

Categorizing Dicuil's *De cursu solis lunaeque*

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Abstract

Dicuil's so-called *Liber de astronomia* has confused many modern scholars. Based on an analysis of its structure, this paper argues that the very nature of the work has often been misunderstood. It was never meant to be a textbook, but scholarly ad-hoc writing, shaped by some special, changing contexts of its presentations at the Carolingian court over the years 814–18. Dicuil himself later described the resulting work as *De cursu solis lunaeque*, which is more fitting than the common modern title.¹

Keywords

Dicuil, *Liber de astronomia*, *Epistula censuum*, computus, artes liberales, poetry, Irish scholars abroad, Carolingian court, Louis the Pious, Claudius of Turin, *Leiden Aratea*

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In 814 and the years following, the Irish scholar Dicuil wrote five books for the Carolingian Emperor Louis the Pious, commonly known as *Liber de astronomia*.² For a long time, this

¹ The research underlying this publication was funded by the Irish Research Council as part of a postgraduate scholarship in the Laureate Consolidator Award Project 'The Irish Foundations of Carolingian Europe (IFCE): The Case of Calendrical Science (Computus)'.

² Dicuil's work is referred to as *De cursu solis lunaeque* (or hereafter as *De cursu*) throughout this article, since this is a more appropriate title (as argued below); it is incompletely edited in Mario Esposito, 'An unpublished astronomical treatise by the Irish monk Dicuil', *Proceedings of the Royal Irish Academy (C)* 26 (1907) 378–446. Cf. the corrections in Mario Esposito, 'A ninth-century astronomical treatise' *Modern Philology* 18/4 (1920) 177–88. Both the transcription and the corrections have been reprinted in Mario Esposito, *Irish books and learning in medieval Europe*, ed. Michael Lapidge (Aldershot 1990), chapters 7–8. They are based on the incomplete codex Valenciennes, Médiathèque Simone Veil, MS 404 (386), fols 66^r–118^r (V; online at <https://gallica.bnf.fr/ark:/12148/btv1b8452582n/f.135.image>), accessed 05.11.2021. In 1929, Edward K. Rand, *A survey of the manuscripts of Tours*, 2 vols (Cambridge MA 1929) i, 193–94 discovered a second copy in Tours, Bibl. Munic., MS 803 ii, fols 58^r–103^v (T; not online yet; I thank the librarians of the BM Tours for allowing me to consult the manuscript *in situ* and to take photos). This led to several very important contributions on Dicuil's works by André van de Vyver, 'Dicuil et Micon de Saint-Riquier' *Revue Belge de Philologie et d'Histoire* 14 (1935) 25–47. Amongst other things, van de Vyver showed that the end of Dicuil's text in T had been displaced to Paris, BnF, MS NAL 1645, fols 1^r–7^v (P; online at <https://gallica.bnf.fr/ark:/12148/btv1b10032215p>), accessed

work received little attention — and rightly so, as some twentieth-century Latinists would say. Max Manitius rated it as ‘ohne jedes weitergehende Interesse’ (not of any further interest), Franz Brunhölzl as ‘ein rechtes Durcheinander sowohl dem Inhalt nach wie in formaler Hinsicht’ (a real mess, both in content and in form).³ Even its editor Mario Esposito judged:

The arrangement is chaotic and the chapters follow one another in the most arbitrary manner imaginable. The treatment of the subject is anything but clear⁴

In recent years, the general view on these five books has begun to change. Bernhard Pabst and Ernst Ulrich highlighted the stylistic originality of the so-called *Liber de astronomia*, namely its pioneering role for the use of *prosimetrum* and combinatorial poetry in the Middle Ages.⁵ Werner Bergmann and Immo Warntjes made the case that Dicuil was one of the most original and advanced computists of his time.⁶ Helen E. Ross & Betty I. Knott credited him with being the first Latin author to explain an important arithmetical formula on triangular numbers.⁷ Fabio Tutrone has asserted that Dicuil was outstanding in his reception of Lucretius’s *De rerum natura*.⁸ Still, this very list of exceptional features also highlights an important unresolved problem with the work: why does a *Liber de astronomia* contain computus, arithmetic, verse permutations, and metapoetry?

The simple answer is: it is not a handbook on astronomy. Dicuil never addresses the work by this title. In the table of contents in front of the work, only chapters of numbered, individual *libelli* are listed (i.e. *Capitula primi libelli incipiunt*, ‘The chapters of the first book begin’, etc.).⁹ The title *Liber de astronomia*, which is found above the table of contents in the

05.11.2021. The combined text of the latter two manuscripts is clearly more complete, and often more correct than the version on which Esposito’s transcription is based. E.g., V lacks the complete fifth book, but also many short parts of the text throughout the other books. So far, only some passages from this combined codex have been transcribed by Alfred Cordoliani, ‘Le comput de Dicuil’, *Cahiers de Civilisation Médiévale* 3/11 (1960) 325–37. Therefore, I am currently preparing a new edition, along with a first translation and commentary. In this article, I will refer to the books and chapters as structured by Dicuil; the folios in both manuscripts; Esposito’s page numbers, chapters (mostly identical with Dicuil’s structure), and subchapters (without base in text or manuscripts). Where applicable, I will also make reference to Cordoliani’s transcript, and the editions of a few short passages by Karl Strecker, *Poetae Latini aevi Carolini* 4/2–3, MGH Poetae (Berlin 1923) 659–60; 917, which are, like Esposito’s edition, only based on V. All citations are taken from my draft critical text, which is based on all codices and all previous editions, with *T* being regarded as the lead manuscript (and *P* as *codex unicus* for the text it covers).

³ Max Manitius, *Geschichte der lateinischen Literatur des Mittelalters*, 3 vols (Munich 1911) i, 651; Franz Brunhölzl, *Geschichte der lateinischen Literatur des Mittelalters*, 2 vols (Munich 1975) i, 307.

⁴ Esposito, ‘A ninth-century astronomical treatise’, 179.

⁵ Bernhard Pabst, *Prosimetrum: Tradition und Wandel einer Literaturform zwischen Spätantike und Spätmittelalter*, 2 vols (Köln/Weimar/Wien 1994) i, 345; Ulrich Ernst, ““Diachronic Turn”: zur Rezeption des Publilius Optatianus Porfyrius in der europäischen Literatur von der Spätantike bis zu den Avantgarden”, *Euphorion: Zeitschrift für Literaturgeschichte* 111 (2017) 343–94: 351.

⁶ Werner Bergmann, ‘Dicuils Osterfestalgorithmus im *Liber de astronomia*’, in Immo Warntjes & Dáibhí Ó Cróinín (eds), *The Easter controversy of Late Antiquity and the early Middle Ages: its manuscripts, texts and table. Proceedings of the 2nd international conference on the science of computus in Ireland and Europe, Galway, 18–20 July, 2008* (Turnhout 2011) 242–87: 261; Immo Warntjes, ‘Computus as scientific thought in Ireland and the Early Medieval West’ in Roy Flechner & Sven M. Meeder (eds), *The Irish in Early Medieval Europe: identity, culture and religion* (London, 2016) 158–78: p. 171; Immo Warntjes, ‘The mechanics of lunar calendars and the modes of calculating Easter, AD 400–1100: contexts and perspectives’, in Fondazione Centro italiano di studi sull’alto medioevo (ed), *La conoscenza scientifica nell’Alto Medioevo: Spoleto, 25 aprile–1 maggio 2019*, 2 vols (Spoleto 2020) i, 273–310: 291 n. 45–292 n. 46; 299–304; 310.

⁷ Helen E. Ross & Betty I. Knott, ‘Dicuil (9th century) on triangular and square numbers’, *British Journal for the History of Mathematics* 34.2 (2019) 79–94: 91–92.

⁸ Fabio Tutrone, ‘Lucretius Franco-Hibernicus: Dicuil’s *Liber de astronomia* and the Carolingian reception of *De rerum natura*’, *Illinois Classical Studies* 45/1 (2020) 224–52.

⁹ Dicuil, *De cursu* I vi (*T*, fols 58^r–58^v; *V*, fols 66^r–66^v).

edition, was invented by Esposito.¹⁰ By labelling the books as *Liber de astronomia*, Esposito implied that they were meant to be some kind of unified textbook or encyclopaedia on astronomy, only to later criticize them harshly for failing to fulfil his own expectation.¹¹ This shows how problematic this modern categorisation is. In order to understand Dicuil's work, this preconception has to be left aside. Instead, the actual nature of the *libelli* has to be reassessed, based on Dicuil's own remarks and on a thorough analysis of the structure.

A crucial step towards understanding this work was provided by Pabst. He suggested that the first two books were a series of unrelated didactic letters to Louis, but that they failed to impress the emperor, causing Dicuil to subsequently transform the work into a textbook.¹² While virtually no details of this hypothesis will be confirmed by the following analysis, the following basic idea is essential: the uncontested fact that Dicuil did not 'publish' these books at once, but in the course of several years, cannot be ignored when considering why he wrote them the way he did. Consequently, structure and purpose will be analysed book by book. As a help to the reader, a concise breakdown of the structure, contents, and context of the individual books can be found in the appendix of this paper.

Book I (814): Entertaining an Emperor

If one tries to make sense of the structure of the first book only by looking at the nine chapter headings in the table of contents, one is indeed likely to support Esposito's view of them as chaotic. If, however, one reads the complete book carefully, one can find an order that is not only straightforward in terms of content, but also highlighted by the author.

At the beginning of chapter six, Dicuil says

*En iterum poteris bina argumenta uidere*¹³

Look, **again** you will be able to see **two formulas**

Dicuil has at this point just finished a long account on two formulas (I i–iii and I iii–v respectively), and treats another two in this chapter. Hidden behind the six chapters are two distinct parts: two interrelated, very complicated calendrical formulas and two interrelated

¹⁰ Esposito, 'An unpublished astronomical treatise', 381; Esposito, 'A ninth-century astronomical treatise', 183.

¹¹ See also Brunhölzl, *Geschichte*, i, 307, characterising the text as 'eine Zusammenfassung des astromischen Wissens der Zeit' ('a summary of the astronomical knowledge of its time'), while accusing Dicuil extensively of digressions and a lack of consistency. The implication that the books were meant to be didactic in essence is ubiquitous in modern scholarship, and can even still strongly be seen in recent important, more differentiated contributions to the understanding of the work, such as Pabst, *Prosimetrum*, i, 330–37; John J. Contreni, 'Dicuil (fl. c. 725–825)', in H. C. G. Matthew & Brian Harrison (eds), *Oxford dictionary of national biography*, 61 vols (Oxford 2004) xvi, 132–34. The latter highlights comparatively clearly some of the important often-neglected features of the text: the dedication to Louis in yearly instalments, the purpose of displaying advanced computistic and poetic skills, and maintaining the emperor as a patron. While the credit of first clearly stressing the high scientific level of the text belongs to Bergmann, 'Dicuils Osterfestalgorithmus', 242–87, p. 244 shows that he still regarded the text as a didactic introduction to the basics of computus. His approach of structuring the work into three parts, the first of which includes (according to p. 247) some parts of Book II, underlines his conception of the work as a unit rather than a series of annual gifts. Arno Borst, *Die karolingische Kalenderreform* (Hanover 1998) 320, is aware of the written and oral presentation in instalments and points out that Dicuil's work contains expert knowledge. However, Borst only brings this up as part of his interpretation of the books as an argument against the Aachen encyclopaedia (see below p. 6) and its basic knowledge; this context alone does not explain many peculiarities of the structure, e.g., the long metrical parts.

¹² Pabst, *Prosimetrum*, i, 330–37.

¹³ Dicuil, *De cursu* I vi (T, fol. 61r; V, fol. 71v; cf. Esposito, 'An unpublished astronomical treatise', 388, c. 6.1).

arithmetical formulas, based on a geometrical principle. The calendrical formulas are complex and require many worked examples (I i and I iii) and exceptions (I ii–iii and I v). The arithmetical formulas are straightforward enough to work with a short explanation across a single chapter without requiring exceptions. Even though Dicuil repeats them in a poem, they are much shorter than the first five chapters. Especially if one only surveys the book’s contents, one might easily be led to judge the importance of contents by their quantity. In this case, the arithmetical formulas seem to be a short insertion that is completely out of place in the calendrical context, for which they have no relevance. However, seen from a qualitative point of view, this part is at least equal to the computistical one: Ross and Knott have pointed out that this chapter is the first Latin text to include an important formula on triangular and square numbers.¹⁴

Likewise, the last two chapters constitute a long and original metrical part, with the first medieval imitation of the verse permutations of Optatianus Porphyrius, *Carmen* XXV (fourth century; not to be confused with the picture poems Optatianus is better known for): four verses (mentioning the measuring of time, the sun, the moon, the stars, cycles, and the permuting of words) are repeated many times in changed word order.¹⁵ In I viii, they are surrounded by other quantitative poetry (i.e. hexameters) and a short prosaic passage, discussing this special kind of poetry and its presentation at court. I viii is a short epilogue, not addressing Louis, but readers who might correct the grammar of the work; this change is underlined by a shift to rhythmical verses. However, Dicuil is still commenting on the rules of versification, so this chapter is closely related to the previous one.

This tripartite structure of Book I is obscured by chapter vii. It mainly consists of two tables that clearly belong to chapters i–v, i.e. the first, calendrical part of the book, since they are completely irrelevant for the surrounding chapters vi and viii. However, there are several possible explanations why these tables might have ended up in I vii. For example, Dicuil certainly wanted to begin the tables at the top of a page, so that they could fit on one page each.¹⁶ Ideally, they were to be placed on two facing pages, in order to facilitate a comparison, as both tables provided different versions of the same set of data. If Dicuil ended chapter v in the middle of a page, especially a verso page, it would have made sense for him to add chapter vi before the tables, instead of wasting precious space. Alternatively, he might have noted down the tables before the formulas themselves, to have them at hand as a reference in the course of writing. In this case, he faced almost the same problem: he could only insert the loose folio after a verso page.

Another explanation is the presentation at court: Dicuil might have intended to read out chapters i–vi orally. Obviously, the tables were not suitable for this purpose. He might have added them as an appendix. If this was the case, it would indicate that Dicuil first intended to complete the book at this point, before having the idea to add a poetical part. The end of I vi would indeed have been a suitable epilogue. No matter which of these suggestions is actually correct, I vii belongs to chapters i–v in terms of content, and there are ways to explain its confusing placement reasonably.

To sum up, there are three seemingly unrelated parts:

¹⁴ Ross & Knott, ‘Dicuil’, 79–94.

¹⁵ Publilius Optatianus Porphyrius, *Carmina*, XXV, in Iohannes Polara (ed), *Publilii Optatiani Porfyrii Carmina* (Turin 1973) 99–102; on Dicuil’s originality, see Ernst, ‘Diachronic Turn’, 351; Optatianus as a model was first highlighted by Manitius, *Geschichte*, 649–50. I am going to discuss Dicuil’s reception of Optatianus and other authors elsewhere.

¹⁶ Dicuil, *De cursu* v i (T, fol. 97^v; cf. Cordoliani, ‘Le comput’, 329) stresses the importance of beginning tables on the top of a page.

- Original formulas to calculate the month of the year and the day of the month, based on lunar ages (I i–v and vii).
- Original formulas to calculate triangular numbers and to relate them to square numbers (I vi).
- Original, playful poetry (I viii–viii).¹⁷

(cf. the breakdown of all *libelli* in the appendix).

This would indeed be a very unsuitable first book of a handbook on computus or even astronomy.¹⁸ However, it does make good sense if we take the text for what Dicuil tells us it is — a demonstration of his talent to a new ruler:

*Usuram parui hanc lucri uolo reddere magnam,
ut non inueniar seruus malus ac piger esse,
concupiens terram fodere abscondendo **talentum**,
liber enim neque sum cogar ne reddere **censum**,
praesertim Franci portent dum **munera** regi.*¹⁹

I want to return this big interest on a small loan,
so that I do not appear to be a bad and lazy slave,
desiring to dig the earth to hide a treasure / my **talent** [a wordplay based on the two meanings of *talentum*].

For I am not free of being forced to deliver my **tribute**,
especially when the Franks are supposed to bring **gifts** for the king.²⁰

These lines have to be read in the context of their writing in 814, probably in April or May: Charlemagne, most likely Dicuil's former patron, died on 28 January. Charlemagne's son Louis, albeit co-emperor since 813, had his own court in Aquitaine. He arrived in Aachen on 27 February. It can be assumed that the new ruler was received with a considerable degree of anxiety. Charlemagne's testament devised the sale of his court library, which was barely a reassuring sign for scholars.²¹ In fact, Philippe Depreux lists Dicuil as one of only eight individuals who almost certainly kept their position at court when Louis succeeded

¹⁷ Cf. Pabst, *Prosimetrum*, i, 330–34.

¹⁸ Pabst, *Prosimetrum*, i, 330.

¹⁹ Dicuil, *De cursu* I viii (*T*, fol. 65^v; *V*, fol. 77^v; cf. Esposito, 'An unpublished astronomical treatise', 396, c. 8.6. For the reading and translation of *cogar ne reddere*, see van de Vyver, 'Dicuil', 29 n. 1. The purpose of entertaining and impressing the new emperor becomes important in several places, e.g., *Nunc genitum Carolo uolo delectare loquendo, / per ludum faciens illi argumenta canendo*. ('Now, I want to entertain the son of Charles with a talk, making the formulas playful for him, by reciting them'), I i (*T*, fol. 58^v; *V*, fol. 67^r, with *dilectare* instead of *delectare*; cf. Esposito, 'An unpublished astronomical treatise', 382, c. 1.1; Strecker, *Poetae* 4/3, 917).

²⁰ Dicuil repeatedly likens the books to the annual gifts of the rich and powerful Franks. He states that he wrote chapter I vi in April, and wants to present the work on 14 May. The best analysis of this is provided by van de Vyver, 'Dicuil', 27–30. He argues, based on the date Dicuil gives us for 814, that the custom of gift-giving in mid-May had become independent from the actual assembly at this point. Pabst, *Prosimetrum*, i, 331–32, suggests, based on Dicuil's wording, but less convincingly, that Dicuil could not present chapters i–vi as planned, and he might have sent them to the emperor later (and maybe separate from the remaining chapters). It would lead too far to analyse these questions in detail here; regardless of them, the purpose of being a gift to Louis is common to and essential for all parts of Book I.

²¹ Einhard, *Vita Karoli Magni* 33, in Georg H. Pertz/Georg Waitz/Oswald Holder-Egger (eds), *Einhardi Vita Karoli Magni*, MGH SRG (Hanover/Leipzig 1911) 40.

Charlemagne; Depreux even expresses a reservation for one of the other seven, and points out that Louis already knew a third one from Aquitaine.²²

Additionally, Louis brought along people from his own court — namely Claudius of Turin, who wrote a chronicle on the six ages of the world, at least partly in 814; he refers to this year as the present one, to Charlemagne’s death, and Louis’s succession.²³ Dicuil might have regarded him as a rival computist. In the previous years, an extensive (untitled) computistical-astronomical encyclopaedia had been written at court, commonly known under the names *3-book-computus*, *Libri computi*, or *Aachen encyclopaedia* (809 — maybe 812).²⁴ According to Arno Borst, Charlemagne had commissioned it as an authoritative and final reference work. Repeating some basic computistical contents was therefore not a very promising choice to impress the new Emperor. On the other hand, this shows that computus was clearly a topic of relevance to a ruler.

To sum up, Dicuil had to, or felt he had to, demonstrate his talent to a new patron at rather short notice. Combining the most impressive and original ideas he had to offer was much more suitable for this purpose than writing a straightforward overview. It also made sense to cover a broad range of his expertise, as a portfolio to outline his skillset.

To get a sense of Dicuil’s skill-set, let us look at all of his works:

- We can see a certain focus on computus in the *libelli*, with a dominating role esp. from Book III on.
- In 818, Dicuil wrote the *Epistula censuum*, a letter on units of measurement.²⁵ While it is hard to attribute this to any specific discipline, it is certainly a defining feature of Dicuil that he generally likes to approach various subjects by measuring them. In his

²² Philippe Depreux, *Prosopographie de l’entourage de Louis le Pieux (781–840)* (Sigmaringen 1997) 47.

²³ A complete edition of the text does not exist yet. Three manuscripts contain the full text: Madrid, BN, MS 9605, fols 104^r–117^v: 115^{r-v} (online at <http://bdh-rd.bne.es/viewer.vm?id=0000054177&page=1>), accessed 30.11.2021; Monza, BC, MS c-9/69, fols 66^r–83^v: 82^v; Vatican, BAV, MS Reg. lat. 1855, fols 69^r–80^r: 79^v (not yet part of the scholarly discourse, but listed on: <https://www.mirabileweb.it/title/de-sex-aetatibus-title/4544>), accessed 30.11.2021. The passage in question is also edited, mainly based on a fragment, as Claudius, *Ser. III* in Arno Borst, *Schriften zur Komputistik im Frankenreich von 721 bis 818*, MGH Quellen zur Geistesgeschichte des Mittelalters, 3 vols (Hanover 2006) iii, 1335–49: 1347. The year 814 is only explicitly specified as the present one in Monza and the fragment edited by Borst, but the other two manuscripts are closely related, and it seems most likely that this was skipped by a copyist when 814 was not the present year anymore. Various other computistical contents of the Monza MS (fols 41^v: LI; 42^{r-v}: LVII; 51^v: LXXXVIII) can be dated to 814. Immo Warntjes suggests that these might likewise derive from Claudius or his circle (in the forthcoming catalogue of computistical texts pre-900 on the project website of the IRC project ‘The Irish Foundation of Carolingian Europe’; I thank him for allowing me access to a draft). Borst discusses the context of the succession and the new position Claudius got at Aachen on pp. 1335–36. He asserts a mutual antipathy between Claudius and the Irish, particularly Dicuil, which is possible. However, Borst’s point that this was caused by Dicuil’s alleged blanket criticism of the *Aachen encyclopaedia* (see the following note) is questionable, at least for 814, as all the main contents Dicuil treats in this year are explicitly original rather than clearly criticizing any other work. Essential contributions on Claudius’s Chronicle are: Mirella Ferrari, ‘Note su Claudio di Torino, “Episcopus ab ecclesia damnatus”’, *Italia medioevale e umanistica* 16 (1973) 291–308; Michael I. Allen, ‘The chronicle of Claudius of Turin’, in Alexander C. Murray (ed), *After Rome’s Fall: narrators and sources of early medieval history* (Toronto/Buffalo/London 1998) 288–319; Elisabetta Bellagente, ‘La chronica de sex aetatibus di Claudio vescovo di Torino’, *Aevum* 73 (1999), 237–46; C. P. E. Nothaft, ‘Chronologically confused: Claudius of Turin and the date of Christ’s passion’, in Immo Warntjes & Dáibhí Ó Cróinín (eds), *Late antique calendrical thought and its reception in the early Middle Ages. Proceedings of the 3rd International Conference on the Science of Computus in Ireland and Europe, Galway, 16–18 July, 2010* (Turnhout 2017) 265–92; Immo Warntjes, ‘The lost fragment of Claudius of Turin’s Chronicle rediscovered, and the relation between Paris BnF Lat. 5001 and Lat. 7400B’, *Filologia Mediolatina* 27 (2020) 383–92.

²⁴ *Lib. comp.*, edited in Borst, *Schriften*, iii, 1054–1334.

²⁵ *P*, fols 7^v–14^v; the relationship of this work to *De cursu solis lunaeque* is discussed below on p. 14.

first *libellus*, he measures time, approaches numbers geometrically, and measures words, syllables, etc. of verse permutations.

- In *De prima syllaba* (825), Dicuil addresses the problem of the metrical length of the first syllable of words whose metrical quantity is often unclear.²⁶ Therefore, this can be attributed to the discipline poetics (or, more generally, to grammar), like the third part of the first *libellus*.
- At an unknown date, Dicuil added a poetic epilogue to Priscian's *Partitiones XII versuum Aeneidos principalium*, which is a poetic and grammatical analysis of the beginnings of the twelve books of the Aeneid.²⁷ This is again reminiscent of Dicuil's analysis of his own verse permutations in I viii.
- In 825, Dicuil refers to the recent completion of a now-lost *Epistola de quaestionibus decim artis grammaticae*, which can obviously be categorised as a grammatical work.²⁸
- Dicuil's (so far) best known work is the *Liber de mensura orbis terrae*, largely a compilation of geographical measurements from ancient sources.²⁹ As pointed out by Natalia Lozovsky, the title and content of *De mensura orbis terrae* are very closely related to geometry in the literal sense — measuring the earth.³⁰ When writing about the triangular numbers in I vi, Dicuil stresses that they are based on a geometrical principle.³¹

Furthermore, Dicuil keeps interrelating these areas: even the titles of his grammatical treatises include numbers and connotations of measuring (*De prima syllaba*; a poetic epilogue to Priscian's *Partitiones XII versuum Aeneidos principalium*; *Epistola de quaestionibus decim artis grammaticae*). All of his works contain poetry and grammatical remarks. In the table of contents to the *Epistula censuum*, he explicitly relates measurements to grammar.³²

In conclusion, the three individual parts of Book I make perfect sense if the intention was to demonstrate three of Dicuil's talents: computus, arithmetic/geometry, and grammar (especially poetics). Even more, far from being just a random array of disjointed contents, the *libellus* shows Dicuil's ability to interrelate the different areas of his expertise. Parts one and two provide two interconnected, original formulas each, and both of these features are stressed by Dicuil:

²⁶ Van de Vyver, 'Dicuil', 25–47, has demonstrated that a part of the *De prima syllaba*, previously attributed to Micon of Saint-Riquier, was actually written by Dicuil. The text is edited from the manuscripts Brussels, BR, MSS 10470–73 and Rouen, Bibl. Munic. Parment, MS 1470 (O 32) in Max Manitius, 'Micon v. St-Riquier "de primis syllabis"', *Münchener Museum für Philologie des Mittelalters und der Renaissance* 1 (1911/12) 121–77. Karl Strecker, 'Studien zu karolingischen Dichtern, I: zu Micons Schrift "De prima syllaba"', *Neues Archiv* 43 (1922) 477–87 showed that there are two independent texts: the poetic prologue on pp. 124–26 of Manitius's edition belongs to the second text, p. 154 l. 20–p. 177. This is the part attributed to Dicuil by van de Vyver, 'Dicuil', 36–40.

²⁷ Dicuil, *De grammatica*, Ernst Dümmler (ed), *Poetae Latini aevi Carolini* 2, MGH Poetae (Berlin 1884) 667–68.

²⁸ Dicuil, *Liber de mensura orbis terrae* 1 (hereafter *De mensura*), in James J. Tierney [& Ludwig Bieler], (ed & trans), Dicuil, *Liber de mensura orbis terrae* (Dublin 1967) 44–45.

²⁹ Dicuil, *De mensura* (Tierney [& Bieler], *Liber*, 44–103).

³⁰ Natalia Lozovsky, 'The earth is our book': *geographical knowledge in the Latin West ca. 400–1000* (Ann Arbor MI 2000) 29.

³¹ Dicuil, *De cursu* I vi (*T*, fol. 61^r; *V*, fol. 72^r; cf. Esposito, 'An unpublished astronomical treatise', 388, c. 6.2).

³² *T*, fol. 58^v: *Capitula epistulae censuum quae in fine aliena non est a grammatica*. ('The chapters of the Letter on Measurements, which is not unrelated to grammar after all').

*de quibus ulla prius numquam argumenta fuere.*³³

never before have there been any formulas about these rules!

En iterum poteris bina argumenta uidere,

*si placet auriculis noua iura haec sumere uestris.*³⁴

Look, **again** you will be able to see **two formulas**

if it pleases your ears to perceive these **new laws**.

The verse permutations feature the sun and moon, the pillars of computus. Dicuil's poetry on the numbers of syllables, metrical feet, words and verses within these verse permutations highlights that versification in general, and this combinatorial poetry in particular, have something to do with numbers, patterns, and measuring. Finally, the first two parts already contain considerable poetic passages. There are short prologues and epilogues in verse to the computistical formulas and tables. The formulas on triangular numbers are repeated in a longer poem.

Book II (815): a Promise Fulfilled

At the end of Book I, Dicuil promises Louis:

*Hoc tibi si placeat paria addam munera rursum.*³⁵

If this should please you, I will add equal gifts again.

Dicuil explicitly refers back to this at the end of Book II:

*anno in praeterito promissum suscipe donum.*³⁶

take the gift promised last year.

This shows that the main purpose of Book II was to follow up on the gifts — and therefore the demonstration of Dicuil's skill-set — of the previous year. In contrast to the situation after Charlemagne's death, he had a whole year at his disposal. In consequence of all this, Book II is closely related to Book I, and in some ways more sophisticated.

This can best be seen from the last part, representing Dicuil's poetic skills: II xiii consists of verse permutations and their discussion, exactly like I viii. Dicuil repeats exactly the same four verses, but with even more permutations. While he strictly followed the pattern provided by Optatianus Porphyrius in Book I, he now adds original combinations. II xiii is a short rhythmical epilogue, like I viiii, but directed to Louis instead of critics.³⁷ In addition,

³³ Dicuil, *De cursu* I i (T, fol. 58^v; V, fol. 67^r; cf. Esposito, 'An unpublished astronomical treatise', 382, c. 1.1; Strecker, *Poetae* 4.3, 917).

³⁴ Dicuil, *De cursu* I vi (T, fol. 61^r; V, fol. 71^v; cf. Esposito, 'An unpublished astronomical treatise', 388, c. 6.1).

³⁵ Dicuil, *De cursu* I viii (T, fol. 65^v; V, fol. 67^v; cf. Esposito, 'An unpublished astronomical treatise', 397, c. 8.6).

³⁶ Dicuil, *De cursu* II xiii (T, fol. 74^v; V, fol. 91^r, with *promisum* instead of *promissum*; cf. Esposito, 'An unpublished astronomical treatise', 414, c. 13.7).

³⁷ *Pulcherrimam auream non habeo aleam; / aleas, quas habeo, tibi donare uolo.* ('I do not have a very beautiful, golden dice game – the dice I have, I want to give to you!'), Dicuil, *De cursu* II xiii (T, fol. 75^r, with *uoleo* instead of *uolo*; V, fol. 91^r; cf. Esposito, 'An unpublished astronomical treatise', 414, c. 14.1; Strecker, *Poetae* 4/2, 660). Cf. the way Dicuil belittles his own gifts to Louis in *De cursu* I vi (T, fols 61^v–62^v; V, fol. 72^v–73^r; cf. Esposito, 'An unpublished astronomical treatise', 389–90, c. 6.4 and c. 6.6; Strecker, *Poetae* 4.3, 917).

Dicuil provides a rhythmical interlude on the use of prose and poetry in II vii (where he changes from prose to verse).

Similarly, the first five chapters (i.e. II ii–vi) of the computistical part are closely related to the five computistical chapters of Book I (i.e. I i–v). While Dicuil calculated the number of the (solar) calendar month in the year in I i–iii, he calculates the lunar month in II ii–iiii; and the calculation of the lunar ages in II vi–vii (from days of the month or the year) is the direct counterpart to the calculation of (solar) calendar days in I iii–v.

The remaining computistical chapters (II viii–xii) are poems, which relates them to the following poetic part (II xiii–xiiii). With Easter reckoning (II viii), *bissexus* (‘leap-year day’) and *saltus lunae* (‘leap of the moon’) (II viii–x), as well as cycles (II xi–xii), they cover the main computistical topics of Books III and IIII. Dicuil might have been testing the waters for his intended focus of the following year, or he could even already have tried to connect Book II to the prospective *libelli*. Another promise to Louis proves that he already had the next instalment in mind:

*Hoc tibi si placeat rursus addam munera pulchra.*³⁸

If this should please you, I will add beautiful gifts again.

While Dicuil uses almost exactly the same words as in I viii, he replaces *paria* (‘equal’, see above) by *pulchra* (‘beautiful’). This is a further indication that he did not plan to stay too close to the first two books, but to add more variation, as appropriate for a gift.

A further indication of Dicuil’s increased attention to the structure of the series as a whole is his introduction of a focus for each book. In II i, he reveals that the first book was treating the sun.³⁹ This was not apparent before. The sun played an important role in the verse permutations, but the main reasoning becomes clear in comparison to Book II, which Dicuil assigns to the moon: the formulas in Book I were calculating solar data (calendar months and days), those in Book II the respective lunar data (lunar months and ages). The moon also features in the verse permutations of Book II (as it already did in Book I). To further justify the focus of Book II, Dicuil comes up with the argument that the planetary intervals in II i are a lunar topic, as the distance from the earth to the moon serves as a basic measure, to which all other distances are related.⁴⁰ As can be seen from this, the foci are not to be understood as titles of a topic that is then treated like in an encyclopaedia or handbook, but rather as leitmotifs connecting the different parts; therefore, they will from here on always be referred to as such.

In terms of its topic, II i seems out of place at first glance, but it actually might be the most revealing chapter of the whole work. Even though the connection to the triangular and square numbers in I vi is not obvious, this first part of Book II can clearly be regarded as the ‘sequel’ to the second part of Book I. Both chapters are thematically clearly distinct from the rest of their books. While I vi was teaching arithmetical formulas based on a geometrical reasoning, II i obviously adds the Classical astronomy of the *artes liberales* to Dicuil’s portfolio, which is not a surprise in the context of computus and of verse permutations featuring the sun and the moon. Additionally, Dicuil picks once again exactly a topic at the borderline of two disciplines: treating the tones of the heavenly spheres, an astronomic model based on

³⁸ Dicuil, *De cursu* II xiii (*T*, fol. 74^v; *V*, fol. 91^r; cf. Esposito, ‘An unpublished astronomical treatise’, 414, c. 13.7).

³⁹ *Postquam iam cecini parcum de sole superno, / pauca canam uariae de lunae cursibus imae ...* (‘After I have already sung a bit about the sun above, I am going to sing a bit about the courses of the changing moon below ...’), Dicuil, *De cursu* II i (*T*, fol. 66^v; *V*, fol. 78^v, with *tantum* instead of *paruum*; cf. Esposito, ‘An unpublished astronomical treatise’, 398, c. 1.1).

⁴⁰ *Quantum inter terram legimus culmenque polorum; / in quo esse argumenta uidens lunaria cernes.* (‘We read how much space there is between the earth and the vault of the heavens; you will see that lunar formulas appear in this’), Dicuil, *De cursu* II i (*T*, fol. 66^v; *V*, fol. 78^r, with *esse hic* instead of *in quo esse*; cf. Esposito, ‘An unpublished astronomical treatise’, 398, c. 1.1).

music, he marks the whole *quadrivium* as his territory with minimal effort, using two opposite intersection points of the disciplines.

But the chapter goes even further: if measuring the earth, as in Dicuil's *Liber de mensura orbis terrae*, is geometry in its literal sense, then measuring the distances between the earth and the planets has a geometrical connotation as well.⁴¹ Lastly, a large part of Dicuil's own contribution to the content is the calculation of specific (for the ninth century) very large numbers in leagues, miles, and *stadia*. His main source Pliny only specifies multiples.⁴² In this way, Dicuil adds arithmetic to the chapter, relating it to the entire *quadrivium*.

Mastering large numbers is not only a mathematical but also a poetic challenge: II i is a poem, once more demonstrating Dicuil's metrical talents. Its poetic form connects it to the end of Book II and to the immediately preceding end of Book I. By focusing on measuring distances, and on dealing with different units of measurement, Dicuil is even foreshadowing (probably unintentionally, but in light of his interests not accidentally) two of his later works: the *Epistula censuum* and the *Liber de mensura orbis terrae*.⁴³

Books III and III (816): a Special Year

At first glance, Book III seems to break with the structure employed in the previous two books (i.e. the combination of parts dedicated to the *quadrivium*, computus, and poetry), as well as with the purpose of impressing Louis and the court. It contains neither a primarily poetic part, nor a reference to the year of its writing, nor does it address Louis explicitly. Moreover, it introduces an additional table of contents with fourteen subchapters for chapter iii.⁴⁴ Pabst noticed that the work changes at this point and rightly pointed out that this has to be seen in the light of changing contexts; he suggested that Dicuil had given up hope of impressing Louis, and therefore tried to turn the work into a computistical textbook.⁴⁵ While this is an essential and impressive contribution, especially given that Pabst just surveyed the work as part of a study of medieval prosimetrum in general, a close study of content and context points into another direction.

First, the chapter on planetary distances (II i) receives its direct sequel in the following book, a poem discussing planetary orbits (III i). At this point, Dicuil is keeping Book III more obviously close to Book II than Book II to Book I. As he highlights in II i that he knows of Louis's interest in such content, it is likely that he started Book III with another astronomical poem for the same reason. This chapter provides evidence that Book III is still very much to be analysed in the context of the Carolingian court.

A very valuable clue here is the number Dicuil provides for the orbit of Mercury, 338 days, which differs from all known Pliny manuscripts (9 days less than the 348 days of Venus, i.e. 339 days).⁴⁶ The arguably most famous manuscript related to Louis the Pious is a luxury

⁴¹ Cf. Lozovsky, 'The earth', 29.

⁴² Plinius, *Naturalis historia*, II 83–88, in Karl F. T. Mayhoff & Ludwig von Jan (eds), *C. Plini Secundi Naturalis historiae libri XXXVII*, 5 vols (Leipzig 1875) i, 153–56, alternative chapters 21(19)–23(21); Esposito, 'A ninth-century astronomical treatise', 180; Tutrone, 'Lucretius', 237–38.

⁴³ Dicuil, *Epistula censuum* (P, fol. 14^v) contains a short note on the homonymous meanings of *tonus* ('tone'), one of which is the distance to the moon, like in *De cursu* II i.

⁴⁴ T, fol. 76^r; V, fol. 93^r (with a sign indicating where the table is meant to be inserted, which was overlooked by Esposito, 'An unpublished astronomical treatise', 417, c. 3.1. This has already been discussed by Immo Warntjes, 'The mechanics', i, 291 n. 45).

⁴⁵ Pabst, *Prosimetrum*, i, 330–37.

⁴⁶ Dicuil, *De cursu* III i (T, fol. 75^r; V, fol. 91^v; cf. Esposito, 'An unpublished astronomical treatise', 415, c. 1.1); cf. Pliny, *Naturalis historia*, II 39 (Mayhoff & von Jan, *C. Plini Secundi*, 138, alternative chapter 8(6)).

edition of the *Aratea*, an ancient astronomical poem, often assumed to have been produced by a workshop in Aachen.⁴⁷ At its end, on fol. 93^v, it contains a diagram of a planetary configuration and constellations. While there are epicycles of Mercury and Venus around the sun (according to Martianus Capella) on the pictures, the written data are Plinian. Richard and Marco Mostert date the planetary configuration to spring 816, and Elly Dekker specifies this convincingly to the Easter moon of 816 (based on the position of the planets in relation to the constellations).⁴⁸ Exactly like Dicuil's chapter III i, the *Leiden Aratea* contains the number 338 days for the orbit of Mercury.⁴⁹ Dicuil wrote his third *libellus* around the same time: while there is no specific date, he presented Book II in 815, Book III in 816.⁵⁰ Dicuil making the same mistake in an astronomical poem as in the diagram appended to another astronomical poem, written almost certainly at the same time, in the same place, and for the same patron, is hardly a coincidence. So far, the anonymous author of the *Vita Hludowici imperatoris*⁵¹ (commonly known as *Astronomus*) has been suggested as editor of Leiden Voss. Lat. Q. 79, solely based on the facts that he was at court in 816, and was consulted on an astronomical event by Louis years later.⁵² The relationship of Dicuil to the manuscript is manifestly closer, if only because both listed the planetary orbits in the same context. This is no proof yet that Dicuil was the editor: he could have been a member of a group project, he could have consulted the manuscript after its completion to use the numbers for his poem (or the other way round), or both authors could have consulted the same flawed manuscript or excerpt of the *Naturalis historia* in the palace library. Nevertheless, the evidence of a direct connection between Dicuil and the *Leiden Aratea* is firmer than for any other known person.

The leitmotif Dicuil assigns to Book III at its beginning is 'cycles': the planetary orbits are closely related to the computistical part, which focuses on cycles; Dicuil uses the same Latin words for orbits and cycles.⁵³ He treats the *cyclus decemnovennis* in chapter ii, and the

⁴⁷ Florentine Mutherich, 'Book illumination at the court of Louis the Pious', in Peter Godman & Roger Collins (eds), *Charlemagne's heir: new perspectives on the reign of Louis the Pious (814–40)* (Oxford 1990) 593–604: 597–600; Richard Mostert & Marco Mostert, 'Using astronomy as an aid to dating manuscripts: the example of the Leiden Aratea planetarium (Leiden, UB, Vossius Q79)', *Quaerendo* 20 (1990) 248–61: 260–61; cf. (more cautiously): Cornelis L. Verkerk, 'Aratea: a review of the literature concerning MS. Vossianus Lat. Q. 79 in Leiden University Library', *Journal of Medieval History* 6 (1980) 245–87: 280–81; on the manuscript, cf. Ivana Dobcheva, 'Leiden, Universitaire Bibliotheken, VLQ 79' (revised: 31.05.2018), in *Aratea Digital, Descriptions* (online at https://aratea-digital.acdh.oeaw.ac.at/pages/show.html?document=desc__leiden_ub_vlq_79.xml&directory=descriptions), accessed 25.11.2021.

⁴⁸ Mostert & Mostert, 'Using astronomy', 248–61; Elly Dekker, 'Carolingian planetary observations: the case of the Leiden planetary configuration', *Journal for the History of Astronomy* 39 (2008) 77–90; cf. Bruce S. Eastwood, 'Origins and contents of the Leiden planetary configuration (ms. Voss. Q.79, fol. 93^v): an artistic astronomical schema of the early Middle Ages', *Viator* 14 (1983) 1–41: 2–4; Cornelis L. Verkerk, 'The heliocentric planetary configuration of the Leiden Aratea: a reaction to Bruce S. Eastwood's article in Viator', *Journal of Medieval History* 10 (1984) 145–47: 146; Eastwood, *Ordering*, 13; 146; 179; I thank C. Philipp E. Nothaft for discussing the dating of the configuration with me.

⁴⁹ Leiden, MS Voss. Lat. Q. 79, fol. 93^v. The astronomical data of the configuration are extensively listed and discussed by Eastwood, 'Origins', 1–41. The number 338 is listed on pp. 9 and 12, and discussed as a mistake on p. 13.

⁵⁰ Dicuil, *De cursu* II xiii (*T*, fol. 74^v; *V*, fol. 91^v); cf. Esposito, 'An unpublished astronomical treatise', 414, c. 13.7); III viii (*T*, fol. 96^v; *V*, fol. 117^v); cf. Esposito, 'An unpublished astronomical treatise', 445, c. 7.6).

⁵¹ *Astronomus, Vita Hludowici imperatoris*, edited and translated into German in Ernst Tremp, *Thegan, Die Taten Kaiser Ludwigs (Gesta Hludowici imperatoris) / Astronomus, Das Leben Kaiser Ludwigs (Vita Hludowici imperatoris)*, MGH SRG (Hanover 1995) 279–55.

⁵² Mutherich, 'Book illumination', 600; Mostert & Mostert, 'Using astronomy', 260; Elly Dekker, 'The provenance of the stars in the Leiden Aratea picture book', *Journal of the Warburg and Courtauld Institutes* 73 (2010) 1–37: 31.

⁵³ *Tertius incipiet tandem nunc nimpe libellus, / stellarum ciclos lunae solisque reuelans, / atque diem primum iam naturaliter anni.* ('The third book will certainly begin now, finally, revealing the cycles of the stars,

532-year cycle and its subperiods of 95 and 247 years in the very long chapter iii. Chapter iii lists various dates on which the beginning of the year could reasonably be placed; the choice of this date affects the lunisolar cycles, and the year is in a manner of speaking a small cycle itself (of 365.25 days, 12 Julian calendar months, and the seasons). Instead of adding a poetic end, as in both previous books, Book III follows immediately. This *libellus*, in turn, does not have a part primarily attributed to the *quadrivium*. Its leitmotifs are the *bissexus* and the *saltus lunae*, and it ends with an elaborate poetic part. Dicuil addresses the *rex* ('king') once and dates chapter viii to 816.⁵⁴ Again, the context provides the key for the understanding of a seemingly arbitrary structure.

Easter 816, as eternalised in the Leiden planetary configuration, was not a random Easter. 816 was the last year of a 95-year period: for all non-bissextile years, i.e. three out of four years, the Easter data repeat after this time, making this the most convenient period for updating the Easter tables. After 19 years, only the date of the Easter full moon repeats, not the Easter date itself; it was therefore more complicated to construct a new table after every *cyclus decemnovenalis*. Compiling a complete 532-year cycle would have required excessive time and writing material. Consequently, many Easter tables were extended for 95 years in 816. Warntjes suggests convincingly that this prompted Dicuil's detailed analysis of the Dionysiac Easter table.⁵⁵ In addition, 816 was a bissextile year (in contrast to the last years of the previous 95-year periods, 626 and 721), and a *saltus lunae* was imminent (in March 817 as preferred by Dicuil, in November 816 as attributed by him to certain *Angli*).⁵⁶ As a consequence, it can be assumed that the interest in these questions was outstandingly strong in this year. Dicuil might have analysed these phenomena himself in the course of preparing Easter tables; regardless of this, he had to expect that any interest in his thoughts on these topics would quickly wane. Therefore, he had to communicate them in one year, even if they provided enough material for two books. As the additional table of contents for III iii suggests, he might only have noticed in the course of writing that he had too much to say for a single book.

Borst and Warntjes pointed out that an anonymous computistical treatise written in Aachen in 816 addresses rare computistical features of the year 816 at the very beginning. Borst assumed that the author reacted to Dicuil's work (as a whole) in various indirect ways, Warntjes suggested that it was written as an objection to Dicuil's lecture from 816 (i.e. the presentation of Books III–III at court), particularly regarding the placement of embolisms and the *saltus lunae*.⁵⁷ This shows that there was an interest in these matters at court in 816. If Dicuil knew the letters Alcuin had written to Charlemagne between 797 and 799 on the occasion of the last *saltus lunae* (797) and an imminent *bissexus* (800), this might have confirmed him in writing to Charlemagne's son about the same topics.⁵⁸ If Books III and III together are regarded as one

of the moon and the sun, and furthermore, the first day of the year according to nature.'). Dicuil, *De cursu* III i (*T*, fol. 75^v; *V*, fol. 91^v; cf. Esposito, 'An unpublished astronomical treatise', 415, c. 1.1).

⁵⁴ Dicuil, *De cursu* III iii and viii (*T*, fols 93^r and 96^v; *V*, fols 113^r and 117^v; cf. Esposito, 'An unpublished astronomical treatise', 439 and 444, c. 4.5 and c. 7.6). As Louis was crowned emperor by Pope Stephen IV on 5 October 816 (after already having crowned himself co-emperor in 813), the wording might suggest that this text was presented before this date. Book IV is at least unlikely to be a gift for this specific occasion, which otherwise might have been a possible explanation for the writing of two books in 816.

⁵⁵ Warntjes, 'The mechanics', 292 n. 46.

⁵⁶ Dicuil, *De cursu* I v (*T*, fol. 60^v; *V*, fol. 71^v; cf. Esposito, 'An unpublished astronomical treatise', 388, c. 5.1–c. 5.2).

⁵⁷ Arg. *Aquens*. I, edited in Borst, *Schriften*, iii, 1350–66: 1356; Borst discusses the computistical challenges posed by this year to the author, often in relation to Dicuil's work, on pp. 1350–54; Arno Borst & Immo Warntjes (eds), *Hermann der Lahme: Schriften zur Zeitrechnung, mit Vorlagen und Nachträgen*, MGH, Quellen zur Geistesgeschichte des Mittelalters (probably 2022): the respective part of the introduction was written by Warntjes, whom I thank for allowing me access to this text before publication.

⁵⁸ Alcuin, *Epistolae* 126; 145; 171, in Ernst Dümmler (ed), *Epistolae Karolini aevi* 2, MGH Epp. (Berlin 1895) 185–87; 231–35; 281–83; cf. Dietrich Lohrmann, 'Alcuins Korrespondenz mit Karl dem Großen über

annual instalment, their structure is very similar to that of Book II, just with a massively increased computistical part on cycles, the *bissextus* and the *saltus lunae* (cf. the breakdown in the appendix). This long computistical part does still not constitute a textbook. An analysis of its content would require a separate paper. However, the studies of some of the contents by Bergmann and Warntjes show clearly that these were contributions to advanced computistics rather than an introduction for didactic use.⁵⁹ This is confirmed by the way Dicuil sometimes addresses an explicitly scholarly audience: *quisquis intellectualis* ('every scholar') and *quisquis ingeniose uixerit* ('whoever has lived the life of a scholar').⁶⁰ By contrast, Dicuil highlights for some other works that they are meant for *pueri parvi* ('little children') and *pueris plus quam sapientibus* ('rather for children than sages'), almost like adding a disclaimer for readers who expected him to write further texts for advanced scholars.⁶¹

In the second last part of Book III, Dicuil explicitly refers back to the second part of Book I: there, Dicuil repeated prose content in verse, in III vii he repeats the content of a poem in prose. He notes that this demonstrates why prose is more suitable for calculations.⁶² This last computistical part also gets more astronomical, by discussing the movements of the moon, the sun, and the zodiac, related to the poem on planetary orbits. At this point, Dicuil seems eager to gather various threads from the previous books.

Similarly, the last two chapters (III viii–viii) are elaborated poems, referring back to the verse permutations, the planetary astronomy, and all computistical leitmotifs of the previous books, as well as the process of writing.⁶³ It is not an ending in which the various elements are suddenly all used to solve a problem or to make sense of each other. Still, it is an ending in which Dicuil looks back at a series of related writings that seem to have been brought to a close.

Book V (817/18): Afterthought

Book V is only extant in what was originally one codex, Tours, BM, MS 803 ii, fols 97^r–103^v (*T*) and Paris, BnF, MS NAL 1645, fols 1^r–7^v (*P*). It consists of only two chapters. The first of them provides condensed Easter tables based on the range of all 35 possible Easter dates, with every potential lunar age on 1 January, the beginning of Lent, and Easter, along with poetic explanations. Chapter ii outlines regularities of the annual increment of the lunar ages within a

Kalender und Astronomie', in Paul L. Butzer & Dietrich Lohrmann (eds), *Science in Western and Eastern Civilization in Carolingian Times* (Basel/Boston/Berlin 1993) 79–115; Arno Borst, *Das Buch der Naturgeschichte: Plinius und seine Leser im Zeitalter des Pergaments* (2nd ed., Heidelberg 1995) 146–65; Kerstin Springsfeld, *Alcuins Einfluß auf die Komputistik zur Zeit Karls des Großen* (Stuttgart 2002) 33–61 (with a good overview of all of Alcuin's computistical or astronomical letters to Charlemagne).

⁵⁹ Bergmann, 'Dicuils Osterfestalgorithmus', 242–87; Warntjes, 'The mechanics', 291 n. 45–292 n. 46; 299–304; 310; Borst & Warntjes (eds), *Hermann* discusses Dicuil's advanced calculation of the length of a synodic lunar month in the same context as above.

⁶⁰ Dicuil, *De cursu* III iii 13; III i (*T*, fols 83^v; 89^v; *V*, fols 102^r; 109^r; cf. Esposito, 'An unpublished astronomical treatise', 427, c. 3.32; 435, c. 1.6).

⁶¹ Dicuil, *De prima syllaba* (Manitius, 'Micons von St Riquier de primis syllabis', 177); Dicuil, *De grammatica* 1 (Dümmler, *Poetae* 2, 667); see also comments directed to *alicui tardanti ingenio* ('any slow-minded person') and a potentially critical *litterator* ('schoolmaster') in Dicuil, *De mensura* VIII 23 and 31 (Tierney [& Bieler], *Liber*, 96–97); cf. Pabst, *Prosimetrum*, i, 330.

⁶² Dicuil, *De cursu* III vii (*T*, fols 95^r–96^v; *V*, fols 115^r–117^v; cf. Esposito, 'An unpublished astronomical treatise', 442–44, c. 7.1–c. 7.5).

⁶³ These chapters are not distinguished as such in *V*, and therefore also not in Esposito's edition. Pabst, *Prosimetrum*, i, 336–37, correctly clarifies that the two additional chapters in the table of contents of *T*, fol. 58^{r-v} refer to these poems, not to any of the texts that are only extant in this manuscript, as stated by van de Vyver, 'Dicuil', 31 and Cordoliani, 'Le comput', 326–29.

19-year cycle starting with the *saltus lunae*. The leitmotifs are therefore the cycle and the epacts (in the general sense of lunar ages).⁶⁴ Louis is not addressed at all. The book ends prosaically and without any epilogue after completing the treatment of the second topic, in sharp contrast to the well-elaborated ending of Book III. Both in the table of contents and in the main text of the surviving codex, it is immediately followed by the *Epistula censuum* of 818, making it unlikely that further chapters are missing.⁶⁵ In light of all this, it seems likely that Dicuil first wanted to complete the work with Book III, and only added Book V when he had additional ideas that he deemed worth noting down. While it is also possible that he inserted some folios years later into his own codex, it is likely that he completed the text before writing the *Epistula censuum*.

The first reason to assume so is that Dicuil consistently produced an annual output in all years between 814 and 818, probably required as ‘gifts’ to Louis. The only year to which no book is explicitly dated is 817, so Book V would fill this gap perfectly. Secondly, the rules in chapter 2 start from the *saltus lunae*.⁶⁶ As Dicuil would place the *saltus lunae* in March 817, it is most likely that he considered them around this time. Valenciennes, Médiathèque Simone Veil, MS 404 (386), fols 66^r–118^r (V), might depend on a copy made before Dicuil added Book V. As some paragraphs of Books I–III are omitted in this manuscript, and the text there is much more neatly arranged than in *T*, it is also possible that the copyist made the decision to stop after what seemed like a better end.

Epistula censuum (818) and *De prima syllaba* (825): Hindsight

According to Alfred Cordoliani, the *Epistula censuum* is to be regarded as an appendix to the computistical work.⁶⁷ Pabst refuted this, pointing to Dicuil’s separate references to the two works in *De prima syllaba*:⁶⁸

*Postquam de cursu solis luneque locutus,
Ponderibus multis mensuris atque notatis*⁶⁹

After speaking of the course of the sun and moon
and writing about many weights and measures

In the table of contents of *T*, this difference is not so clear. The *Epistula censuum* and the *De prima syllaba* are listed on the same level as the five individual *libelli*, albeit differentiated by their distinct names and added descriptions.⁷⁰ The dedication to Louis as a tribute, reminiscent of Dicuil’s words in the first book, likewise shows that the *Epistula censuum* was in some ways very close to a sixth *libellus*. However, Dicuil did not label it as such in the table of contents or in the *Epistula censuum* itself, and he referred back to his previous works with two separate hexameters in 825. The series of five books had developed into something that he himself perceived of as a unit, at the latest when he wrote further works that differed more from them than the *libelli* did amongst themselves.

⁶⁴ Dicuil, *De cursu*, v i (*T*, fol. 97^r; Cordoliani, ‘Le comput’, 329).

⁶⁵ *T*, fol. 58^v; Paris, BnF, MS NAL 1645, fol. 7^v.

⁶⁶ Dicuil, *De cursu*, v ii (*T*, fol. 101^r; cf. Cordoliani, ‘Le comput’, 330).

⁶⁷ Cordoliani, ‘Le comput’, 331.

⁶⁸ Pabst, *Prosimetrum*, i, 345, n. 130.

⁶⁹ Dicuil, *De prima syllaba*, 7–8 (Manitius, ‘Micons von St Riquier de primis syllabis’, 125).

⁷⁰ *T*, fols 58^r–58^v.

If we regard the work as a purposeful mix of disciplines, this certainly is not reflected in the modern titles *Liber de astronomia* or *Computus*; and, as this paper has shown, they are of no help in understanding the structure and genre of the text. It would therefore make more sense to think of the books in the same terms that Dicuil did, as *De cursu solis lunaeque*.⁷¹ This label fits the computistical parts, as solar days and years, lunar ages and months, and the cycle of the sun and moon were the very foundation of computus. Notably, Dicuil often uses the word *cursus* in calendrical contexts, i.e. in relation to computistical cycles rather than astronomical orbits, e.g., in the prologue of the first computistical part of Book II:

*Postrema argumenta uide simulatque priora,
ut solis cursus et lunae cernere possis*⁷²

See the following formulas (i.e. II ii–vi), as well as the previous ones (i.e. I i–v),

so that you can establish **the courses of the sun and the moon**

The label also fits the astronomical parts, in which positions and orbits of the sun and the moon are discussed among those of the other planets (with an explicit emphasis on the moon in II i). Finally, it fits the poetic parts, because the text of the verse permutations addresses the swift sun, the delaying moon, and long cycles. The poetic element is additionally represented by *de cursu solis lunaeque* being part of a hexameter. The label suits all leitmotifs of the individual books, even mirroring the order of Book I (*sol*) and II (*luna*); in ordering the two heavenly bodies in this manner, it follows the tradition of the Irish computistics of AD 650–750.⁷³ Finally, when writing this in 825, Dicuil might already have had the title for another work in mind, the *Liber de mensura orbis terrae*, likewise written in 825. Both titles can be regarded as parallel, and together the two (of course in many ways very different) works treat the cosmos on the earth and beyond, measuring space and time.

It is worth keeping in mind that in the directly following verse, Dicuil used the words *Ponderibus multis mensuris atque notatis* to refer to the work from 818. However, he had not only called this work *epistula census* in its third verse and *epistula censuum* in the table of contents, but he also still uses the latter title in the prose part of *De prima syllaba*.⁷⁴ *De cursu solis lunaeque* was never used so clearly as a title; it remains a description given eleven years after writing the first book. When Dicuil started writing in 814, he had other priorities than laying the foundations for a treatise on the course of the sun and moon. The work is not to be understood as a conclusive handbook on any one clear topic. Keeping the table of contents in mind, it should rather be thought of as *Libelli de cursu solis lunaeque* than as a *Liber de cursu solis lunaeque*.

⁷¹ While Dicuil, *De prima syllaba* 7 (Manitius, ‘Micons von St Riquier de primis syllabis’, 125) reads *lunaeque*, all manuscripts of the five *libelli* themselves spell the respective word either *lunae* or *lunę* throughout. The above spelling is therefore not only more convenient, but also at least as likely to be Dicuil’s original spelling.

⁷² Dicuil, *De cursu* II ii (*T*, fol. 67^v; *V*, fol. 79^v; cf. Esposito, ‘An unpublished astronomical treatise’, 400, c. 1.4).

⁷³ For instance, see the full title of *De ratione computandi*, in Maura Walsh & Dáibhí Ó Cróinín (eds & trans), *Cummian’s letter De controuersia Paschali, together with a related Irish computistical tract ‘De ratione computandi’* (Toronto 1988) 115: *IN DEI NOMINE INCIPIUNT PAUCA DE RATIONE COMPUTANDI SECUNDUM SOLEM ET LUNAM*. See also n. 2, outlining that the work is structured accordingly into two parts, one dealing with the solar, one with the lunar calendar; and Immo Warntjes, *The Munich Computus: text and translation. Irish computistics between Isidore of Seville and the Venerable Bede and its reception in Carolingian times* (Stuttgart 2010) CVII–CVIII, on the basic commonality of moving from the sun to the moon to the cycles in all three early medieval Irish computistical textbooks. The third of these, the *Computus Einsidlensis*, is currently being edited and translated by Tobit Loevenich, Dublin.

⁷⁴ *P*, fol. 7^v; *T*, fol. 58^v; Dicuil, *De prima syllaba* (Manitius, ‘Micons von St Riquier de primis syllabis’, 174); cf. van de Vyver, ‘Dicuil’, 35–36 n. 5.

Conclusion

Dicuil was prompted by Louis's accession to power in 814 to write a text in order to entertain his new patron and to demonstrate his advanced skills and originality in the areas of computus, arithmetic/geometry, and grammar, especially poetics. At this point, he was not sure yet if he would continue the work, and this depended on the reaction at court. While Dicuil was confident enough to be able to produce a similar text in the following year, his priority was certainly the immediate impact of Book I in 814. The sophisticated interweaving of computus, *quadrivium*, and poetry kept shaping the following books, where the focus among the disciplines of the *quadrivium* shifted towards astronomy. However, the approaching end of a 95-year period in 816, as well as it being a bissextile year with an imminent placement of the *saltus lunae*, drove the work increasingly into the direction of an advanced computistical analysis. The common features of these *libelli* became more obvious in comparison to the following texts Dicuil wrote, culminating in his concise label *De cursu solis lunaeque* given to them in 825. While this makes for a suitable title, the work should not be conceived of as a textbook, handbook, or encyclopaedia, but as something between court poetry, a review 'portfolio', and a published series of collected research papers or lectures. As such, they can be used to study the interrelation of the covered disciplines; advanced scholarship of their time; the process of 'publishing' at the Carolingian court; and the atmosphere of court scholarship in the first years of Louis the Pious.

Appendix: Breakdown of *De cursu solis lunaeque*

Chapters	Contents	Main Discipline	Date and Context
Table of contents	Chapter headings of <i>Libelli</i> I–V and <i>Epistula censuum</i> ; reference to a metrical table of contents of <i>De prima syllaba</i> at its beginning		Probably gradually from 814 to 825
Book I	Leitmotif: the sun (only mentioned in Book II)		
i–v; vii	Formulas to compute the month of the year and day of the month from the lunar ages; short prologues and epilogues in verse	Computus	April 814; gifts for Louis
vi	Formulas on triangular numbers and their relationship to square numbers; long epilogue repeating the formulas and addressing Louis in verse	<i>Quadrivium</i> (arithmetic/geometry)	April 814; gifts for Louis (mid-May)
viii–viii	Verse permutations (featuring the sun and moon); poetry about these verse permutations (esp. about the numbers of metrical feet, syllables, and letters); poetry addressing Louis; rhythmical epilogue addressing people who want to correct the grammar of the text	Poetry	Gifts for Louis (mid-May)

Book II	Leitmotif: the moon		
i	Poem on the distances between the earth and the seven planets (various units of measurements; cosmic tones); contradictions of ancient authors	<i>Quadrivium</i> (astronomy, with elements of music, geometry, arithmetic)	Dicuil expects Louis to like this in particular
ii–vi	Two formulas each calculating lunar months and lunar ages respectively (cf. I i–v); prologues and epilogues in verse	Computus (1)	Probably April 815; cf. I i–v
vii	Rhythmical transition from prose to verse	Poetry (1)	
viii–xii	Computistical poetry: short rules for Easter and Lent; <i>bissextus</i> and <i>saltus lunae</i> ; solar and lunar years; real and fictional cycles	Computus (2)	Computistical events of 816/17 (end of a 95-year period, <i>bissextus</i> , <i>saltus</i> , cf. Books III–III)
xiii–xiiii	Verse permutations (featuring the sun and moon); poetry about these verse permutations (esp. outlining how to establish all remaining combinations of the words); poetry addressing Louis; rhythmical epilogue	Poetry (2)	815; Dicuil refers back to promise from Book I; cf. I viii–viii
Book III	Leitmotif: cycles		
i	Poem on the orbits of the planets	<i>Quadrivium</i> (esp. astronomy)	Cf. II i; <i>Leiden Aratea</i> (Easter 816)
ii–iiii	<i>Cyclus decemnovennis</i> ; additional table of contents for III iii; deep analysis of the 532-year cycle (and the 95- and 247-year periods within it); first day(s) of the year; short poetic parts	Computus	End of a <i>cyclus decemnovennis</i> and a 95-year period in 816; <i>Arg. Aquens</i> .
Book III	Leitmotif: <i>bissextus</i> ; <i>saltus lunae</i>		
i–iiii	Solar and lunar <i>bissextus</i> ; <i>saltus lunae</i> ;	Computus	Bissextile year 816; <i>saltus</i> in 816/17
v–vii	Movements of the moon, sun, and the zodiac (last chapter first in poetry, to demonstrate its unfitness for such computations)	Computus; sidereal astronomy; poetry	Cf. I vi; III i
viii–viii	Poems defending the work, esp. its grammar; permutations of a single verse; summary of the treated contents	Poetry	816 cf. I viii–viii; II xiii–xiii; retrospect
Book V	Leitmotif: cycle and lunar ages		
i–ii	Condensed Easter tables (based on the 35 possible dates of Easter) with poetic explanations; annual increments of lunar ages (with short prologue in verse)	Computus	Rules starting after the <i>saltus lunae</i> (March 817), first special rule from 10 February 818