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## After Tycho: Philippist astronomy and cosmology in the work of Brahe's Scandinavian assistants

### Introduction

Recent work on the astronomer Tycho Brahe has emphasised his relationship to the Lutheran tradition of astronomical and astrological investigation usually associated with the scholarship and curricular reforms of Philipp Melanchthon.<sup>1</sup> The importance of this tradition to the reception of Copernican astronomy and to the transformation of the study of celestial phenomena in the sixteenth and seventeenth centuries has long been recognised.<sup>2</sup> Yet, historians remain divided about how best to describe it. Some have been happy to label it a Lutheran mode of studying the heavens - part, indeed, of a Lutheran tradition of natural philosophy.<sup>3</sup> Others, however, for reasons spelled out particularly clearly by Charlotte

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<sup>1</sup> E.g. J. R. Christianson, 'Tycho Brahe's German Treatise on the Comet of 1577: A Study in Science and Politics', *Isis*, 70 (1979), 110-140; Jole Shackelford, 'Providence, Power, and Cosmic Causality in Early Modern Astronomy: The Case of Tycho Brahe and Petrus Severinus', in John Christianson et al., eds, *Tycho Brahe and Prague: Crossroads of European Science* (Frankfurt am Main: Verlag Harri Deutsch, 2002), 46-99; Håkon Håkansson, 'Tycho the Prophet: History, Astrology and the Apocalypse in Early Modern Science', in Kevin Killen and Peter J. Forshaw, eds, *The Word and the World: Biblical Exegesis and Early Modern Science* (Basingstoke: Palgrave, 2007), 137-156; Adam Mosley, 'The Reformation of Astronomy', in Bridget Heal and Ole Peter Grell, eds, *The Impact of the European Reformation* (Aldershot: Ashgate, 2008), 231-249.

<sup>2</sup> See, *inter alia*, Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols (New York: University of Columbia Press, 1941), 6, 378-405; John Warwick Montgomery, 'Cross, Constellation and Crucible: Lutheran Astrology and Alchemy in the Age of the Reformation', *Ambix*, 11 (1963), 65-86; Robert S. Westman, 'The Melanchthon Circle, Rheticus and the Wittenberg Interpretation of the Copernican Theory', *Isis*, 66 (1975), 165-193; Charlotte Methuen, *Kepler's Tübingen: Stimulus to a Theological Mathematics* (Aldershot: Ashgate, 1998).

<sup>3</sup> Peter Barker, 'The Role of Religion in the Lutheran Response to Copernicus', in Margaret J. Osler, ed., *Rethinking the Scientific Revolution* (New York: Cambridge University Press, 2000), 59-88; Peter Barker, 'The Lutheran Contribution to the Astronomical Revolution: Science and Religion in the Sixteenth Century', in John Brooke and Ekmeleddin Ihsanoglu, eds, *Religious Values and the Rise of Science in Europe* (Istanbul: IRCICA, 2005), 31-62; Sachiko Kusukawa, 'The Natural Philosophy of Melanchthon and his Followers', *Sciences et Religions: De Copernic à Galilée (1540-1610)* (Rome: Ecole Française de Rome, 1999), 443-453. Sachiko Kusukawa, 'Lutheran uses of Aristotle: a comparison between Jacob Schegk and Philip Melanchthon', in Sachiko Kusukawa and Constance Blackwell, eds, *Philosophy in the Sixteenth and Seventeenth Centuries: Conversations with Aristotle* (Aldershot: Ashgate,

Methuen, have favoured a more cautious approach. With Luther himself largely indifferent to academic study of the natural world, and actively hostile to the scholastic traditions of natural and moral philosophy, it was indeed Melanchthon rather than Luther who promoted astronomy and astrology both within the university curriculum and as elite intellectual pursuits of particular religious significance. Yet as the process of confessionalisation unfolded, giving the very term ‘Lutheran’ its salience, Melanchthon’s right to be considered a Lutheran theologian was called into question, and close followers, such as his son-in-law Caspar Peucer, were accused of crypto-Calvinism. Thus, a tradition of philosophical inquiry that owed so much to Melanchthon may not have appeared *confessionally* very Lutheran, by the end of the century.<sup>4</sup> At least partly for this reason, therefore, some have preferred to describe it as Melanchthonian or Philippist - terms with an established use in church history in charting one faction in the theological struggles *within* Lutheranism in the later sixteenth and early seventeenth centuries, in the German-speaking territories of the Empire and Scandinavia.<sup>5</sup>

The features of Lutheran or Philippist natural philosophy have also been debated. Both Charlotte Methuen and Gábor Almási have suggested that the doctrines usually described as underpinning Melanchthon’s promotion of astronomy and astrology, concerning the providential governance of the world, may have been *characteristic* of the tradition without being *distinctive*.<sup>6</sup> In other words, individuals from different confessional backgrounds could and did share very similar views about divine providence and order. Nor did attitudes favouring direct observation of phenomena, as opposed to the acceptance of authority, or particular approaches to the interpretation of scripture, diverge precisely along confessional lines. A recent contribution to the debate, Nienke Roelants’ doctoral thesis of

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1999), 169-188, both offers arguments in favour of the existence of ‘Lutheran natural philosophy’ - understood as natural philosophy directed to Lutheran ends - and cautions against the expectation that it might take a single form, or be shared by all Lutherans.

<sup>4</sup> Charlotte Methuen, ‘On the Problem of Defining Lutheran Natural Philosophy’, in John Brooke and Ekmeleddin Ihsanoglu, eds, *Religious Values and the Rise of Science in Europe* (Istanbul: IRCICA, 2005), 63-80.

<sup>5</sup> See, for example, Gábor Almási, ‘Rethinking Sixteenth-Century “Lutheran Astronomy”’, *Intellectual History Review*, 24 (2014), 5-20, on pp. 6-7; Robert Kolb, ‘Dynamics of Party Conflict in the Saxon Late Reformation: Gnesio-Lutherans vs. Philippists’, *Journal of Modern History*, 49 (1977), supplement, D1289-D1305; Thorkild Lyby and Ole Peter Grell, ‘The consolidation of Lutheranism in Denmark and Norway’, in Ole Peter Grell, ed., *The Scandinavian Reformation: From Evangelical Movement to Institutionalisation of Reform* (Cambridge: Cambridge University Press, 1995), 114-143.

<sup>6</sup> Methuen, ‘On the Problem of Defining Lutheran Natural Philosophy’, 72-75; Gábor Almási, ‘Rethinking Sixteenth-Century “Lutheran Astronomy”’.

2013, has pursued a different line of inquiry, suggesting that scholars such as Georg Joachim Rheticus, Caspar Peucer and Tycho Brahe inherited from Luther himself, and not only Melanchthon, a moderate scepticism about man's postlapsarian capacity to attain knowledge of Creation.<sup>7</sup> But Roelants' otherwise persuasive analysis fails what might be called the 'Methuen test', insofar as it has only demonstrated that this attitude was characteristic of the astronomers she has studied, not that it was universally present amongst Lutheran scholars, or absent from individuals belonging to other confessional groups. Roelants' analysis might yet provide the means of distinguishing a truly *Lutheran* astronomy from that of other confessions; more work would need to be done, however, to make the case secure.

Methuen herself posits that a confessionally-distinctive Lutheran natural philosophy would be one shaped by the doctrine of Christ's ubiquity, Luther's way of accounting for his real presence in the Eucharist without transubstantiation. One would thus expect it to be noticeably different from Catholic and Reformed philosophy in its conceptualisation of body, place, and space.<sup>8</sup> But Methuen does not point to the actual existence of such a natural philosophy - and cosmology as traditionally rather narrowly-conceived by historians of early modern astronomy, as concerning the debate over world-systems, might not seem a promising field in which to locate one.<sup>9</sup> As we shall see, cosmological reflections on the part of Lutheran astronomers of a broader sort did touch on relevant concerns, but not necessarily in such a way as to clearly confirm their orthodoxy. That is hardly surprising; the position of Philippist theologians on the nature of Christ's presence was one of the chief grounds on which they were charged with crypto-Calvinism, and refusal to subscribe to the doctrine of Christ's ubiquity generated problems for the most famous 'Lutheran' astronomer of all, Johannes Kepler.<sup>10</sup> Methuen's notion of Lutheran natural philosophy would thus seem ideally

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<sup>7</sup> Nienke Roelants, *Lutheran Astronomers After the Fall (1540-1590): A Reappraisal of the Renaissance Dynamic between Astronomy and Religion*, Ghent University, 2013. See also Peter Harrison, *The Fall of Man and the Foundations of Science* (Cambridge: Cambridge University Press, 2007), 89-107.

<sup>8</sup> Methuen, 'On the Problem of Defining Lutheran Natural Philosophy', 75-78.

<sup>9</sup> Barker, however, has argued that doctrines of the ubiquity and Real Presence of Christ underpinned Lutheran attention to nature as a product of, and testament to, providential design. See his 'On the Role of Religion', 61-62. Like Almási, 'Rethinking Sixteenth-Century "Lutheran Astronomy"', 7-8, I remain unpersuaded by this argument on the basis of the evidence presented.

<sup>10</sup> For the example of Niels Hemmingsen, dismissed from his chair in theology at the University of Copenhagen for this reason, see Lyby and Grell, 'The consolidation of Lutheranism in Denmark and Norway', 120-122. For Kepler, see Max Caspar, *Kepler* (New York: Dover, 1993), 213-220, and Jürgen Hübner, *Die Theologie Johannes Keplers zwischen Orthodoxie und Naturwissenschaft* (Tübingen: Mohr Siebeck, 1975), especially 138-139.

chosen to exclude, rather than include, those belonging to the Melanchthonian tradition. Perhaps that was her intention: to demonstrate the impossibility of there being a *Lutheran* natural philosophy before or outwith an orthodox Lutheranism.

A final reason for being circumspect about both the labelling and the characterisation of the astronomical legacy of Melanchthon is implicit in the very idea of ‘tradition’. Though stabilised, to a considerable degree, by textbooks and curricula, doctrines and motivations are susceptible to change as they are transmitted, particularly perhaps from one generation to the next. Melanchthon himself, after all, did not produce his natural philosophy entirely *de novo*. Instead, he wove together various scholastic and Stoic resources in ways that were shaped by humanistic method, pedagogic needs and insights, and, to a considerable extent, his own lived experience; his natural philosophy, and the uses to which he put it, were shaped by events of the early Reformation, the concerns about maintaining moral and political order they generated, and doctrinal disputes.<sup>11</sup> Those he taught, directly or indirectly, appropriated, modified, and assimilated his materials in ways that could be just as creative and novel, in their context of own particular circumstances. In conjunction with Methuen’s claim that a doctrinal shibboleth is absent, the potentially-Protean nature of Philippist astronomy and cosmology might seem to make the prospects for studying it especially dim. That would indeed be the case if historians were forced to investigate astronomers’ approaches to the study of the heavens *without* any knowledge of their lives. But those are not the conditions under which we inquire into the past. Indeed, we possess more than enough biographical data to treat the transformation of the intellectual tradition over the time and space as the very object of our study.

That, then is the purpose, of this chapter: to explore how one programme of investigation of the heavens with a Philippist provenance - that of Tycho Brahe - shaped others carried out in the next generation. No less than other representatives of the Phillipist tradition, Tycho adopted and adapted the doctrines and agendas which he encountered in his youth, elaborating a programme of study that both contained Melanchthonian elements and yet was also clearly his own. Amongst the activities and doctrines promoted at Tycho’s observatory and ‘research institute’, Uraniborg, were observational reform of astronomy

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<sup>11</sup> Sachiko Kusukawa, *The Transformation of Natural Philosophy: The Case of Philip Melanchthon* (Cambridge: Cambridge University Press, 1995). For the expression of the resulting concerns - e. g., with nature as visible testimony of providential order, and with the refutation of Epicurean atheism and Stoic determinism - see Kusukawa, ed., and Christine Salazar, trans., *Philip Melanchthon: Orations on Philosophy and Education* (Cambridge: Cambridge University Press, 1999).

through improved instrumentation; the pursuit of iatrochymical knowledge alongside knowledge of the heavens; the (occasional) recourse to scripture as a route to knowledge of nature; the rejection of both a Copernican account of the universe and traditional notions of celestial spheres; and the study of celestial novelties, that is comets and novae.<sup>12</sup> The focus here is on two ‘graduates’ of that programme who achieved a particular prominence in post-Reformation Scandinavia: Cort Aslakssøn, or Cunradus Aslacus, as his name was Latinised; and the second-best known of Tycho’s assistants, after Kepler, Christian Sorenson of Lomborgberg, better known as Longomontanus. Both took up positions at the University of Copenhagen: Aslakssøn as professor of Latin (1600), Greek (1602), and Hebrew (1606), then Theology from 1607; Longomontanus as professor of mathematics in 1607, and then of superior mathematics (astronomy) in 1621. Both authored texts closely associated with Tycho and his project: Aslakssøn the *De natura caeli triplicis*, produced during Tycho’s lifetime in 1597 and dedicated to him; and Longomontanus the *Astronomia Danica*, published in 1622.<sup>13</sup> These publications, amongst others by the same authors, can profitably be studied to shed light on the continued existence and further evolution in Denmark of astronomical Philippism.

Earlier scholarship on these individuals and on these works as representatives of the Tychonic programme in Denmark is scarce, but does exist. In 1972, in considering ‘How Copernicanism took root in Denmark and Norway’, Kristian P. Moesgaard described Aslakssøn’s *De natura caeli triplicis* as presenting a Tychonian philosophy and theology, including a Tycho-Aristotelian cosmology which found acceptance and influence through being reformulated and propagated by Caspar Bartholin.<sup>14</sup> In the same article, he characterised Longomontanus’s *Astronomia Danica* as a more traditional work of Tychonian astronomy, albeit one containing a Tycho-Copernican rather than a strictly Tychonian world-

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<sup>12</sup> For this description of Uraniborg, see Victor E. Thoren, ‘Tycho Brahe as the dean of a Renaissance research institute’, in Margaret J. Osler and Paul Lawrence Farber, eds, *Religion, Science and Worldview: Essays in Honor of Richard S. Westfall* (Cambridge: Cambridge University Press, 1985), 275-296. For Tycho’s life and research programme more generally, see Victor E. Thoren, *The Lord of Uraniborg: A Biography of Tycho Brahe* (Cambridge: Cambridge University Press, 1990) and John Robert Christianson, *On Tycho’s Island: Tycho Brahe and His Assistants, 1570-1601* (Cambridge: Cambridge University Press, 2000).

<sup>13</sup> Cunradus Aslacus, *De natura caeli triplicis libelli tres* (Siegen: n. p., 1597); Christian Sørensen Longomontanus, *Astronomia Danica* (Amsterdam: Ex officina Typographica Guilielmi I. Caesii, 1622). In this and subsequent notes I follow the titlepages in citing Aslakssøn’s works using the Latinised name ‘Aslacus’.

<sup>14</sup> K. P. Moesgaard, ‘How Copernicanism took Root in Denmark and Norway’, *Studia Copernicana*, 5 (1972), 117-151, on p. 122.

system.<sup>15</sup> Moesgaard used the word ‘Tychonian’ where others might prefer ‘Tychonic’; but there is perhaps something to be gained from employing both of these terms, restricting ‘Tychonic’ to doctrines and methods strictly in accordance with Tycho’s own, and ‘Tychonian’ for ones that are in keeping with the spirit but not the letter of Tycho’s approach and ideas.

Of course, the distinction between the ‘Tychonic’ and the ‘Tychonian’ is not always very clear. In the case of Tycho’s alchemical pursuits and the way they informed his cosmology, little enough is known directly about his practices and principles that much must instead be inferred from Tycho’s close association with the Paracelsian physicians Johannes Pratensis and Petrus Severinus.<sup>16</sup> Jole Shackelford has studied the texts of both Aslakssøn and Longomontanus for evidence of Paracelsian doctrine as mediated by Severinus’s work - a task made easier in Aslakssøn’s case by that fact that his *De natura caeli triplicis* not only makes several references to chymists and the *ars spagyrica*, but openly quotes Severinus’s *Idea Medicinae* (1571) as a source.<sup>17</sup> Shackelford and Ole Peter Grell have differed somewhat about the correct interpretation of Aslakssøn’s apparent Paracelsianism within the context of the theological struggles in early-seventeenth-century Denmark, Aslakssøn also being known for successfully evading the attempts of Hans Poulsen Resen to eject moderate Lutherans such as himself from church and university positions. This conflict, Grell has argued, was not a direct Danish translation of the German struggle between strict Gnesio-Lutherans and moderate Philippists, but rather an attempt to impose religious uniformity for political reasons; and it was Aslakssøn’s supposed crypto-Calvinism, rather than his Paracelsianism, that caused concern in university circles.<sup>18</sup> Shackelford has countered with

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<sup>15</sup> Moesgaard, ‘How Copernicanism took Root in Denmark and Norway’, 126-134. See also his focused discussion of both authors in ‘Cosmology in the Wake of Tycho Brahe’s Astronomy’, in W. Yourgrau and Allen D. Breck, eds, *Cosmology, History and Theology* (New York and London: Plenum Press, 1977), 295-305.

<sup>16</sup> Jole Shackelford, *A Philosophical Path for Paracelsian Medicine: The Ideas, Intellectual Context, and Influence of Petrus Severinus (1540-1602)* (Copenhagen: Museum Tusulanum, 2004), 63-94.

<sup>17</sup> Jole Shackelford, *A Philosophical Path for Paracelsian Medicine*, 318-323; Aslacus, *De natura caeli triplicis*, pp. 100, 103. Shackelford plays particular attention to Aslakssøn in ‘Rosicrucianism, Lutheran Orthodoxy, and the Rejection of Paracelsianism in Early Seventeenth-Century Denmark’, *Bulletin of the History of Medicine*, 70 (1996), 181-204, on pp. 188-192, and ‘Unification and the Chemistry of the Reformation’, in Max Reinhart, ed., *Infinite Boundaries: Order, Disorder, and Reorder in Early Modern German Culture* (Kirksville, MO: Sixteenth Century Journal Publishers, 1998), 291-312.

<sup>18</sup> Ole Peter Grell, ‘The Reception of Paracelsianism in Early Modern Lutheran Denmark: from Peter Severinus, the Dane, to Ole Worm’, *Medical History*, 39 (1995), 78-94, on p. 78,

the suggestion that, in early seventeenth-century Denmark, the dividing line between theological Philippism and Paracelsianism is not so easily discerned.<sup>19</sup> In his account, the fortunes of the two were closely intertwined.

This chapter will not attempt to resolve that dispute, which is most consequential in any case for understanding the Paracelsianism (or lack of it), of other Scandinavian scholars, most notably Ole Worm. Since, however, despite the difficulty of defining Tycho's own alchemical beliefs, an alchemically-informed cosmology remains one of the legacies likely bequeathed by Tycho to his assistants, in what follows I shall try to explore these and other elements in their scholarship by means of a close-reading of their texts with eyes well-attuned to Tycho's concerns. As well as making some remarks about the genres and audience for the writings of Aslakssøn and Longomontanus, I shall approach them addressing issues of epistemology, doctrine, and sources, and try thereby to assess their Tychonic and Tychonian credentials. I shall close with some remarks on what light, if any, such investigation sheds on the understanding of Philippist astronomy and cosmology, in Scandinavia and elsewhere.

### **Aslakssøn on the Nature of the Threefold Heaven**

Aslakssøn's *De natura caeli triplicis* is a curious work. Published in 1597, it appeared during Tycho's lifetime and was dedicated to him, but after Aslakssøn had left Uraniborg and his service. Aslakssøn (1564-1624) had worked there for less than three years, from October 1590 to April 1593; having obtained his MA at Copenhagen in May 1593, and receiving the *stipendium regium* to study abroad, he departed from Denmark for six years, serving as tutor to two Danish noblemen, one of them Tycho's nephew.<sup>20</sup> Amongst the institutions at which Aslakssøn and his charges spent time was the Reformed Herborn Academy, which for a brief

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n. 4 and pp. 86-88; Grell, 'The Acceptable Face of Paracelsianism: The Legacy of Idea Medicinæ and the Introduction of Paracelsianism into Early Modern Denmark', in Ole Peter Grell, ed., *Paracelsus: The Man and His Reputation, His Ideas and their Transformation* (Leiden: Brill, 1998), 245-267, especially 256-259.

<sup>19</sup> Shackelford, 'Rosicrucianism, Lutheran Orthodoxy, and the Rejection of Paracelsianism in Early Seventeenth-Century Denmark'; 'Unification and the Chemistry of the Reformation'; 'To Be or Not to Be a Paracelsian: Something Spagyric in the State of Denmark', in Gerhild Scholz Williams and Charles D. Gunnoe, eds, *Paracelsian Moments: Science, Medicine, and Astrology in Early Modern Europe* (Kirksville, MO: Truman State University Press, 2002), 35-69; 'Paracelsianism and the Orthodox Lutheran Rejection of Vital Philosophy in Early Seventeenth-Century Denmark', *Early Science and Medicine*, 8 (2003), 210-252, especially 218-220 and 224-225.

<sup>20</sup> Christianson, *On Tycho's Island*, 252.



period in the 1590s was located at Siegen rather than Herborn itself. It was at Siegen that Aslakssøn's work was published, and in the dedication, written at Basle, Aslakssøn claimed to have 'begun to meditate and write' on 'the nature of heaven' a little under two years previously, whilst at the Academy.<sup>21</sup> The dedication explicitly reveals the author's debt not only to Tycho but also to the Herborn faculty, notably the co-founder and leading light, Johannes Piscator, and one of the professors, Johann Heinrich Bisterfeld. These men, and the Marburg philosopher Rudolph Goclenius, all Calvinists, are credited with reading the work and suggesting improvements.<sup>22</sup>

With respect to its pedagogic orientation and curriculum, Howard Hotson has characterised the Herborn Academy as Philippo-Ramist.<sup>23</sup> In other words, what was taught and studied there drew on the textbook traditions and pedagogy of both Ramus and Melancthon. That the semi-Ramism of Piscator and his academy informed Aslakssøn's scholarship becomes evident just after the dedication of the *De natura caeli triplicis*, where there appears a 'Synopsis Methodica' setting out the nature and subject-matter of the work as a dichotomous table. The prose of the main text is also prone to dichotomous distinctions.<sup>24</sup> It is clear, therefore, that the work was shaped by more than Tycho's training and agenda; in that very broad sense, it was a Tychonian, rather than a Tychonic, volume.

The 'threefold heaven' in the title is a reference to the three distinct 'heavens' treated by the text: the airy heaven of the sublunary world, the starry heaven, and the perpetual heaven of the afterlife. Again, to begin with a single term 'heaven' and to analyse it in its various senses is suggestive of a Ramist methodical approach, rather than a Tychonic one - and at first sight it might be thought, in book three, to have led Aslakssøn into a place where Tycho himself was not usually inclined to go, the realm of explicit theology. In this part of the work, Aslakssøn argues that the heaven of the blessed is a created, finite, and corporeal place - corporeal because the human nature of Christ and the elect are themselves corporeal,

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<sup>21</sup> Aslacus, *De natura caeli triplicis*, 3: 'Annus iam ferme secundus agitur ... ex quo in illustrissima Schola Sigenensi, quae tum primo Herborna istuc translata est, quorundam instinctu & roagtu impulsus, de NATURA CAELI theses quasdam meditari & conscribere occoepi.'

<sup>22</sup> Aslacus, *De natura caeli triplicis*, 4.

<sup>23</sup> Howard Hotson, *Commonplace Learning: Ramism and its German Ramifications, 1543-1630* (Oxford: Oxford University Press, 2007), 101-102.

<sup>24</sup> See, on this technique, Brian P. Copenhaver and Charles B. Schmitt, *Renaissance Philosophy* (Oxford: Oxford University Press, 1992), 227-239; Hotson, *Commonplace Learning*, 46-48.

and therefore require a corporeal abode.<sup>25</sup> In the afterlife, Aslakssøn asserts, humans possess bodies that are eternal and incorruptible, but are bodies nevertheless.<sup>26</sup> Consequently, his discussion in this book retains something of a natural philosophical character - or at least, it addresses a theology in which theories of place, space, and body play a key role.

Whether Tycho's mentoring of Aslakssøn played any part in the formation of these views is difficult to tell. As Caroline Bynum Walker has shown, concern with the resurrection of the body formed a powerful strand of patristic and medieval thought, and a materialistic conception of the afterlife came to dominate theological discussion in the twelfth and early thirteenth centuries.<sup>27</sup> However, the late-medieval doctrine of purgatory helped to focus attention away from the body at resurrection and onto the postmortem experiences of the separated soul, divided from the body.<sup>28</sup> As well as denying the existing of purgatory, Luther rejected the idea that death produced a separated soul capable of sensation and consciousness; his doctrine of 'the sleep of the soul' was that the souls as well as the bodies of the dead remained insensate and unaware until the day of resurrection.<sup>29</sup> Thus Lutheran eschatology emphasised the rising of body-and-soul together, and therefore strongly implied, at the very least, the corporeality of the afterlife. Up to a point, therefore, this part of *De natura caeli triplicis* appears to have articulated nothing more than standard evangelical theology.

The physical status of the postmortem human body, however, was never by itself of great importance to Luther or to Lutheran theology; the status of *Christ's* resurrected body, on the other hand, was. Insistence on the corporeality of Christ's glorified body was used by opponents of Luther's understanding of the Lord's Supper, in conjunction with the multiple scriptural references to him sitting at the right hand of God, to deny that Christ's human body and blood could be really present during the eucharist, as a literal interpretation of the words of institution seemed to require.<sup>30</sup> And Aslakssøn's remarks about Christ's eternal body

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<sup>25</sup> Aslacus, *De natura caeli triplicis*, 181-214. This third book was later excerpted and republished in English translation, as Ralph Jennings, trans., *The Description of Heaven. Or, A Divine and Comfortable Discourse of the Nature of the Eternall HEAVEN, the Habitation of God, and all the Elect* (London: Printed by A. M. for John Bramridge, 1623).

<sup>26</sup> Aslacus, *De natura caeli triplicis*, 205-214.

<sup>27</sup> Caroline Bynum Walker, *The Resurrection of the Body in Western Christianity, 200-1336* (New York: Columbia University Press, 1995).

<sup>28</sup> Walker, *The Resurrection of the Body in Western Christianity*, 280-291.

<sup>29</sup> Trevor O'Reggio, 'A re-examination of Luther's View on the State of the Dead', *Journal of the Adventist Theological Society*, 22 (2011), 154-170.

<sup>30</sup> Martin Lohse, *Martin Luther: An Introduction to his Life and Work* (Edinburgh: T & T Clark, 1987), 73-74; David C. Steinmetz, *Calvin in Context* (Oxford: Oxford University Press, 1995), 172-186.

appear, at least in the opinion of Jole Shackelford, to deny it the ubiquity that strict Lutheran doctrine required.<sup>31</sup> The critical passages of the text are ambiguous, probably intentionally so. They comprise quotation of biblical passages and late-antique authorities - Augustine of Hippo, Cyril of Alexandria, and Vigilius of Trent - that distinguish between Christ's divine and human nature and the availability of each to the believer, and close with the Augustinian admonition that it is not for us to inquire into the secrets of heaven.<sup>32</sup> Such equivocation amidst the late sixteenth-century struggles for doctrinal clarity does indeed, on balance, savour of (Lutheran) heresy - although whether any *contemporary* reader of the work objected to it on such grounds remains unclear. Moreover, as Dane T. Daniel has shown, the concept of the eternal body - part of the creation of God the Son, and bestowed on mankind by his sacrifice - was central to the theology and cosmology of Paracelsus.<sup>33</sup> The content of book three of Aslakssøn's work could be seen as stemming, therefore, from his Philippist theology *or* his Paracelsianism - or indeed, their conjunction as Philippist Paracelsianism or Paracelsian Philippism - and could perhaps, therefore, have been nurtured on Hven.<sup>34</sup>

Evidence of the Tychonian character of books one and two of the *De natura caeli triplicis* is much less ambiguous. Aslakssøn's work as a whole is systematic (and *methodical*) without being exhaustive or encyclopaedic – as indeed suits its titular designation as three *libelli* rather than *libri*. Thus, in book one, on the airy heaven, Aslakssøn does not present a

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<sup>31</sup> Shackelford, 'Unification and the Chemistry of the Reformation', 307-309. In Shackelford's view, this part of the work is at least *compatible* with Aslakssøn's Paracelsian cosmology, and possibly causally-related to it. He separately discusses the relationship between orthodox Lutheran views of the resurrected body and Paracelsian doctrine in 'Paracelsianism and the Orthodox Lutheran Rejection of Vital Philosophy in Early Seventeenth-Century Denmark', 246-248.

<sup>32</sup> Aslacus, *De natura caeli triplicis*, 196-198; especially 198: 'UBI autem & QUOMODO in hoc supremo Caelo sit corpus Dominicum: curiosissimum & supervacaneum (ut monet Augustinus) est inquirere. Tantummodo in Caelo esse credendum est. *Non enim fragilitatis est nostrae, Caelorum secreta discutere, sed est nostrae fidei, de Dominici corporis dignitate, sublimia & honesta sapere.*'

<sup>33</sup> Dane T. Daniel, 'Paracelsus on Baptism and the Acquiring of the Eternal Body', in Gerhild Scholz Williams and Charles D. Gunnoe, eds, *Paracelsian Moments: Science, Medicine, and Astrology in Early Modern Europe* (Kirksville, MO: Truman State University Press, 2002), 116-134; Dane T. Daniel, 'Invisible Wombs: Rethinking Paracelsus's Concept of Body and Matter', *Ambix*, 53 (2006), 129-142. Interest in the 'resurrected body' was an established part of the alchemical tradition before Paracelsus, too; see Zachary Matus, 'Resurrected Bodies and Roger Bacon's Elixir', *Ambix*, 60 (2013), 323-340. I am grateful to Jennifer Rampling for referring me to this article.

<sup>34</sup> As noted by Shackelford, 'Unification and the Chemistry of the Reformation', 302, n. 21, there is evidence that Aslakssøn reported having seen Paracelsus's biblical commentaries in Tycho's possession.

meteorology, but is concerned to address certain questions about what is – and what is not – part of the sublunary atmosphere. Hence chapter four of this section of the work contains the eminently Tychonic doctrine that there is no sphere of elemental fire above the air and below the moon; or rather, indeed, that there is no such thing as elemental fire.<sup>35</sup> In this passage Aslaksson follows Tycho in *rejecting* what he took to be the view of Paracelsus, that the heavens were fiery.<sup>36</sup> The longer book two, on the starry heaven, contains extensive discussion of what we can also recognise as Tychonic doctrines: the claim that the starry heaven is fluid, but in no way elemental, rather being ethereal; that there is, however, some kind of relationship between heaven and the earth; that the presence of comets in the heaven is evidence of its fluidity; that the planets move through this fluid heaven, freely; and that they are not moved by any celestial orbs or external intelligences, but are furnished with a divinely-endowed knowledge of their courses.<sup>37</sup> The latter claim enabled Aslaksson, as it had Tycho, to explain the lawlike-regularity of the heavenly motions so fundamental to Melanchthon's promotion of astronomy, despite having done away with the celestial apparatus that traditionally explained them - and to do so, moreover, in a way that could only strengthen the inference from visible phenomena to invisible Creator, and thereby from natural order to moral order and political stability.<sup>38</sup> There is perhaps an echo in it, too, of the innate knowledge, divinely-endowed on the *human* mind, that underpinned Philippist epistemology and moral philosophy.<sup>39</sup>

There is no mathematical astronomy as such in book two, and little that relates directly to the debate over world-systems. Aslaksson's twentieth-century biographer, Oskar Garstein, characterised the work as a synthesis of the theories of Copernicus and Tycho, and

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<sup>35</sup> Aslacus, *De natura caeli triplicis*, 16-23.

<sup>36</sup> J. L. E. Dreyer, ed., *Tychonis Brahe Dani Opera Omnia* (Copenhagen: Libraria Gyldendaliana, 1913-1929), 15 vols (henceforth *TBOO*), vol. 6, 135 (Tycho to Christoph Rothmann, 13 August 1588).

<sup>37</sup> Aslacus, *De natura caeli triplicis*, 40-180. On external intelligences and celestial motions, see Edward Grant, *Planets, Stars, and Orbs: The Medieval Cosmos 1200-1687* (Cambridge: Cambridge University Press, 1994), 526-568.

<sup>38</sup> Cf. *TBOO*, vol. 6, 178 (Tycho to Rothmann, 24 November 1589) and 221 (*Auctor ad lectorem*).

<sup>39</sup> Sachiko Kusukawa, 'Vinculum Concordiae: Lutheran Method by Philip Melanchthon', in Daniel A. Di Liscia, Eckhard Kessler, and Charlotte Methuen, eds, *Method and Order in Renaissance Philosophy of Nature: The Aristotle Commentary Tradition* (Aldershot: Ashgate, 1997), 337-354, especially 344-345; Sachiko Kusukawa, 'Nature's Regularity in some Protestant Natural Philosophy Textbooks, 1530-1630', in Lorraine Daston and Michael Stolleis, eds, *Natural Law and Laws of Nature in Early Modern Europe* (Aldershot: Ashgate, 2008), 105-121, especially 112-113.

asserted that it in Aslakssøn adopted the world-system of Copernicus.<sup>40</sup> This verdict appears to stem from his reading of the argument of chapter 23 of book two, that ‘The starry heaven is immobile’.<sup>41</sup> It is true that in this chapter Aslakssøn refers to Copernicus’s explanation of the apparent diurnal rotation of the heavens through attribution of a daily rotation to the Earth. Yet he did not wholeheartedly endorse the Copernican theory, asserting rather that it solved one absurdity, the attribution of rapid motion to a most fluid substance - which by its very nature, he argued, was incapable of carrying around with it the planets - at the cost of another.<sup>42</sup> Aslakssøn is not concerned in this chapter with explaining the apparent daily motion of the planets, or indeed that of the fixed stars; he seeks only to deny that the phenomena indicated that the fluid substance of the heavens was itself in motion. Like Tycho, he argues that the planets moved by themselves through the fluid heavens; unlike his mentor, he hints that their apparent motion in the sky *was* their proper motion, and not a composite of their own motion and a diurnal motion to be attributed to the rotation of either the heavens as a whole or, as Copernicus had argued, the Earth.<sup>43</sup>

Of the other chapters of this book, the first is particularly noteworthy for its account of how knowledge of the starry heaven can be obtained. The means by which knowledge of heaven can be acquired fall into two categories, Aslakssøn argues: those that are common to acquiring knowledge of the stars as well as of heaven, and those that are specific to either the stars or the heavens. In the former category he places, in order: scripture, then philosophy, and in particular the science of optics. The latter category he subdivides into observations and hypotheses. For observations, he states, geometry and arithmetic are necessary aids, with geometry subdivided into a mechanical part, dealing with instruments, and a metrical part, dealing especially with what we would now think of as trigonometry.<sup>44</sup>

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<sup>40</sup> Oskar Garstein, *Cort Aslakssøn: Studier over Dansk-Norsk Universitets- og Lærdomshistorie omkring år 1600* (Oslo: Lutherstiftelsens Forlag, 1953), 193, 350.

<sup>41</sup> Aslacus, *De natura caeli triplicis*, 166-173.

<sup>42</sup> Aslacus, *De natura caeli triplicis*, 168: ‘Alii vero quibus haec Copernici de mobilitate Terrae hypothesis minus aridet, ut quae unum de rapidissima Caeli subtilissimi revolutione declinans absurdum, in aliud aequae difficile impingere videatur...’.

<sup>43</sup> In making this argument, on p. 169 of *De natura caeli triplicis*, Aslakssøn draws on, and refers, to the spherics of the Calvinist theologian and mathematician, Abraham Scultetus: see *Sphaericorum libri tres... Accessit de solutione triangulorum tractatus ... Pitisci* (Heidelberg: typis Abrami Smesmanni impensis Matthaei Harnisch, 1595), 98-105. As recorded on the end flyleaf of the extant copy in the library of the ETH Zürich, Tycho Brahe received this work via Aslakssøn in February 1596.

<sup>44</sup> Aslacus, *De natura caeli triplicis*, 41-44.

Much of this is identifiably Tychonic. That Aslakssøn should have emphasised the importance of optics, and categorised it with philosophy rather than geometry, fits with the inferences made by Tycho and his correspondent Christoph Rothmann in debates about refraction and the distinction - or lack of such - between air and aether.<sup>45</sup> Aslakssøn cites their epistolary exchanges in his work;<sup>46</sup> and he sides with Tycho in arguing that the lack of refraction at the boundary between the two does not reveal that air and aether are one and the same substance.<sup>47</sup> Unlike Tycho, however, Aslakssøn appears to have found a copy of the edition of Euclid's optics by Ramus's disciple Johannes Pena, an important source for optical arguments about the substance of the heavens, and one for which Tycho himself searched in vain into the 1590s.<sup>48</sup> In the section on instruments, Aslakssøn emphasises quadrants and sextants - as, at this time, only someone familiar with the observatories at either Uraniborg or Kassel would do - and when describing their use in establishing the celestial phenomena precisely, mentions the 'Atlas-like' Tycho by name.<sup>49</sup> And when it comes to explicating 'hypotheses', Aslakssøn notes the shifting understanding of this term from whatever mathematical device serves to save the celestial appearances to, in particular, collections of such devices in the form of planetary-systems, of which he considered there to be three: the Ptolemaic, the Copernican, and the Tychonic.<sup>50</sup> This is all precocious stuff for 1597, given the limited circulation of Tycho's own publications before this point in time;<sup>51</sup> it is not too surprising for an alumnus of Uraniborg, but clear evidence nevertheless of Aslakssøn's Tychonic credentials.

What, however, should we make of Aslakssøn's identification of scripture as the *first* source of knowledge of the starry heaven? It is wholly consistent with Aslakssøn's treatment of the *three* heavens in this work, and with his emphasis on scripture as the sole source of knowledge of the perpetual heaven.<sup>52</sup> And it is consistent with his later authorship of the *Physica et ethica Mosaica*, a natural and moral philosophy based on exegesis of the first three

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<sup>45</sup> Adam Mosley, *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge University Press, 2007), 74-75, 84-89, 94.

<sup>46</sup> Aslacus, *De natura caeli triplicis*, 40, 122, 160.

<sup>47</sup> Aslacus, *De natura caeli triplicis*, 66-72.

<sup>48</sup> Aslakssøn quotes Pena on pp. 18-20 and 67. On Tycho's indirect knowledge of Pena, see Mosley, *Bearing the Heavens*, 76-77. It should be noted, however, that Scultetus's *Sphaericorum libri tres* also cites Pena; I have not undertaken to exclude the possibility that Aslakssøn's knowledge of Pena's work was mediated by this source.

<sup>49</sup> Aslacus, *De natura caeli triplicis*, 42-43.

<sup>50</sup> Aslacus, *De natura caeli triplicis*, 44-45.

<sup>51</sup> Mosley, *Bearing the Heavens*, 119-126.

<sup>52</sup> Aslacus, *De natura caeli triplicis*, 183-184.

chapters of *Genesis* – a work that recapitulates some of the material in the *De natura caeli triplicis*.<sup>53</sup> (As Ann Blair has noted, this work resembles the biblical commentary tradition, with scripture affording Aslakssøn an opportunity to set out his existing views, rather than forcing him to develop new ones, systematically).<sup>54</sup> But how Tychonic or even Tychonian is it? Though invoked to some extent in his rejection of Copernicanism, in conjunction with other arguments, Tycho's commitment to the Bible as a real source of cosmological knowledge is elusive in his own publications and much of his correspondence.

One author who has considered the issue in some depth is Kenneth J. Howell.<sup>55</sup> Yet consideration of Aslakssøn's text raises the question of whether what Howell takes to be Tycho's position is fully his own. One of the sources Howell considers is a 1590 letter sent by Tycho to Caspar Peucer, responding to a letter of May 1589 in which Peucer challenged Tycho about aspects of his cosmology. A particular issue raised by Peucer in his letter, and addressed in Tycho's reply, was the nature of the supposedly 'supracelestial waters' – the waters *above* the firmament divided from the *waters* below, according to Genesis chapter 1.<sup>56</sup> Answering Peucer, Tycho rejected the suggestion that these waters lay above the celestial bodies, perhaps even constituting the adamantine sphere separating the heaven of the beatific vision from the mortal world; they should be interpreted instead, his letter asserted, as water in the airy atmosphere, in the form of clouds and vapours.<sup>57</sup>

This topic is one that Aslakssøn addresses too, in books one and two of his work, using similar arguments, and reaching the same conclusions; these sections of his treatise could perhaps be interpreted as an elaboration of Tycho's letter to Peucer. Thus, whereas Tycho's letter cites Calvin amongst the theologians who share his view, Aslakssøn actually quotes Calvin's commentary on *Genesis*.<sup>58</sup> Whereas Tycho's letter shows a passing acquaintance with resources such as Sebastian Castellio's Latin bible, the Hebrew lexicon of

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<sup>53</sup> Aslacus, *Physica et ethica Mosaica, ut antiquissima, ita vere Christiana, duobus libris comprehensa* (Hannover: Typis Wecheliani, apud haeredes Ioannis Aubrii, 1613).

<sup>54</sup> Ann M. Blair, 'Mosaic Physics and the Search for a Pious Natural Philosophy in the Late Renaissance', *Isis*, 91 (2000), 32-58, on p. 53.

<sup>55</sup> See Kenneth J. Howell, *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science* (Notre Dame, IN: University of Notre Dame Press, 2002), 73-108.

<sup>56</sup> *TBOO*, vol. 7, 185-187 (Peucer to Tycho, 10 May 1589), 231-237 (Tycho to Peucer, 1590). On the problem of the supercelestial waters and their role in discussions of the fluidity of the heavens, see Grant, *Planets, Stars, and Orbs*, 332-335; W. G. L. Randles, *The Unmaking of the Medieval Christian Cosmos, 1500-1760* (Aldershot: Ashgate, 1999), *passim*.

<sup>57</sup> *TBOO*, vol. 7, 232.

<sup>58</sup> *TBOO*, vol. 7, 233; Aslacus, *De natura caeli triplicis*, 31.

Santes Pagninus, and the bible of Immanuel Tremellius and Franciscus Junius, Aslakssøn's work shows extensive familiarity with these and with other texts relevant to exegetical philosophy, such as the *Physica Christiana* (1576) of Lambertus Danaeus and Hieronymus Zanchius's *De operibus Dei intra spacium sex dierum creatis opus* (1591).<sup>59</sup> And Aslakssøn certainly knew of Tycho's letter; he cited it in the *De natura caeli triplicis* in support of a particular point about the integrity of celestial bodies.<sup>60</sup>

Many things could explain Aslakssøn's familiarity with Tycho's 1590 letter to Peucer, and the congruence between the views it expresses and exegetical strategies it employs, and his own, apparently enduring, methods and beliefs. Given Tycho's self-conscious use of his own correspondence in publicising his work, managing his reputation, and advancing his programme, Aslakssøn's might well have been called upon, during his service on Hven, to make one or more copies of the letter for wider circulation, or to prepare it for printing.<sup>61</sup> He might even, for the same reasons, have obtained a copy of it elsewhere, after leaving Uraniborg.<sup>62</sup> Yet it is worth noting that the precise date of the letter is unknown, and it is not impossible that it was written whilst Aslakssøn was on Hven, and perhaps even with his assistance.

From his placement of the letter within Tycho's *Opera omnia*, it can be inferred that J. L. E. Dreyer supposed that it was written in February 1590, several months before Aslakssøn came to Uraniborg. Yet the evidence of the letter itself suggests a later composition. It responds to Peucer's letter to Tycho of 10 May 1589 and to another later and shorter letter from Peucer, no longer extant, delivered to Tycho by the French diplomat Jacques Bongars. Tycho received the first of these letters shortly before the summer solstice, when he attended the *herredag*, the annual assembly of Danish nobility on the mainland, and resolved to write his reply once he returned to Uraniborg; he received the second letter when passing through Copenhagen, on this or another occasion.<sup>63</sup> Bongars agreed to act as the courier for Tycho's reply to Peucer, but then failed to come to Hven, to carry out this promise, through the whole

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<sup>59</sup> *TBOO*, vol. 7, 233-235; Aslacus, *De natura caeli triplicis*, e.g. 7, 15, 22, 24-25, 36, 71, 73, 80, 87, 124-127, 132.

<sup>60</sup> Aslacus, *De natura caeli triplicis*, 137. On p. 149, he cites Peucer's letter to Tycho of 10 May 1589, to which the 1590 letter is (in part) a reply.

<sup>61</sup> Mosley, *Bearing the Heavens*, 99-102.

<sup>62</sup> On pp. 122-123, Aslacus quotes from what he describes as a certain letter of Tycho to John Craig, 'as Goclenius reports'. The quoted text comes, in fact, from Tycho's 'apologetic writing' to John Craig, as discussed below; see *TBOO*, vol. 4, 474. Since Goclenius is not a known correspondent of Tycho, however, this quotation illustrates how manuscript material originating on Uraniborg could have reached Aslacus via an indirect route.

<sup>63</sup> *TBOO*, vol. 7, 228-229.



of the following summer; the letter was thus a long-delayed response to Peucer, ostensibly for this reason.<sup>64</sup> Thus far, if we assume that the summer solstice in question was 1589 rather than 1590, all these details are compatible with a February composition. In addition, however, the letter shows that Tycho inferred, from Peucer's failure to mention it in his epistles, that he had not yet received an 'apologetic writing', which Tycho had also sent to him for his inspection and approval.<sup>65</sup> From other letters of this period, it is clear that 'apologetic writing' is a reference to Tycho's defence of his views on comets against the criticisms of his Aristotelian correspondent John Craig, a text that he did not finish composing - and hence did not begin to send out to correspondents - until October 1589.<sup>66</sup> Clearly, Tycho could not have reasonably expected to find mention of this work in Peucer's letters unless he received at least one of them - the one carried by Bongars - some time after that date. A whole summer having passed after *that*, then, would seem to imply that the letter was written no earlier than the autumn or winter of 1590. And, as noted above, Aslaksson started at Uraniborg in October of that year.

Given both the deeply collaborative nature of Tycho's astronomical enterprise, and the extent to which he nevertheless took credit for the work carried out by his assistants, it would not be surprising, I think, if his correspondence turned out to sometimes be the product of more hands and minds than has hitherto been realised.<sup>67</sup> Tycho certainly appreciated that there was much at stake in corresponding with Caspar Peucer - the son-in-law of Melancthon, and guardian of his reputation, and the most visible casualty of the struggle in Saxony between the Gnesio-Lutherans and the Philippists.<sup>68</sup> Thus, in composing his response to Peucer's letter of May 1589, Tycho might well have thought it prudent to draw on the expertise of a bright young Copenhagen-trained theologian-in-the making (were one to hand), particularly since he proposed to disagree with many of Peucer's scripturally-based

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<sup>64</sup> *TBOO*, vol. 7, 229.

<sup>65</sup> *TBOO*, vol. 7, 239.

<sup>66</sup> See *TBOO*, vol. 7, 195 (Tycho to John Craig, 25 October 1589), and 222 (Tycho to Thaddaeus Hagecius, 25 January 1590), where Tycho refers to having sent Hagecius a copy of his *Apologia* 'around the beginning of November'. On Tycho's quarrel with Craig, see Adam Mosley, 'Tycho Brahe and John Craig: The Dynamic of a Dispute', in John Robert Christianson et al., eds, *Tycho Brahe and Prague: Crossroads of European Science* (Frankfurt am Main: Verlag Harri Deutsch, 2002), 70-83.

<sup>67</sup> Of this letter in particular, Dreyer noted, *TBOO*, vol. 7, 411, that the extant copy he consulted and reproduced was 'pluribus manibus scriptum et multis locis correctum vel auctum est' - which is suggestive, at least, of a collaborative and prolonged process of composition.

<sup>68</sup> Kolb, 'Dynamics of Party Conflict in the Saxon Late Reformation'.

cosmological claims. Thus, if Aslakssøn's later work is capable of being read as the fuller expression of a Tychonic or Tychonian cosmology, partly rooted in skilled exegesis, whose seeds were contained within the letter of 1590, that may well be because the letter was one that he helped to write. But even if he did not contribute to the letter's composition, the echo of its contents in the *De natura caeli triplicis* show just how formative his time at Uraniborg was in shaping Aslakssøn's cosmology.

### **Longomontanus's Danish Astronomy**

In contrast to Aslakssøn, Longomontanus (1562-1647) was one of the longest-serving of Tycho's assistants. Although the exact date of his arrival on Hven is not recorded, we know that he began work at Uraniborg in 1589 and stayed there until Tycho's own departure in early 1597; he left Tycho's service with a letter of recommendation dated 1 June of that year. After some years of peripatetic study, he rejoined Tycho in Bohemia in January 1600, having failed to secure a satisfactory position on his own account. He departed Prague with another letter of recommendation several months later, little more than a year before Tycho died.<sup>69</sup> As several historians have suggested, it is likely that he, rather than Kepler, would have been Tycho's preferred successor, not least because he was a skilled observational astronomer and mathematician who made significant contributions to the technical astronomy published under Tycho's name.<sup>70</sup> Thus, as N. M. Swerdlow has recently discussed, he was largely responsible for the lunar theory which appeared in Tycho's posthumous *Astronomiae instauratae progymnasmata* (1602); he published a revised version of this theory in his *Astronomia Danica* of 1622.<sup>71</sup>

The *Astronomia Danica* itself has been variously described. Kristiaan P. Moesgaard, for example, labelled it a systematic treatment of astronomy largely based on Ptolemy and Copernicus, while John Christianson has referred to it as a 'great summary of Tychonic astronomy'.<sup>72</sup> The work was certainly both systematic and Tychonic – and thereby largely dependent, as Tycho's was, on variants of the mathematical models of Ptolemy and Copernicus. But such descriptions do not entirely capture the notable features of this work, or explain how and why it deviated from the Tychonic enterprise on which it was based.

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<sup>69</sup> Christianson, *On Tycho's Island*, 313-317.

<sup>70</sup> Christianson, *On Tycho's Island*, 316.

<sup>71</sup> N. M. Swerdlow, 'The Lunar Theories of Tycho Brahe and Christian Longomontanus in the *Progymnasmata* and *Astronomia Danica*', *Annals of Science*, 66 (2009), 5-58.

<sup>72</sup> Christianson, *On Tycho's Island*, 318.

In September 1588 Tycho had outlined – again in a letter to Caspar Peucer – the systematic work of astronomy that he proposed to produce, in seven parts. This would treat (i) the instruments of astronomy, (ii) trigonometry and other necessary mathematical aids, (iii) the sphere of fixed stars, (iv) the sun and the moon (v) the longitudes of inferior planets Venus and Mercury (vi) those of the superior planets, Mars, Jupiter, and Saturn, and (vii) the latitudes of all of the planets. Treating these topics, in this order, would provide a substitute for the great works of Ptolemy and Copernicus, which also dealt with the celestial bodies, but (so Tycho asserted) not sufficiently systematically, because they did not begin with a discussion of astronomical instruments and mathematics.<sup>73</sup> Partly because of the time and effort he spent dealing with a topic not included in this list, the recent novel phenomena of the heavens – in the form of the nova of 1572 and various comets – Tycho did not succeed in producing such a work himself.<sup>74</sup> But neither, quite, did Longomontanus, even if the *Astronomia Danica* contains many of its elements. Rather than being modelled on, and thereby substituting for, Ptolemy’s *Almagest* or Copernicus’s *De revolutionibus*, with Tychonic modifications, Longomontanus’s *magnum opus* takes its cue from the basic university textbooks in astronomy, the *De Sphaera* and the *Theoricae Planetarum*.<sup>75</sup> Thus, the work is divided into two parts, with part one devoted to spherical astronomy and part two to the planets. The newly-fashionable topic outside the academies, new phenomena in the heavens, is relegated to an appendix.

The work as a whole has the character of a textbook, albeit one for advanced students; it contains frequent references to ‘novices’ and ‘youths’ and copious worked examples. Trigonometry and instruments are treated within it as important foundations for astronomy, as Tycho had suggested, but not quite in the way that he outlined. Thus trigonometry appears as one of two *prognorismata*, or prior distinguishing marks of astronomy, preceding the first part of the work, on spherics.<sup>76</sup> Observational instruments receive an extended treatment in chapter seven of book two of part one, with Longomontanus explaining that ‘without this

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<sup>73</sup> *TBOO*, vol. 7, 132-133 (Tycho to Peucer, 13 September 1588).

<sup>74</sup> Mosley, *Bearing the Heavens*, 123-124.

<sup>75</sup> See Olaf Pedersen, ‘The *Corpus Astronomicum* and the Traditions of Medieval Latin Astronomy’, *Studia Copernicana*, 13 (1975), 57-96.

<sup>76</sup> The two parts and the appendix of Longomontanus’s *Astronomia Danica* are independently paginated; I shall designate them as I, II, and Appendix. See, in this case, I, 5-41. There is an internal inconsistency in the organisation of the text: on the first page of the text, the *prognorismata* are listed as belonging to book one of the two books on spherics. However, the discussion of them is followed, on p. 51, with a *praefatiuncula* on the books of the spherics, and p. 52 begins the first chapter of what is clearly labelled the first book.

knowledge, no-one becomes an expert in our astronomy'.<sup>77</sup> But pedagogic concerns and the appropriation of the *sphaera* genre, at least in part, led Longomontanus to treat as the most fundamental astronomical instrument not any of the sophisticated devices developed and used at Uraniborg, but rather the demonstrational armillary sphere, the *sphaera materialis*. This is introduced in chapter two of book one of part one, as a general instrument for delineating the apparent celestial motions, with its representational significance emphasised in the following three chapters.<sup>78</sup> Then, when he subsequently turns to instruments for observation, in chapter seven of book two, he notes that almost all such instruments could be considered parts of the material sphere he has already described.<sup>79</sup>

A Copenhagen disputation presided over by Longomontanus in 1612, and subsequently published, also focused on the *sphaera materialis*; it shares some of its content with the *Astronomia Danica*, including its labelled diagram of the instrument.<sup>80</sup> In this avowedly *philosophical* disputation, the claim that astronomy is the most noble part of philosophy - save for metaphysics - is openly made.<sup>81</sup> Such status-raising moves on the part of academic writers on astronomy were conventional, and not confessionally unique; in competition for prestige with professors of other disciplines, mathematicians had good reason to lay claim to the superior nature of their objects of study, such as their perfection and proximity to the divine, or the greater certainty of their methods. But there is no reason to suppose that they were not also sincere, nor that they were not tuned by particular pedagogic traditions and beliefs.<sup>82</sup> Melanchthon's emphasis on the particular value of the celestial motions as testimony to divine Providence (itself an echo of ancient opinion), justifying consideration of them as part of natural philosophy and not only mathematics,<sup>83</sup> is re-

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<sup>77</sup> Longomontanus, *Astronomia Danica*, I, 118: 'extra hanc cognitionem, nullus in Astronomia nosta artifex evadit'.

<sup>78</sup> Longomontanus, *Astronomia Danica*, I, 52.

<sup>79</sup> Longomontanus, *Astronomia Danica*, 118.

<sup>80</sup> Longomontanus, *Disputatio Philosophica quae Secunda Astronomiae est, de Sphaerae Coelestis legitima constitutione officio, & multiplici utilitate* (Copenhagen: Typis Henrici Waldkirchii, 1612); compare the diagram on sig. Av of this disputation with that on I, 55, of the *Astronomia Danica*. On university disputations as forms of professorial publication in this period, see William Clark, *Academic Charisma and the Origins of the German Research University* (Chicago and London: University of Chicago Press, 2006), 203-208.

<sup>81</sup> Longomontanus, *Disputatio Philosophica quae Secunda Astronomiae est*, sig. B3v: 'I. An Philosophiae pars nobilissima sit Astronomiae, Metaphysica excepta? Affirm.'

<sup>82</sup> For a different view, see Almási, 'Rethinking Sixteenth-Century "Lutheran Astronomy"', 10-13.

<sup>83</sup> Kusukawa, 'Nature's Regularity in some Protestant Natural Philosophy Textbooks, 1530-1630', 114.

expressed here in the claim that astronomy reveals ‘a harmony of order and motions, clearly divine, on which many metaphysical traces have been impressed, to the extent that you should declare heaven the opened book not only of Nature, but also of the whole Universe’.<sup>84</sup> The contrast between ‘Nature’ and the ‘whole Universe’ implies that for Longomontanus, as for his Philippist predecessors, there was more at stake in studying the stars and planets even than the claim of astronomers to be able to supply knowledge of the physical world.

In the *Astronomia Danica*, too, the importance of the distinction between natural philosophy is evident both in the extent to which it is adhered to, and the extent to which it is carefully undermined. Whereas in Aslaksson’s book the authorities cited included a range of natural philosophers and theologians, those named by Longomontanus are principally the classical authors and astronomers appropriate for inclusion in a work of mathematics: Hesiod, Pliny, Ovid, Ptolemy, Albategni, Regiomontanus, Copernicus, Reinhold, Tycho, Kepler, and the like. Philosophers feature more rarely: Plato and Plotinus receive the occasional honourable mention; Aristotle appears mainly to be castigated for his erroneous views. Much of this resembles Tycho’s major publications, but the *Astronomia Danica* also contains genre-busting elements of a non-Tychonic kind. Whereas Tycho’s own scholarly but non-academic works tended to strategically separate astronomy and astrology, increasingly so in his later years, Longomontanus interwove mathematical astrology into his text, something that was relatively unusual for the academic genres on which it was based.<sup>85</sup> The inclusion of sections and aspects in the introductory chapters on spherics could perhaps be explained by the requirements of the Copenhagen curriculum, but not the horoscopic analyses of the comets of 1607 and 1618 in the *Astronomia Danica*’s appendix.<sup>86</sup> Thus, Longomontanus seems not to have inherited Tycho’s doubts about the traditional *practices* of astrology - but

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<sup>84</sup> Longomontanus, *Disputatio Philosophica quae Secunda Astronomiae est*, sig. B3v: ‘Ab ordinis ac motuum divine planè harmonia, cui multa Metaphysica vestigia impressa sunt, adeo ut Coelum non solum Naturae librum, sed & totius Universitatis expansum dicas.’

<sup>85</sup> For Tycho’s changing attitude to astrological techniques, see Gábor Almási, ‘Tycho Brahe and the Separation of Astronomy from Astrology: The Making of a New Scientific Discourse’, *Science in Context*, 20 (2013), 3-30; cf., however, Håkon Håkansson, ‘Tycho the Prophet: History, Astrology and the Apocalypse in Early Modern Science’, in Kevin Killeen and Peter J. Forshaw, eds, *The Word and the World: Biblical Exegesis and Early Modern Science* (Basingstoke: Palgrave Macmillan, 2007), 135-156. Robert S. Westman has noted the importance of genre constraints on the mixing of astronomy and astrology in *The Copernican Question: Prognostication, Skepticism, Celestial Order* (Los Angeles & Berkeley: University of California Press, 2011), 104-105.

<sup>86</sup> Longomontanus, *Astronomia Danica*, I, 57-60, and Appendix, 38-43.

not concerning the principle of celestial causation which justified the treatment of astrology as physics, for about that Tycho had none.

On two important cosmological topics, Longomontanus differentiated himself from his former master in interesting ways. First, in advocating a modified form of his master's world-system, in which the Earth remained at the centre of the universe but rotated once every 24 hours, Longomontanus almost casually asserted the necessity of an accommodationist reading of the Bible. No one should wish to attribute real motions to the fixed stars, he suggested, 'except one who mordantly wishes to uphold sacred scripture in a few places, and not (as they seem to be) apparently accommodated to human intellect'.<sup>87</sup> True, he also invoked scripture in rejecting the Copernican proposition that the Earth was not created at the centre of the universe.<sup>88</sup> But, at the same time, he gave considerable weight to Tycho's arguments based on the disproportionality of the Copernican system - a result of the enlargement of the distance between the planets and the stars, and the consequent increase in size of the latter, which having the Earth in motion around the Sun would necessarily require.<sup>89</sup> Although his world-system was Tychonian, rather than Tychonic, the reasoning that he employed to justify his choice might be thought to shed some light on Tycho's own weighting of scriptural exegesis vis-à-vis considerations of physical geometry. In other words, Longomontanus's work can be used to suggest that Tycho, too, had recourse to scripture to confirm beliefs formed by pursuing other modes of inquiry, and not the other way round. This is not to argue that either scholar was insincere in pointing to the bible as a source of cosmological knowledge; both evidently felt that there could be no incompatibility between the bible, properly understood, and the results of their astronomical labour. But given the susceptibility of the text to differing interpretations, which Longomontanus at least acknowledged,<sup>90</sup> it is difficult to see how they could have used it to *arrive* at their very particular views without the use of other evidence.

The second cosmological issue whose treatment in the *Astronomia Danica* is significant concerns the nature of celestial matter. This was the subject of the second the two *progorismata* preceding the first part of the work on spherics - and hence, in

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<sup>87</sup> Longomontanus, *Astronomia Danica*, II, 19: 'nisi mordicus sacram scripturam paucis in locis, & non (ut videntur) nisi captui humano apparenter accomodatus'. See also Longomontanus, *Disputatio Philosophica quae Secunda Astronomiae est*, sig. A3r.

<sup>88</sup> Longomontanus, *Astronomia Danica*, II, 17.

<sup>89</sup> Longomontanus, *Astronomia Danica*, II, 17-19. For Tycho's use of this argument, see Mosley, *Bearing the Heavens*, 144-145.

<sup>90</sup> As noted by Howell, *God's Two Books*, p. 92, Tycho seemed not to.

Longomontanus's presentation, a topic fundamental to the understanding of astronomy.<sup>91</sup> Longomontanus's treatment is similar in several respects to the second book of Aslaksson's *De natura caeli triplicis*. Thus Longomontanus is at pains to explain here that the celestial region is unencumbered by physical orbs or spheres, and not fiery in nature, but occupied by a fluid substance distinct in nature from elemental water and air.<sup>92</sup> But he then goes on to present some rich reflections about this substance, Tychonian rather than Tychonic in character, which draw on scripture, on chymical authors, and on optical evidence.<sup>93</sup> A key argument offered here is that the substance of the heavens is not, as the scholastics had argued, without contrary qualities. As experience and experiment suggest, the light-producing bodies of the cosmos, especially the sun, generate and disseminate heat; thus, Longomontanus argues, it makes sense that the *expansum* which fills the space between such bodies, constitutes the substance through which they pass, and acts as the luminiferous medium, possesses the opposite quality of cold.<sup>94</sup> Longomontanus's account of this substance is interesting for two reasons. First, the term 'expansum' is one employed Tycho's epistolary exchanges with Peucer, as a suitable translation for the Hebrew *raqia*; this allowed Tycho to claim that scripture supported the idea that the heavens were fluid.<sup>95</sup> Second, Longomontanus's *expansum* possesses the property of ubiquity: it extends throughout the universe, occupying terrestrial as well as celestial space, and constituting the medium for light and other celestial rays even beneath the surface of the Earth, and is 'most tenuous and subtle, nay indeed akin to incorporeal and insensible'; if 'anyone said it were relatively spiritual, and to be likened to the fifth essence of Aristotle, he would, in my judgement, not be far from the truth'.<sup>96</sup> Though Longomontanus himself does not emphasise it, his discussion here therefore touches on (and equivocates over) the issue at stake in the great Christological debate of the Protestants: could a corporeal substance be everywhere, or was a ubiquitous substance necessarily spiritual?

Longomontanus refers back to his theory of celestial matter in his brief appendix on celestial novelties. This appendix is conventional in a number of ways. It analyses comets and

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<sup>91</sup> Longomontanus, *Astronomia Danica*, I, 42-49.

<sup>92</sup> Longomontanus, *Astronomia Danica*, I, 42-43.

<sup>93</sup> Longomontanus, *Astronomia Danica*, I, 43-49. See also Moesgaard, 'Cosmology in the Wake of Tycho Brahe's Astronomy', 296-298.

<sup>94</sup> Longomontanus, *Astronomia Danica*, I, 45-46.

<sup>95</sup> Howell, *God's Two Books*, 103.

<sup>96</sup> Longomontanus, *Astronomia Danica*, I, 43: 'tenuissimum & subtilissimum, quippe incorporeo & insensibili similimum'; I, 45: 'si quis spiritualem respective, & Aristotelis quintae essentiae assimilandam dixerit, haud multum, meo iudicio, a vero abluet'.

novae in terms of the four scholastic causes – efficient, material, formal, and final – as a number of works of natural philosophy did from the late middle ages onwards.<sup>97</sup> It presents them in a very traditional sense, as portents of terrible things, but with the Phillipist refinement (subsequently distributed across confessional boundaries), that these were signs intended by God to encourage sinners to repent.<sup>98</sup> And it seeks to explain, again, in a way that accords with Phillipist understanding, that because God’s providential governance of his creation operates through secondary causes, there is no contradiction between the natural and the eschatological explanations of their purpose.<sup>99</sup>

In discussing the efficient and the material causes of comets, Longomontanus reports on the pious ignorance of their true nature that had increasingly become the norm in the later sixteenth century, as the Aristotelian explanation of them as meteorological phenomena began to seem more and more untenable. Tycho himself, he notes, had agreed with the Imperial Physician Thaddaeus Hagecius that *how* comets were generated in heaven was to be ascribed ‘ “to the marvellous Works of God” ’ and considered something that ‘ “is removed from our fuller knowledge” ’, even as he pledged to set out his opinion on their creation at the close of his three-volume work on new phenomena in the heavens.<sup>100</sup> Tycho did not live to fulfil this promise, though he dropped a few broad hints at the close of his *Astronomiae instauratae progymnasmata*, where he likened comets to the nova of 1572.<sup>101</sup> Thus Longomontanus was free to offer, and claim credit for, some speculations of his own. Like Tycho, Longomontanus saw a connection between the matter of comets and novae and the

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<sup>97</sup> Longomontanus, *Astronomia Danica*, Appendix, 5-21. On the scholastic tradition, see Adam Mosley, ‘The History and Historiography of Early Modern Comets’, in Miguel A. Granada, Adam Mosley, and Nicholas Jardine, *Christoph Rothmann’s Discourse on the Comet of 1585: An Edition and Translation with Accompanying Essays* (Leiden: Brill, 2014), 282-325, especially 291-297. For cometary interpretation in a different near-contemporary Lutheran and Scandinavian context, but displaying similar themes and concerns, see Martin Kjellgren, *Taming the Prophets: Astrology, Orthodoxy and the Word of God in Early Modern Sweden* (Lund: Sekel, 2011), 129-183.

<sup>98</sup> Longomontanus, *Astronomia Danica*, Appendix, 17-21. See also Mosley, ‘The History and Historiography of Early Modern Comets’, 297-311, 323-325.

<sup>99</sup> Longomontanus, *Astronomia Danica*, Appendix, 17-21. For Melanchthon’s understanding of God’s use of celestial secondary causes, see Sachiko Kusukawa, ‘*Aspectio divinatorum operum*: Melanchthon and astrology for Lutheran medics’, in Andrew Cunningham and Ole Peter Grell, *Medicine and the Reformation* (London: Routledge, 1993), 33-56.

<sup>100</sup> Longomontanus, *Astronomia Danica*, Appendix, 5: ‘ “[Hagecius] admirandis Dei operibus, quomodo id eveniat pie adscribit, & a nostra plenaria cognitione remotum adscribit, quod & ego [Tycho] non inficio” ’. For the source of Longomontanus’s quotation, see *TBOO*, vol. 3, 27.

<sup>101</sup> *TBOO*, vol. 3, 306-307.



Milky Way.<sup>102</sup> Unlike him, however, he sought to connect the coming-to-be and passing away of such phenomena in the heavens to the existence of the contrary qualities, heat and cold, which he had, without direct precedent, located in the celestial realm. His explanation likens celestial generation to processes at work in terrestrial procreation: occupying a domain considered by him to be subject to material change, the heavenly bodies are capable, he argues, at times determined by divine providence - and thus, far from randomly - of producing invisible *semina*. These seeds, embedded in the *expansum*, develop into the visible celestial phenomena, novae and comets, in a process akin to the reproduction of animals and the propagation of plants.<sup>103</sup> As Jole Shackelford has noted, the seminal theory of generation underpinning this account can be traced back to Paracelsian theories, as articulated by Petrus Severinus, and can also be found in Aslakssøn's work.<sup>104</sup> Thus in its matter theory, as well as its focus on novel celestial phenomena, the Appendix testifies to the common cosmological inheritance of Tycho's Scandinavian disciples. Yet, if we are to believe Longomontanus himself, his use of this inheritance in this instance was Tychonian rather than Tychonic, since it elaborated a fuller theory of cometary generation than Tycho himself had presented.<sup>105</sup>

## Conclusion

The two works that I have examined, by two of Tycho's assistants who went on to enjoy important careers within Denmark, show clear signs of having been shaped by their authors' experiences in Tycho's employ. They are, in certain identifiable respects, Tychonic. But they are not narrowly so, and it is certainly too limited a view to see the author of one, Aslakssøn, as one of Tycho's philosophical and theological heirs, and the author of the other, Longomontanus, as Tycho's astronomical heir. Both works were certainly also shaped by their authors' subsequent educational experiences and settings, as well as their particular talents and concerns. Since they present inflected forms of what might we might think of as a

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<sup>102</sup> Longomontanus, *Astronomia Danica*, Appendix, 9-11.

<sup>103</sup> Longomontanus, *Astronomia Danica*, Appendix 7-11.

<sup>104</sup> Shackelford, 'Unification and the Chemistry of the Reformation', 301-302. See also, however, Hiro Hirai, 'Logoi Spermaticoi and the Concept of Seeds in the Mineralogy and Cosmogony of Paracelsus', *Revue d'histoire des sciences*, 61 (2008), 245-264, for the pre-Paracelsian roots of seminal theory.

<sup>105</sup> Longomontanus's quotation of Tycho, as indicated in n. 100, was part of an *apologia* for expressing opinions on a topic that had eluded other great men; we must either accept the implication that Tycho's views were not fully worked out, or suppose that Longomontanus was dissimulating in order to maximise the credit that he could claim for himself.

Tychonic tradition or school of approaching the study of the heavens, with their authors deviating slightly from Tycho's own modes of enquiry, doctrines, and context, we might label them Tychonian.

To be Tychonian in Denmark at the turn of the century was also, however, to belong to a longer Philippist tradition of studying the heavens. That too is evidenced by the texts in question, even if, bearing Charlotte Methuen's caveats in mind, it seems possible only to point to material that seems *characteristic* of the legacy of Melanchthon, and not to anything *unique* to astronomical Philippism, or indeed the Lutheran confession more generally. To the extent that both Aslakssøn and Longomontanus subscribed to cosmologies informed by Paracelsian theories of matter and generation, as Tycho too had done, the evaluation of their confessional credentials is complicated by the existing historiography concerning the relationship between Lutheran orthodoxy, Philippism, and Severinian Paracelsianism in early seventeenth-century Denmark. But the search for doctrinal specificity in the Melanchthonian astronomical tradition seems to me misguided, on a number of grounds. Theologically, Philippists were not always clearly distinguishable from Calvinists, and they have typically been identified with a degree of irenicism and openness lacking in their 'hardline' Lutheran opponents; the very aspiration to doctrinal clarity was something that, in a sense, the Gnesio-Lutherans used against them, rather than something to which they wholly subscribed. Moreover, successive generations of astronomical Philippists worked with, and indeed made substantial contributions to, a changing body of knowledge, using different methods and techniques. At the start of the Reformation, for example, comets were predominantly thought of as meteorological phenomena; by the end of the sixteenth century, the leading Lutheran astronomers had come to believe that they were wholly celestial phenomena. Some of them had developed, and applied to this study, new instrumentation of unprecedented accuracy. But while understanding of both their *physical* nature and the mode of inquiring into their location had thus been radically transformed, appreciation of their *eschatological* significance as divinely-ordained calls to repent was widely retained. It is these continuities and changes within the multi-generational tradition of astronomical Philippism that we must describe and explain.

There is still more work to be done, I think, to draw out the astronomical and cosmological thought of both Aslakssøn and Longomontanus, and thereby to bring them out of the shadow of their master and collaborator. A fuller study of both authors' use of scriptural exegesis and the contemporary reception, or lack of one, accorded to their respective reflections on corporeality and ubiquity, would be helpful in clarifying the

relationship between theological doctrines to which they were increasingly *supposed* to subscribe and their natural philosophies. Having said that, one of the reasons for pursuing such work is that sheds further light on Tycho himself. On the one hand, it raises some interesting questions about the contribution that Tycho's assistants made to work published or circulated under his name - questions that may not be fully answerable, but are certainly worth bearing in mind. On the other hand, considering Tycho, a member of the third-generation of Philippists, in the light of the work of those members of the fourth-generation that he helped to train, brings into relief aspects of his own work that may need to be rethought as reflecting traditional concerns. Thus bookended, for example, Tycho's insistence that a systematic work of astronomy should first treat instruments and mathematics looks less a personal preference, and more like the kind of concern to establish the sources and foundations of astronomical knowledge that both Aslaksson and Longomontanus also displayed, as well as earlier Philippists and Johannes Kepler. As Nienke Roelants has suggested, such epistemological concerns may have their origins in Lutheran anthropology. The heavens had to be *knowable* to convey the lessons that Melancthon and his followers sought to extract from them, despite the limitations placed on man's ability to know nature as a result of the Fall.