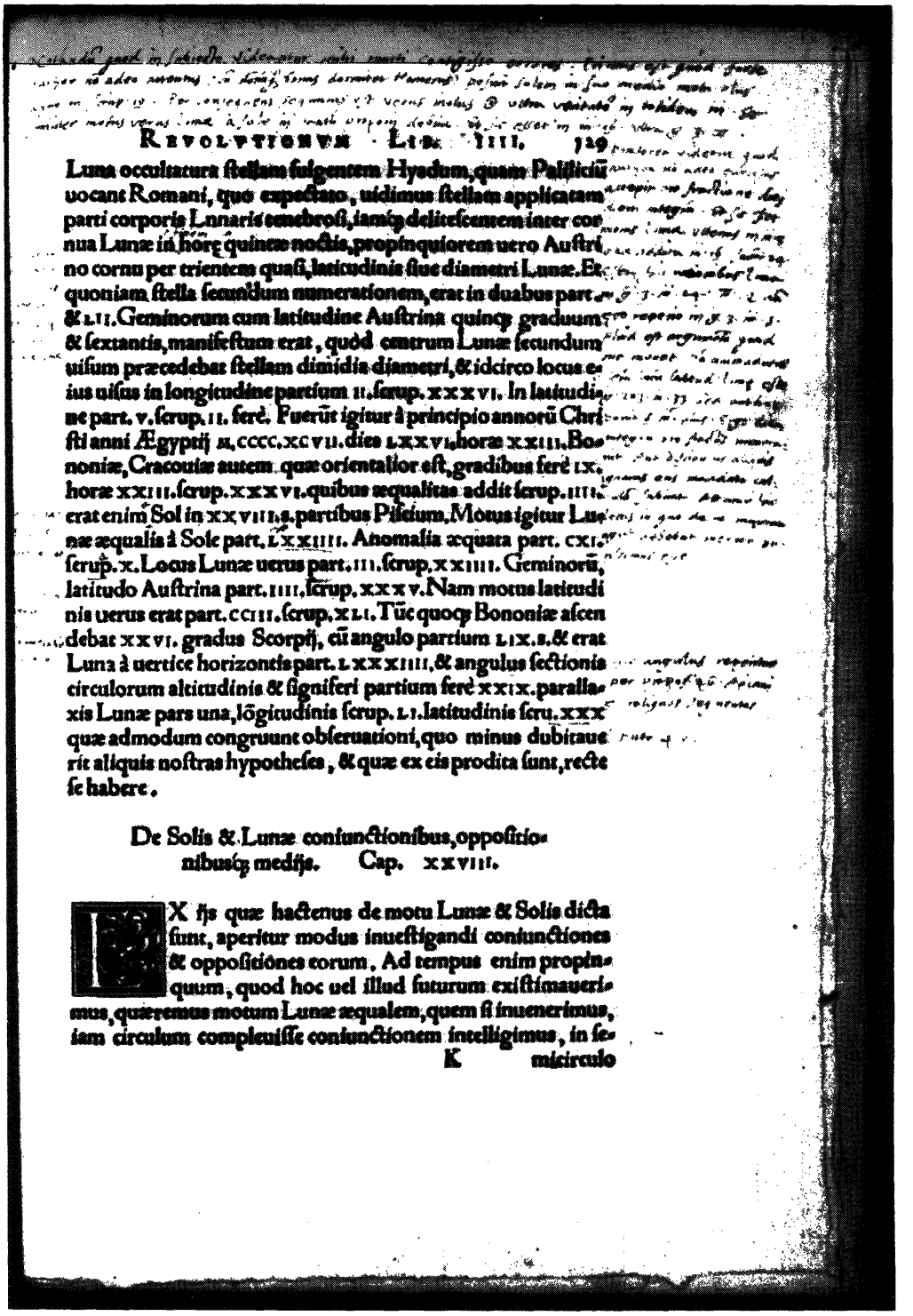
> The ancients used other hypotheses so that they could reach a certain level of agreement with and explanation of the planetary motions. Highly learned geometers, as if constructing mechanical devices, built into the realms of each of the planets many orbs so that the pattern of the motions can be skilfully represented. One can learn it from the theories of various authors such as Fracastoro, Peurbach, and so on.
>
> Even Archimedes is said to have made models of celestial motions,

> that is to say, of complete orbs, so as to make them manifest to the eye. Our contemporaries try to explicate the rules of motion with eccentric and concentric orbs, with epicycles and various circles.
>
> While one does not suppose that such machinery as they imagine is there in the skies, yet one should not judge them with the teaching of Averroës, nor according to the resentment of many, who deride offhand this science: it was created with the highest skills and it has led to harmonious laws of motions, allowing computations that are correct or at least very close to the reality. In this way the geometers do not propose that the pictures they substitute are those of the real heavens, but they do demonstrate in an educated way the reasons for the motions.

Fracastoro's *Homocentrica* (Venice, 1538) presented a scheme of homocentric spheres that did not lend itself to actual calculations. The Averroists had as their astronomer al-Bitruji, whose confused system of homocentric spheres was described in *Alpetragii arabi planetarum theorica physicis rationibus* (Venice, 1531). Peurbach's *Theoricae novae planetarum* (Nuremberg, 1474 and many later editions) concerned the physical (as opposed to mathematical) aspects of the planetary spheres, essentially an attempt to embed the eccentric circles and epicycles of the Ptolemaic astronomy into a system of homocentric aetherial spheres in the manner of Aristotle. These were all "physical" pictures, to be distinguished from the bulk of *De revolutionibus*, which fell into the mathematical or geometrical part of the curriculum. Offusius is clearly placing Copernicus among the mathematicians.

> This is how one should understand the position of the present author; out of them there follow highly satisfying predictions. The foundations of the motions are revealed more surely and more exactly than those from the automata and from the suppositions of geometers from Antiquity to these our own times.
>
> On the other hand, when the arguments from geometry and physics are inadequate, we do not doubt, following the testimony of the Holy Scripture, that the Earth is at rest and that the Sun moves. For the Psalmist clearly confirms the Sun's motion: "He set the tabernacle for the Sun, which is as a bridegroom coming out of his chamber, and rejoiceth as a strong man to run a race. His going forth is from the end of the heaven, and his circuit unto the ends of it" [Psalms 19:4–6]. Another Psalm tells of the Earth, "which He hath established for ever" [Psalms 104:5]. And Ecclesiastes in the first chapter states: "But the Earth abideth for ever. The Sun also ariseth, and the Sun goes down, and hastens to his place where he arose" [Ecclesiastes 1:4–5].

It is remarkable how closely Offusius here anticipates the specific scriptural references that Kepler and Galileo would later cite as the standard Biblical objections to the Copernican doctrine. The principal one omitted here is Joshua's commanding the Sun (not the Earth) to stand still at the Battle of Gibeon.



REVOLVTIONVM Lib. IIII. 129

Luna occultatura ſtellam fulgentem Hyadum, quam Palilicij uocant Romani, quo expectato, uidimus ſtellam applicatam parti corporis Lunaris tenebroſi, iamq; deliteſcentem inter cornua Lunæ in hora quinæ noctis, propinquiorem uero Auſtrino cornu per trientem quaſi, latitudinis ſiue diametri Lunæ. Et quoniam ſtella ſecundum numerationem, erat in duabus part. & LII. Geminorum cum latitudine Auſtrina quinq; graduum & ſextantis, manifeſtum erat, quòd centrum Lunæ ſecundum uiſum præcedebat ſtellam dimidia diametri, & idcirco locus eius uiſus in longitudine partium II. ſcrup. XXXVI. In latitudine part. V. ſcrup. II. ferè. Fuerũt igitur à principio annorũ Chriſti anni Ægyptij M.CCCC.XCVII. dies LXXVI. horæ XXIII. Bononiæ, Cracouiæ autem quæ orientalior eſt, gradibus ferè IX. horæ XXIII. ſcrup. XXXVI. quibus æqualitas addit ſcrup. IIII. erat enim Sol in XXVIII. 8. partibus Piſcium. Motus igitur Lunæ æqualis à Sole part. LXXIIII. Anomalia æquata part. CXI. ſcrup. X. Locus Lunæ uerus part. III. ſcrup. XXIIII. Geminorũ, latitudo Auſtrina part. IIII. ſcrup. XXXV. Nam motus latitudinis uerus erat part. CCIII. ſcrup. XLI. Tũc quoq; Bononiæ aſcendebat XXVI. gradus Scorpij, cũ angulo partium LIX. 8. & erat Luna à uertice horizontis part. LXXXIIII. & angulus ſectionis circulorum altitudinis & ſigniferi partium ferè XXIX. parallaxis Lunæ pars una, lõgitudinis ſcrup. LI. latitudinis ſcru. XXX quæ admodum congruunt obſeruationi, quo minus dubitauerit aliquis noſtras hypotheſes, & quæ ex eis prodita ſunt, recte ſe habere.

De Solis & Lunæ coniunctionibus, oppoſitionibuſq; mediis. Cap. XXVIII.

EX his quæ hactenus de motu Lunæ & Solis dicta ſunt, aperitur modus inueſtigandi coniunctiones & oppoſitiones eorum. Ad tempus enim propinquum, quod hoc uel illud futurum exiſtimauerimus, quæremus motum Lunæ æqualem, quem ſi inuenerimus, iam circulum compleuiſſe coniunctionem intelligimus, in ſemicirculo

K

FIG. 2. Offusius's marginalia on one of the most complex places in *De revolutionibus*, IV,27, on the lunar parallax. The uppermost comment is transcribed in ref. 15. All eight copies of Copernicus's book in the "Master of the 1550 Radices" series contain this note, in eight different hands. Reproduced with permission of the Trustees of the National Library of Scotland.

> Ptolemy, however, in Book I of the *Almagest*, explains on physical and geometrical grounds that the Earth does not move as a whole and undergoes changes only on a local scale, and he places it in the middle of the heavens as the centre of the universe.
>
> Our present author stands in opposition to those opinions; his reasons and demonstrations are worthy to be studied and admired even by those of the highest and most excellent intellect.

Before turning to a few specific marginal annotations in the book itself, it is useful to examine the relation of Offusius's major astrological work, *De divina astrorum facultate*, to the *De revolutionibus*. Although published posthumously in 1570, Offusius's book was apparently finished in late 1557. The preface is dated 8 January 1556, but this is possibly a fabrication on the part of his widow, for his *Ephemerides*, published early in 1557, refers to the work as in progress, and later in the book itself Offusius mentions "this month of December 1557". While the book is primarily concerned with planetary influences, it is physically founded to the extent of inquiring into planetary sizes and distances in an attempt to establish a basis for their influences. The *De divina astrorum facultate* explicitly mentions Copernicus twice, once in a footnote citing the eclipse geometry of IV,19 (for getting the distance to the Sun), and later when Offusius wishes to justify his choice that Venus lies closer to the Earth than Mercury. This can be true in the Copernican system, but it is somewhat ironical that Offusius uses Copernicus as one of the authorities since the book essentially follows the geocentric nesting of the planetary spheres in order to establish their distances.

As might be expected for someone interested in planetary distances, Offusius annotates some of the relevant places in *De revolutionibus*. First, there is a significant note where Copernicus introduces the dimensions of the solar system. In I,10, the first place where specific numbers are found in *De revolutionibus*, Copernicus reviews the time-honoured nesting theory whereby the mechanisms of Mercury and Venus are tightly stacked between the Moon and Sun. He gives the Moon's maximum distance as $64\frac{1}{6}$ terrestrial radii, multiplies by 18 to get the Sun's distance, and subtracts the Moon's distance to get the interval between. Offusius writes on f. 8: "A sixth of a sexagesimal part equals 10′. It seems, however, that an error is committed here, and in place of one sixth should be written 27′. For 64 sexagesimal parts with 10′ lead to an Earth–Sun distance of 1155 parts. However, the author nevertheless puts 1160 parts, which agrees with multiplying $64^{p}27'$ by 18."[13] (Trivial as the note may seem, it was later picked out by Hagecius, as we will describe in a later section.)

One of the major annotations, and one found in all eight copies of *De revolutionibus* in this family, also deals with distances, this time of the Moon (Figure 2). In IV,27, a passage whose detailed understanding requires a familiarity with many different prior techniques, Copernicus deals with the lunar parallax. There, at the top of f. 129, Offusius has written:

> NB: Below it seems to me there are many errors. The first is that the author in not paying enough attention — for even the good Homer sometimes nods[14] — put the Sun in its mean motion 10′ above its mean value. As a consequence, it follows that the true motion of the Sun exceeds the actual value by the same number of minutes; and similarly one should put the true lunar elongation up as much. Thus it [the true position of the Moon] would be found 16′ beyond 3° of Gemini. Besides it seems that the author, not being critical enough, took a full day instead of a fraction of a day, thereby increasing the Moon's motion by 8′, which added to the 16′ makes 24′. Thus by these calculations the Moon would be 3°24′ into Gemini, whereas I found 3°5′. There is another argument that troubles me. I found the [argument of the] Moon's true motion in latitude as 203°33′, but the author makes it 8′ more. Thus he counted a full day instead of a fraction, or by his order some inexperienced student carried out the calculation. Yet this place, dealing with a highly important question, deserves to be quite flawless.[15]

This is indeed one of the most demanding calculations in Copernicus's book. It begins with a description of Copernicus's own observation of an occultation "which we made at Bologna after sunset on 9 March 1497. We observed that the Moon was about to occult the bright star in the Hyades [Aldebaran], and after waiting, we saw the star arrive at the dark part of the Moon and forthwith it disappeared between the horns of the Moon, at the end of the fifth hour of the night." A modern astronomer, armed with a recomputation of the circumstances, and even Copernicus's own manuscript note about the time of the occultation, can discover that Copernicus had to massage the time of his observation and to use an inferior position of Aldebaran to make it work.[16] Otherwise Copernicus has calculated the solar and lunar positions correctly by his own tables, though some of the subsequent numbers are slightly off. Unfortunately, at the beginning of the long paragraph transcribed above, Offusius stumbles in his calculations for the place of the Sun and Moon. Given the erroneous start, the subsequent remarks make sense, that is, a difference of 8′ in the Moon's motion could be accounted for by rounding up to midnight rather than calculating for the precise minutes before midnight. Interestingly enough, Offusius has added a series of short corrections to the rest of Copernicus's printed paragraph, and there he really does handle the detailed calculations with more accuracy than Copernicus did. In any event he has ameliorated his major criticism with the tempering remark that even the good Homer nodded.

Finally, we must mention the characteristic radices for 1550 regularly added to the mean motion tables, that is, the mean position of the Sun, Moon, or planet for 0^h 1 January 1550. Copernicus buries within his text the radices for midnight of the night preceding A.D. 1. Hence, anyone who wishes to use the book for computing planetary positions in the 1550s would find it very handy to have updated mean positions where they could be readily

found. However, most later users relied on Reinhold's *Prutenic tables*, where the numbers were conveniently tabulated for each century. In any event, the radices for 1550 would have been helpful for anyone contemplating the calculation of an ephemeris during that time, and it is to such an effort that we next turn.

Offusius as a Calculator of Ephemerides

Pontus de Tyard, the Pléiade, polymath, and future bishop, wrote in 1558 that "Jofranc Offusien, whose acquaintance and friendship I acquired with great pleasure while passing through Dieppe (about two years ago) made some [planetary tables] for one year only, to my knowledge different from all the rest".[17]

In the context, Tyard had been discussing both tables and ephemerides, and presumably here he referred to Offusius's published *Ephemerides anni salutis humanae 1557. ex recenti theoria, eiusque tabulis supputatae*. Several new ephemerides were produced for 1557, or beginning in that year. The reason was that the standard ephemerides, produced earlier at Tübingen by Johann Stoeffler, continued only through 1556. As the Stoeffler ephemerides were about to run out, in 1556, Johannes Stadius of Antwerp published the most impressive continuation, ephemerides for 17 years, based on the *Prutenic tables*.

Offusius, in the preface to his *Ephemerides*, indicated that he had worked on the problem of planetary influences for 14 years, and had become increasingly dissatisfied with the *Alfonsine tables*, which he rejected as worthless. He did not, however, mention either Copernicus or the *Prutenic tables*, apart from the obscure and oblique hint in the title of his book, the "ex recenti theoria", which presumably refers to Copernicus. But he was explicit in saying that he differs "from the tables of the most recent authors", which surely is an implicit reference to Reinhold. If we look at his ephemeris for January, it appears that Offusius was simply using Reinhold's *Prutenicae tabulae*, but when we examine the subsequent months, it becomes clear that Offusius was doing something "different from all the rest", although rather closely patterned on Copernicus's data. For the Sun, he has clearly adopted the Prutenic calculations, and for the Moon his deviations lie within 10′ of the Prutenic calculations. For the planets, however, the differences are striking even though the underlying relationship with the *Prutenic tables* remains clear.

In Figure 3 we show the errors in Martian longitudes for 1557 according to the Alfonsine, Prutenic, and Offusian calculations. The similarities and discrepancies speak for themselves. By March Mars was in retrograde, approaching opposition, and it would have been plain even with simple instruments that Offusius's calculations were deviating from the sky. Our thorough attempt to replicate his planetary calculations by changing the Copernican parameters, or by assuming certain computational simplifications or systematic errors, has failed. In retrospect, it is apparent from the irregu-

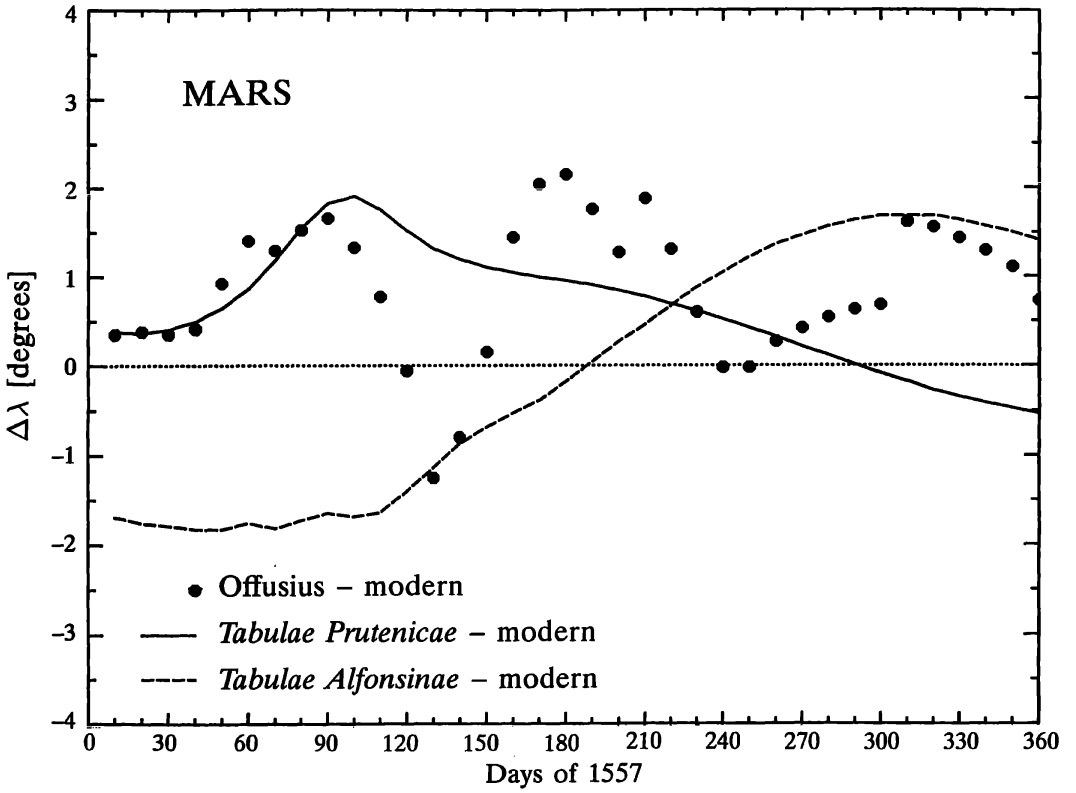


FIG. 3. Errors in geocentric longitude for Mars in 1557; note Offusius's whole degree discontinuities around days 201 and 300 (July 20 and October 27).

larity of Offusius's error curves that no adjustment of the handful of parameters governing the Alfonsine or Copernican calculation could give such an erratic pattern. Instead, the deviations must surely arise from an *ad hoc* attempt to fit the predictions to match certain positions, with an intermediate interpolation based heavily on the Prutenic positions. That this is surely the case can be seen by the fact that his stated positions for Mars suddenly jump by a degree on July 20 and again on October 27, but the on-going smooth interpolation leads back to either a Prutenic or an Alfonsine position.

Precisely how Offusius chose the places to modify the prior predictions is not clear, although he boasted in his *De divina astrorum facultate* that he had collected about 2700 observations. In the preface to his *Ephemerides*, Offusius announced that Mercury would pass in front of the Sun twice, on April 4 and September 19. He urged his readers to use two pieces of different coloured glass for viewing, and he excused himself from giving an exact hour because he said the theory of Mercury was still inexact, although he believed his theory was better than the others. The extent to which he was deluding himself appears in Figure 4, where we have plotted the longitude errors for Mercury in 1557. Baldly stated, he was wildly wrong in his transit predictions. Nevertheless, he generally succeeded rather better than Reinhold or

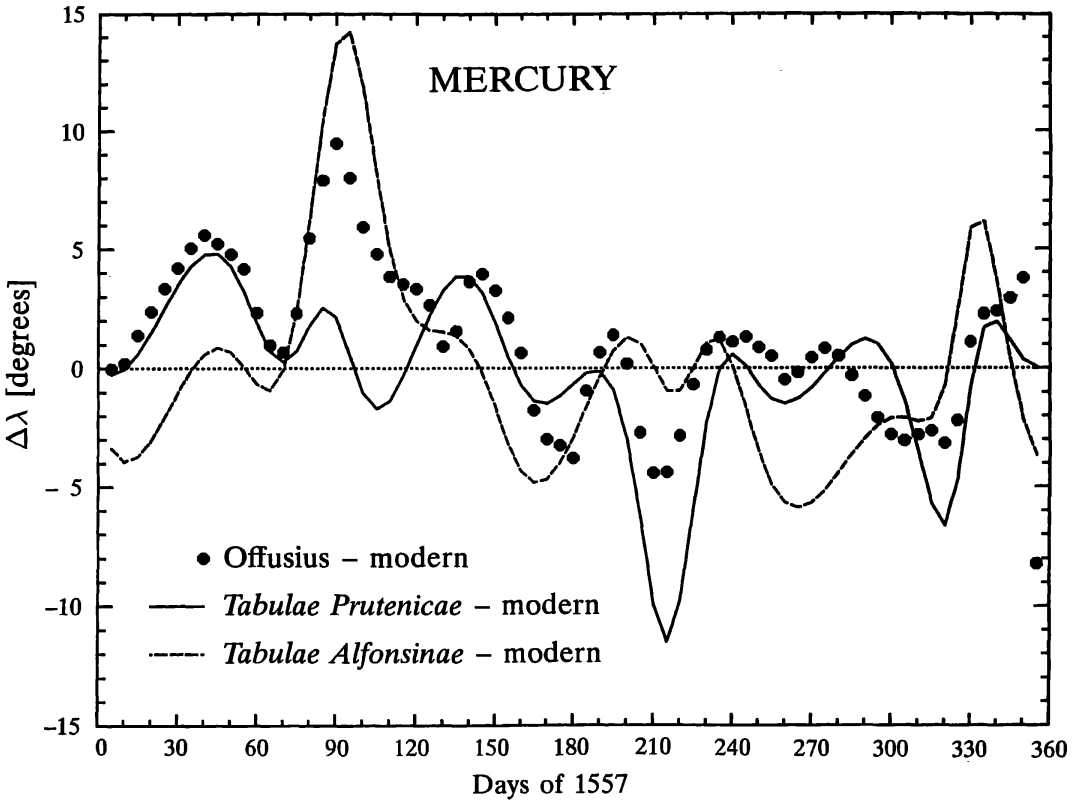


FIG 4. Errors in geocentric longitude for Mercury in 1557. Offusius has predicted transits on April 4 and September 19 (days 94 and 262); in the sixteenth century transits of Mercury were possible only at the end of April and the beginning of November.

Copernicus for Mercury, though the larger differences came at the time of inferior conjunction when the planet was invisible.

We should note for the record that Offusius published his *Ephemerides* during the year 1557, that is, not entirely in advance of the predictions. By that time Stadius's Prutenic-based ephemerides had become available, so they would have provided a handy crib. Offusius never follows him exactly, however, and in his *De divina astrorum facultate*, he explicitly damns the Stadius tabulations along with several Alfonsine ones. However, judging especially from the Martian results, we have strong doubts as to his technical proficiency as a planetary theorist.

The Parisian Astronomical Atelier

The discovery of an unprecedented number of copies of *De revolutionibus* with such similar annotations leads us to inquire about the Parisian astronomical scene in the mid-sixteenth century. Apart from the astronomical activity around Reinhold in Wittenberg, there has been no other comparable evidence for a major group of scholars so involved with the technical details of Copernicus's work. John Dee, who visited the University of Paris in 1550,

claims that 40,000 students were there, and among the seventeen friends whose names he lists (including six of the nine professors of the Collège Royal) were several astronomers.[18]

First in Dee's list was Oronce Fine (1495–1555), later also praised by Offusius's student Mesmes as the leading astronomer of France.[19] Fine was a prolific, if somewhat unoriginal, author and translator, and since 1531 had held the second chair of mathematics at the Collège Royal. Fine's junior contemporary and close friend was Antoine Mizauld (*c.* 1520–78), who published a posthumous edition of some of Fine's mathematical works, which included Fine's bibliography. Mizauld's specialty was astrological meteorology; he published *Phaenomena, sive aëriae ephemerides* (Paris, 1546) and later also two Alfonsine-based ephemerides, for 1555 and for 1556–57.[20] Other astronomers mentioned by Dee were Guillaume Postel (1510–81), who became the third royal professor of mathematics (in 1539) and who published several astronomical works in the early 1550s, and Paschasius Hamellius (Pasquier Duhamel) (d. 1565), who took over the first mathematics chair as of 1540, and who in 1545 issued an edition of the *Alfonsine tables*.[21] Dee also listed Jean Fernel (1497–1558), physician to Henry II, who had earlier published *Cosmotheria* (Paris, 1528) and other astronomical works (but who abandoned mathematics and astronomy after his wife and father-in-law complained about the cost of scientific instruments), Petrus Ramus (1515–72) whose innovative ideas and politicking would reshape the Collège Royal in the 1560s, and his student, Jean Pena (1528–58), who has been rediscovered in recent years as a Renaissance Stoic.[22]

Whether any of these men were the secondary annotators of these copies of *De revolutionibus* has not been determined, although a search of the Parisian archives for appropriate handwriting samples might establish some connections. On the one hand, the book itself was quite expensive — nearly $200 by present standards — so that it is unlikely that a tutorial group of undergraduates would be equipped with such a text. On the other hand, Offusius in his *De divina astrorum facultate* calls the public professors asses and sycophants, hardly suggesting warm, collegial relations with the better-known mathematicians of the Collège Royal, although such rhetorical flourishes were perhaps only part of the day's style. All we can stay is that the publication record from Paris in the 1550s indicates a lively astronomical industry, and these annotated copies of *De revolutionibus* shows that a recent and controversial cosmology was being examined in Paris in a predominantly Catholic setting as well as in the previously known Protestant settings such as Wittenberg and (eventually) Tübingen.

Offusius's Influence

As a type, Offusius seems to fall into the same category as Paul Wittich (*c.* 1546–86), who flourished in central Europe a generation later.[23] Both men were itinerant mathematical astronomers of unusual competence, in search of patrons and unconnected with universities, and both men attracted a series

of students who copied out the marginalia of their texts. Offusius was on the cutting edge of the new astronomy, for *De revolutionibus* was scarcely a decade old. Judging from his disparaging remarks about the professors in Paris, he must have been willing to take on the Establishment. However, since the 25-year-old John Dee seems to have sponsored him for a year,[24] and from the pleasant remarks made by the 35-year-old Pontus de Tyard, he apparently had a pleasing personality who made friends easily. His only identified student, Jean Pierre de Mesmes (1516 – after 1574), not only identified him as "my preceptor" but wrote a flattering remark at the end of his *De revolutionibus*:

> Jofrancus Offusius, not one of the common astronomers, made in 1552 for Master du Rousseau a very beautiful instrument for distinguishing the motion of the Sun and Moon.

(Master du Rousseau later became the Clockmaker for Paris, but is otherwise unidentified.) Mesmes's copy is today at the Bibliothèque Nationale (Paris BN).

Two other, anonymous, sets of annotations were clearly made from Mesmes's *De revolutionibus*. These are the one now in Soissons, and one at the Paris Observatory (Paris Obs), both of which carry derivative copies of the "Master Rousseau" passage. The existence of these annotated copies suggests that Mesmes in turn may have tutored astronomy students in Paris.

Little more can be said about the Soissons copy. More problematic is Paris Obs, which bears Peucer's *Ex libris* on its title page with the comment "manu sua notatus". This copy has a fair number of independent annotations, including a long passage on the title page that includes not only certain of the Offusian parameters but also a reference to Michael Maestlin's *Ephemerides*, which was not published until 1580. There are also some still later annotations that could conceivably have been added by the Wittenberg astronomer. Peucer became astronomy professor in 1554, and the inventory of his library made in the 1580s lists a *De revolutionibus* that remains otherwise unlocated.[25] He was jailed for crypto-Calvinism from 1574 to 1586, so his ownership would presumably have to fall after this, when he was still active as a Wittenberg astronomer, as his correspondence with Tycho Brahe indicates. The Paris Obs volume was eventually acquired by the eighteenth-century French astronomer J. N. Deslisle, an active book collector who spent two decades in St Petersburg and who collected books in many places. None of the annotations in the book, either Offusian or non-Offusian, seems to match Peucer's handwriting particularly well, although a few of the demonstrably later ones could be his. Considering all this evidence, we have to conclude that the copy was in Peucer's possession and by some strange fate finally returned to its earlier city.

In surveying Offusius's influence, these eight annotated copies of *De revolutionibus*, including his own, bear witness to his teaching. We must therefore sketch briefly what is known about the history of the other copies.

The member of the family with the fullest provenance is the one in

Debrecen. The annotations it carries seem particularly close to Offusius's original marginalia, and it is the only secondary copy to have significant notes on f. 8, where Offusius criticized Copernicus's quick calculation of the solar distance. As mentioned earlier, the book was purchased in Paris by the Hungarian polymath Johannes Sambucus (Jånos Zsåmboki) (1531–84) who inscribed his name and the date 1560 on its title page. Thereafter the copy seems to have remained in central Europe, participating in the minor wanderings of the Sambucus collection until it was purchased around 1780 by the Reformed Church Seminary in Debrecen.

The first edition now in Ann Arbor came from a French provenance, but the earliest ownership marks have not been identified. The combination of its having a copy of the Offusius annotations and a later French locale suggests that it spent most of its lifetime in the vicinity of Paris. By the eighteenth century, and probably by the seventeenth, the copy was in the Lamoignon Library, a distinguished private collection in Paris, which was subsequently auctioned in London in 1791.[26]

The *De revolutionibus* now in Pisa shows no signs of its earlier venues, so it is idle to speculate on the trail that led from the Offusius copy to Italy (although it it tempting to consider that perhaps Cardano was involved). Nor does the University of Oklahoma copy in Norman show much evidence of a provenance, except that it probably also resided for some time in Italy. However, it was annotated by someone fairly familiar with Offusius, because he changed the "ego" to "Vesalius" in three places, which, as we have mentioned, is a toponym for our Master of the 1550 Radices.

But what about the fate of Offusius's own copy, with its extensive appendix of lecture notes? Here the evidence for its trail has unexpectedly surfaced in a quite different place. In all likelihood the Prague astronomer Thaddeus Hagecius (Hayek) (1540–99) would have owned a copy of *De revolutionibus*, but no example with this provenance has turned up. However, the copy once owned by Johannes Praetorius, now at Yale, has a cryptic note reading:[27]

> Thaddeus Hagecius. I have received these from a certain person (Paul Wittich) [the identification presumably being added by Praetorius]. Some errors of Copernicus: IV,27: He takes the solar motion 10′ more than it should be so that the Sun is 16′ beyond 3° of Gemini. It seems he takes the integral day for the fraction of a day, and this is also proved by the motion of the Moon in latitude, which is squared off to an integral day if we follow Copernicus. I,10: [Where the text reads] "the distance to the Sun contains 1160 such parts..." he assumes the maximum distance of the Moon to be $64^{p}10'$ rather than $64^{p}27'$. [Where the text reads] "for indeed, between the apsides of Mercury [there are approximately 177′ parts]..." the error is 8′ parts.

As we have indicated, all eight Offusian copies contain a substantial note on f. 129. A few have minor notes on f. 8, but only one, the copy now in Edinburgh, has annotations sufficiently developed that might attract special attention, and these map into the remark attributed to Hagecius with such

uncanny detail that we can hardly avoid the conclusion that either the Edinburgh original or another now-lost close copy was in Hagecius's purview if not his actual possession.

It is interesting to note that neither Reinhold nor Homelius (nor Praetorius) made much of f. 129 as far as their own annotations are concerned. Paul Wittich, who presumably gave the information to Hagecius, does examine the point in some detail and on very comparable lines, which gives circumstantial confirming evidence to our conjecture that Wittich and indirectly Hagecius had access to the copy now in Edinburgh. In his copy of *De revolutionibus* now in the Vatican Library, Wittich has recalculated the equation of time of the occultation, perhaps to verify the Offusian claim about the day being rounded off to an integer part, but being a much better mathematician than Offusius, must have soon enough discovered that Offusius's criticism was erroneous. With respect to f. 8, however, Wittich does investigate that topic, with similar conclusions, and he also invokes Offusius at that point in one of his copies, using (without citation) a few of the numbers from *De divina astrorum facultate*. Surely Wittich or Hagecius saw the Edinburgh copy at some point, or heard about its annotations in detail, but did they know its source? Since Wittich mentions "Jofrantius" on f. 8 of his Vatican copy, it seems likely that he did.[28]

In conclusion, the identification of the Master of 1550 Radices as Jofrancus Offusius has solved one of the principal remaining mysteries uncovered by the Copernican census. It focuses a spotlight on Paris as a previously unrecognized nexus of Copernican studies. The existence of eight books with the Offusian annotations attests to Offusius's influence as a teacher and to his interest in the technical aspects of *De revolutionibus*. It also helps to delineate the still rather poorly understood role of the itinerant astronomical tutor, a role in which Paul Wittich and Nicolaus Raymerus Ursus are our previous principal exemplars.

REFERENCES

1. Owen Gingerich, *An annotated census of Copernicus'* De revolutionibus *(Nuremberg, 1543 and Basel, 1566)* (forthcoming, Leiden, 1994).
2. N. M. Swerdlow and O. Neugebauer, *Mathematical astronomy in Copernicus's De revolutionibus* (New York, 1984), 269, remark that the analysis of this passage "is of interest for a number of reasons, not the least of them being its complexity".
3. Erasmus Reinhold, *Ephemerides duorum annorum 50. et 51.* (Wittenberg, 1550), and G. J. Rheticus, *Ephemerides novae* (Leipzig, 1550); see Owen Gingerich, "Early Copernican ephemerides", *Studia Copernicana*, xvi (1978), 403–17.
4. Offusius's name is omitted from all the standard biographical reference works. His two books are duly described together with a few incidental references to him by Lynn Thorndike, *A history of magic and experimental science*, vi (New York, 1941), 22–24 and 108–11. Offusius's astrological writings are discussed in dissertations by Mary Ellen Bowden, "The scientific revolution in astrology: The English reformers, 1558–1686", Yale University, 1974, and Philip M. Sanders, "The regular polyhedra in Renaissance science and philosophy", University of London, 1990. We thank Dr Sanders for sharing the relevant chapter of his dissertation.
5. At that time we were still unaware that the Norman copy also belonged to the group, because it did not have the characteristic 1550 radices although it contains most of the other annotations.

6. f. 58: Circa hec sydera notandum quod anno 1550 currente demensus sum Hispali que sequuntur....
7. John Dee, *General and Rare Memorials pertayning to the Perfect Arte of Navigation* (London, 1577), f. ε iij. This preface has been reprinted in "Autobiographical tracts of Dr. John Dee", ed. by James Crossley, in vol. xxiv of the Chetham Society series (Manchester, 1851).
8. Dee wrote in his copy of Ficino's *De triplici vita*, "Similem ego lapidem vidi et eiusdem qualitatis. anno 1552 vel 1553. Aderant Cardanus Mediolanensis, Joannes Franciscus et Monsier Beaudulphius Legatus Regis Gallici in ædibus Legati in Sowthwerk." The connection with Offusius was pointed out by Philip M. Sanders, and is recorded in Julian Roberts and Andrew G. Watson (eds), *John Dee's library catalogue* (Bibliographical Society; London, 1990), 85, note 256. The book itself is in the Folger Shakespeare Library in Washington.
9. Mentioned in passing on p. 162 in Charles J. Mendelsohn, "Cardan on cryptography", *Scripta mathematica*, vi (1939), 157–68. Cardano received a privilege for his book from Henry II in June 1556, and was possibly in Paris at this time; his reference to Offusius is on p. 459 of the folio edition.
10. Pontus de Tyard, *Mantrice ou discours de la verité de divination par astrologie* (Lyons, 1558), cited in Thorndike, *A history of magic*, vi (ref. 4), 108.
11. We are grateful to James Walsh of the Houghton Library for this information.
12. In caput 5. An terrae competat motus circularis.

    Aliqui disputarunt moveri terram. Et Copernicus statuit nec octavam spheram nec Solem moveri, cum quidem caeteris coelestibus orbibus motum tribuit. Nonnulli etiam terram inter sydera collocant. Extat adhuc liber Archimedis de numeratione arenae, in quo narrat Aristarchum Samium hoc paradoxum tradidisse Solem stare immotum, et terram circumferri circa Solem. Etsi autem artifices acuti et perspicaces multa exercendorum ingeniorum causa querunt, tamen possumus iudicare non velle eos talia pro certis asseverare. Et huius nostri authoris Coper[nici] consilium et sententia in sua praefatione satis exponitur his verbis:

    Inde igitur occasionem nactus coepi et ego de terrae mobilitate cogitare. Et quamvis absurda opinio videbatur tamen quia sciebam aliis ante me hanc concessam libertatem, ut quoslibet fingerent circulos ad demonstrandum phaenomena astrorum: existimavi mihi quoque facile permitti, ut experirem, an posito terrae aliquo motu, firmiores demonstrationes, quam illorum essent, inveniri in revolutione orbium coelestium possent. [*De revolutionibus* f. iv]

    Non igitur omnino affirmat Copern[icus] terrae mobilitatem (quemadmodum multis imperitis videtur) sed ex hypothesi mobilis terrae, et ex aliis suppositionibus concludit et demonstrat ea quae observantur in astris eorumque orbibus. Et dat ordinem certamque regulam mathematicis rationibus, modumque de phenomenis sive apparentiis iudicandi ac corporum coelestium motus supputandi.

    Veteres per alias hypotheses processerunt, et ut aliquo modo constarent et comprehendi possent motus planetarum. Doctissimi homines geometrae, quasi fabricantes automata, plures orbes quasi domiciliis singulorum planetarum incluserunt, ut erudite motuum ratio reddi posset, quemadmodum discitur ex variis authorum theoriis, Fracastorii et Purbachi, aliorumque. Et quidem Archimedes dicitur αυτοματα motuum coelestium, videlicet integros orbes, fabricasse, et oculis hos motus subiecisse. Nostri per eccentricos et concentricos orbes, per epicyclos et varios circulos motuum regulas demonstrare conati sunt. Et licet re ipsa tales quales fingunt in coelo machinae esse non putantur, tamen non ob id ferenda est inter doctos Averroïs sententia, multorumque aliorum petulantia, qui hanc theoriarum doctrinam omnino derident qua [sic] et magna arte extructa est, et leges motuum concinnas docuit, ex quibus computatio institui vera aut certe proxima vero potuit. Sic geometrae tales nolunt in coelo esse picturas quales supponunt, sed erudite causas motuum ostendunt.

    Ita iudicandum est de positionibus huius authoris, ex quibus computationes longe concinniores instituuntur, motuumque ratio certius et exactius deprehenditur quam ex authomatis aut suppositionibus veterum geometrarum, qui de his ad haec usque tempore [*sic*] tractaverunt.

    Non dubitamus autem ex testimoniis divinae scripturae, quando argumenta geometrica et physica deficerent, terram ipsam esse immobilem at solem moveri. Nam psalmus clarissime affirmat moveri solem: Soli posuit tabernaculum in ipsis: Et ipse tamquam sponsus procedens de thalamo suo, exultat ut gigas ad currendum viam suam. Ab extremo caelorum egressus eius, et revolutio eius ad extremum eorum.

    De terra alius psalmus inquit: Qui fundavit terram super stabilitatem suam, non movebitur in eternum et semper.

    Et Ecclesiastes in primo cap[ite] inquit: Terra autem in aeternum stat. Oritur Sol et

occidit, et ad locum suum tendens ibi oritur.

Ptolemaeus autem libro primo Magnae Compos[itionis] demonstrat physicis et geometricis rationibus Terram non moveri motu locali sed tantum mutatione loci: Et in medio coeli situm centrum universi.

Quibus contrariae sunt positiones huius authoris, cuius rationes et demonstrationes dignae sunt, quas quantumvis magnum atque excellens ingenium contempletur atque admiretur.

13. 1/6, id est sextans 60 partium, sunt 10 m. Videtur autem hic error commissus, et loco sextantis unius, scribendum potius esse m 27. Nam sexag. 64 cum 10 m efficiunt a terra solis distantiam partium 1155. Author autem aliam ponit nempe partium 1160 quae constat ex partibus 64 et 27 m decies octies multiplicatis.
14. The allusion to Homer is lacking in the Debrecen and Oklahoma copies.
15. Notandum quod in subiecto videantur mihi multi contigisse errores. Primus est quod forte author non adeo attentus (cum nonnunquam bonus dormitat Homerus) posuit solem in suo medio motu plus aequo in scrupulis 10. Per consequens sequutus est verus solis motus ultra veritatem in totidem m[inuta]; et similiter verus motus lunae a sole in tantum proponi debuit et si sic esset in m.16 ultra g.3 Geminorum.

    Praeterea videtur quod author non adeo curiosus accepit pro fractione diei diem integrum et sic esset motus lunae ulterius in m.8 qua addita m.16 faciunt 24. Essetque iis rationibus luna in g.3 m.24 Geminorum, quam ego reperio in g.3 m.5.

    Aliud est argumentum quod me monet. Nam animadverti verum motum latitudinis lunae esse g.203 m.33 sed author ponit 8 m. plus, ergo diem integrum pro fractis numeravit aut discipulus aliquis ignarus eius mandato calculum subivit. Attamen hic locus (in quo de re maxima agitur) debebat merito purissimus esse.
16. This passage has been investigated in detail by Swerdlow and Neugebauer, *op. cit.* (ref. 2), 229–30, 266ff.
17. Tyard, *Mantice* (ref. 10); translation from Sanders's dissertation (ref. 4), 212.
18. Dee, "Autobiographical tracts" (ref. 7), 8.
19. See Emmanuel Poulle, "Fine, Oronce", in *Dictionary of scientific biography*, xv (1978), 153–7.
20. The existence of the 1546 publication and the extraordinarily rare *Ephemeris coelestis anni huius labentis 1555* (Paris, 1555) and the equally rare *Ephemeris coelestis anni huius bisextilis 1556* (Paris, 1556) for 1556–57 led Houzeau and Lancaster to invent a ghost series from 1546 to 1557.
21. See M. L. Am. Sédillot, *Les professeurs de mathématiques et de physique générale au Collége de France* (extrait du *Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche*, ii–iii, 1869–70) (Rome, 1869) .
22. See Peter Barker, "Jean Pena (1528–58) and Stoic physics in the sixteenth century", *The southern journal of philosophy*, xxiii (1985), 93–107.
23. See Owen Gingerich and Robert S. Westman, *The Wittich connection: Conflict and priority in late sixteenth-century cosmology* (*Transactions of the American Philosophical Society*, lxxviii, no. 7; Philadelphia, 1988).
24. Later, Dee, in a more crotchety mood, after the posthumous publication of *De divina astrorum facultate* in 1570, cried plagiarism and "foule injury" ("Autobiographical tracts" (ref. 7), 58); more charitably, John Heilbron writes that Offusius "perhaps propounded a few of the three hundred astrological aphorisms that his host [Dee] then confided to a manuscript now unfortunately lost" (*John Dee on astronomy:* Propaedeumata aphoristica *(1558 and 1568), Latin and English*, ed. and transl. by Wayne Shumaker (Berkeley, 1978), 54).
25. Robert Kolb, *Caspar Peucer's library: Portrait of a Wittenberg professor of the mid sixteenth century* (Sixteenth Century Bibliography, 5; St Louis Center for Reformation Research, 1979).
26. The subsequent history via the Radcliffe Observatory in Oxford will be traced in more detail in the Copernican census.
27. D. Taddaeus Hagecius: a quodam recepi: (Paulo Witichio). Error Copern: lib: IIII Cap. 27. Posuit solis motum, plus aequo in 10 scr. propter ita solem in 16′ ultra 3 gr $\frac{1}{2}$. Videtur accepisse pro fractione diei integrum diem, idque arguitur quoque ex motu latit: lunae qui ad integrum diem quadrat, si Copernicum sequemur. Item. lib. I, Cap 10. Solis intervallum contineri et illarum partium esse 1160. Item. Vult distantiam maximam lunae 64.10 sed 64.27. Item. Etenim inter absides Mercurii etc. Hic error est partium 8 cum dimidia.
28. See Gingerich and Westman, *The Wittich connection* (ref. 23), 39.