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A Sphere unto Itself: the Death and Medieval Framing of the History of Chinese Cosmology

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Abstract: This paper attempts to explain the lack of dialogue between Indian and Chinese cosmologies in the astral sciences of the Six Dynasties and Tang. The history of cosmology in China, we are told, died in the eighth century, the final blow having been delivered by the monk Yixing. Almost everything we know about this history derives from three sources: Shen Yue and Li Chunfeng's respective 'heavenly patterns' monographs (5th & 7th cent.) and Gautama Siddhārtha's *Kaiyuan zhanjing* (729). The former, I argue, impart history with a neat *telos* that survives to our day: the history of cosmology is the history of instrumentation (two-dimensional diagrams and gnomon planes vs. three-dimensional sphere instruments); there were three true 'schools', but the contest was settled almost as soon as it began in the second century, the subsequent centuries being defined by irresponsible ideas that threatened the rightful winner. The success of Shen and Li's frame, I argue, admitted no viable intellectual place for foreign ideas in their histories. Shifting perspective, I look at how Buddhists engaged with this discourse, examining the case of astronomers Gautama and Yixing, the dilettante Liang Wudi (r. 464-549), and the encyclopaedist Daoshi (7th cent).

Biography: Daniel Morgan is a postdoctoral researcher at the ERC project SAW (CNRS-Université Paris Diderot), whose research focuses on the history, sociology, and historiography of the astral sciences in early imperial China, the plurality of mathematical cultures, polymathy, and medieval Chinese ideas of the history of knowledge.

[Introduction]

I am going to tell you a story—a story of a bubble of a world that was perfect and self-contained until Europeans came along and popped it. I'm not talking about China, of course, which was a sprawling and open affair through which ideas, goods and people passed in and out like blood through a healthy heart. I'm speaking instead of the Chinese idea of the greater world—their cosmology—and of the history of this world. This story I am about to tell you is a modern story, but it is really actually also a *medieval* story that we don't realize that we are all retelling. So this story has a story too, we might say, and I shall tell you both.

Chinese Cosmology, a Modern History

The first thing you learn about Chinese cosmology is that it does not exist. There are texts that the Sanskritist or classicist would immediately identify as 'cosmology', yes, and sinologists once read and discussed them under that very rubric, it is true, but things have changed.¹ Following the cultural turn in

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¹For old studies of Chinese cosmology under the rubric 'cosmology', see for example Forke (1925), Maspero (1929), Needham (1959: 210–27), Nakayama (1969: 24–44), Loewe (1975). Under the same rubric in Asian languages, 宇宙論 (cosmology), see Xi & Zheng (1975), Jin Zumeng (1991) and Wang Yongmao (2000).

the history of science of the 1970s, Western-language sinology has circumscribed *this* topic as ‘cosmography’—by which is vaguely meant ‘cosmology unworthy of the name’—to focus on ‘real’ cosmology.² The discussion of ‘cosmology’ now focuses exclusively on the sort of ‘analogical’ and ‘correlative’ thought (once ‘primitive’ and ‘magical’) that one finds first and foremost in divination, theology, the occult, and theoretical medicine. Chinese cosmology *is* (as of the 90s) ‘correlative cosmology’: the classification of things into yin-yang 陰陽, five-agents 五行 and *Yijing* 易經 matrices and the belief that ‘like affects like’ within them.³ Even Asian-language sinology is following suit, which is interesting, *since there is no word for ‘correlative cosmology’ in any Asian language*. Where we once got by with the synecdoche 陰陽五行 (yin-yang & five agents) or the expression 天人感應 (heaven & man stimulate & respond), we sinologists have now begun to empty the word 宇宙論 (cosmology) of its generally-accepted sense as well, relegating its former meaning to new categories like 天地結構學說 (theories on the structure of heaven and earth).⁴ You cannot speak to a twenty-first century sinologist about ‘cosmology’, as a historian of any other civilisation understands the term, because the very word has been plucked from his/her lexicon so as to sustain a centuries-old essentialist narrative about the strangeness of the oriental mind.

The second thing you learn about cosmology, if you are persistent enough to find where the sinologist has hidden it, is that it is pointless. The story goes like this. There were once three ‘schools’ 家. One was clever, one was silly, and one was lost. The earth was flat. The silly one said the sky was flat too, the clever one said that it was a great encompassing sphere, and the lost one said there was no sky, or so we think, because the lost one got lost. Unlike the story of the turtle and the hare, the favourite won the race almost as soon as it began, by the second century, before which we have very, very few sources. The race was over, and everyone was happy, but some lingered to explain the results or to say some nonsense to the contrary. Five centuries later, a Buddhist monk named Yixing 一行 (683-727) pointed out that no one had actually won the race. Everyone was so convinced/disinterested ever after that they never talked about it again until Catholic monks arrived.

The competition was one of elegance and compromise between the

²The first and strongest proponent of the cosmology/cosmography distinction in Chinese intellectual history has been Christopher Cullen. The distinction is introduced in Cullen (1977) but is given the clearest description in Cullen (1996: xi, n. 2):

My use of the term ‘cosmography’ rather than ‘cosmology’ is a deliberate distinction. By the first of these terms I mean a description that is mainly concerned with the shape and size of the heavens and the earth, and with the disposition and motions of the heavenly bodies—a cosmic equivalent of geography. By the second term I mean any theory of how the universe works in a more metaphysical sense. In China I would call discussion of Yinyang and Five Phase thinking cosmology in this sense. Of course both terms involve prefabricated ‘observer categories’ and we cannot guarantee that they will correspond to the ‘actor categories’ we hope to recover by studying the writings of ancient Chinese thinkers. In a case such as Plato’s *Timaeus* the cosmographical/cosmological distinction hardly seems to be present in the author’s mind at all.

While personal communication with Cullen on 13 Jan 2015 confirmed my original suspicion that he did not intend anything beyond a precision of terms by this distinction, it has been picked up elsewhere in sinology to support reductionist statements like ‘la modélisation des mouvements célestes n’a pas débouché en Chine sur une cosmographie de type géométrique, à la manière des systèmes développés en Grèce, mais sur une cosmologie de type calendaire’ (Kalinowski 2004: 88).

³On Chinese analogical/correlative thinking, see Graham (1986). For examples of scholarship on analogical/correlative thinking under the rubric ‘cosmology’, see Henderson (1984), Kalinowski (1991), Wang Aihe (2000), Harkness (2011). For an overview of the history of the Western sinological treatment of this thought, up to its promotion to ‘Chinese cosmology’, see Saussy (2000) and Nylan (2010).

⁴For the use of 宇宙論 (cosmology) in the sense of correlative thought, see for example Li Ling (2006) and Asano (2006). The example of 天地結構學說 (theories on the structure of heaven and earth) comes from Chen Meidong (2007); we now also see expressions like 宇宙模型 (cosmic model), 宇宙構造 (cosmic structure), etc.

(clever) ‘sphere’ 渾 and the (silly) ‘umbrella’ 蓋. ‘Spherism’ posited the sky with a shape intuitive to our experience of the stars rising, setting, surrounding, and rotating around us at a more-or-less constant distance (fig. 1). A ‘sphere’ not only looked right, it explained a lot of things. With the sun as the sole light source, for example, the disposition of the sun, moon, and earth would explain lunar phases and eclipses. With the sun and moon travelling on a ‘yellow path’ (ecliptic) at an incline from the equator, their changing declinations would explain their changing points or rising, setting, and culmination. Importantly, it inclined the sky so that the Chinese observer may take his rightful place at the ‘earth’s centre’ 地中. ‘Umbrellism’, on the other hand, posited ‘heaven & earth’ to be parallel disks, hats, umbrellas or (upside-down) plates, one above the other (fig. 2). This was and is very unintuitive, and it requires some ingenuity to square with experience. Nothing actually ‘enters’ 入 (sets), for example, it simply appears to converge with the ‘earth/horizon’ 地 at a distance; and so too does it get dark when the sun gets far enough away. The moon is eclipsed in opposition because... yin & yang, something, something. Also, rising, setting, and culmination vary because the sun and moon cycle through seven different orbits around the world-axis. Why go to all this trouble? ‘Umbrellism’ offers numerous hypothetical advantages over ‘spherism’, but what matters is those underscored by its proponents: it made ‘heaven & earth’ perfect mirrors of one another, it kept one on high and one below, and it prevented the sun (: fire) from having to ‘enter’ the world ocean (: water)—all as we would expect of a rational world.

Faced with a choice, most thinkers (and *all* experts) preferred, in Liu Zhuo’s 劉卓 (544-610) words, (spherist) ‘truth duly verified by experience’ 真已驗 over (umbrellist) ‘reasoning’ 理 and ‘arbitrary supposition’ 意斷.⁵ As a side note, even thinkers otherwise thoroughly embedded in religious and occult practices like Ge Hong 葛洪 (283–343) took extraordinary pains after the fact to observationally refute and rationalize their way around yin-yang, five-agents and analogical arguments against the sphere, however much sinologists would have the latter be the monolithic framework of their mental universe.⁶ So the sphere was victorious, and so it was vanquished too, for Yixing ultimately dismissed the debate on empirical grounds:

今誠以為蓋天，則南方之度漸狹；以為渾天，則北方之極浸高。此二者，又渾、蓋之家未能有以通其說也。由是而觀，則王仲任、葛稚川之徒，區區於異同之辨，何益人倫之化哉！

Now, if you sincerely take it as an umbrella heaven, then [how do you explain that] the *du* 度 (\approx degree)⁷ gradually narrows as you go south [?] And if you take it as a sphere heaven, then [how do you explain that] the pole steadily rises as as you go north[?] These two things are what neither the sphere nor umbrella school (家) are as yet able to reconcile with their explanations (說). If you observe/contemplate (觀) [the matter] from this [perspective], then for the disciples of Wang [Chong] 王充 (umbrellism) and Ge [Hong] (spherism), what aid ultimately was their trifling over such distinctions to the betterment of man?!⁸

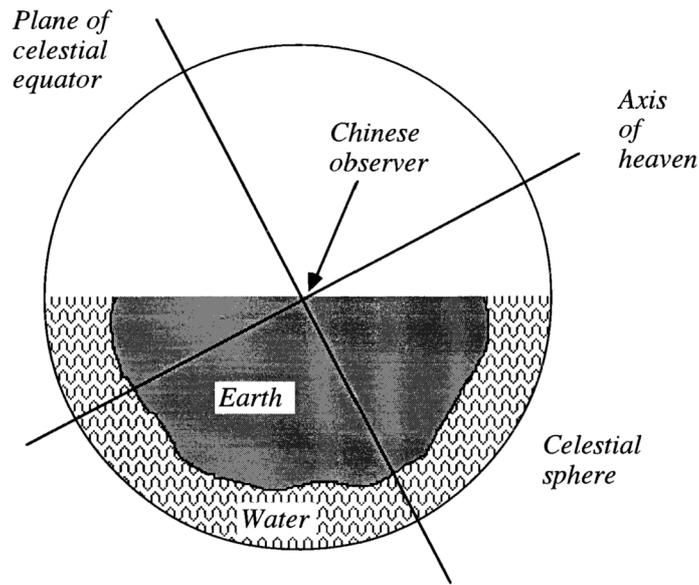
⁵ *Sui shu*, 19.521.

⁶ See Ge Hong’s meticulous case against Wang Chong’s 王充 (27 – c. 100) ‘umbrellist’ cosmology, also mentioned in Yixing’s citation below, as recorded in *Jin shu*, 11.280–84; tr. Ho (1967: 54–58).

⁷ Definition: the *du* 度 is a linear measure, convertible with terrestrial distances, used in the context of the astral sciences (and that context only) as a pseudo-angle with which to measure along the circumference of any given great circle, and defined as the distance travelled by the mean sun in one day, where the number of *du* in one “circuit of Heaven” depends upon the accepted value in days for the length of the solar year (*sui* 歲). In other words, $360^\circ \approx 365\frac{1}{4} du$.

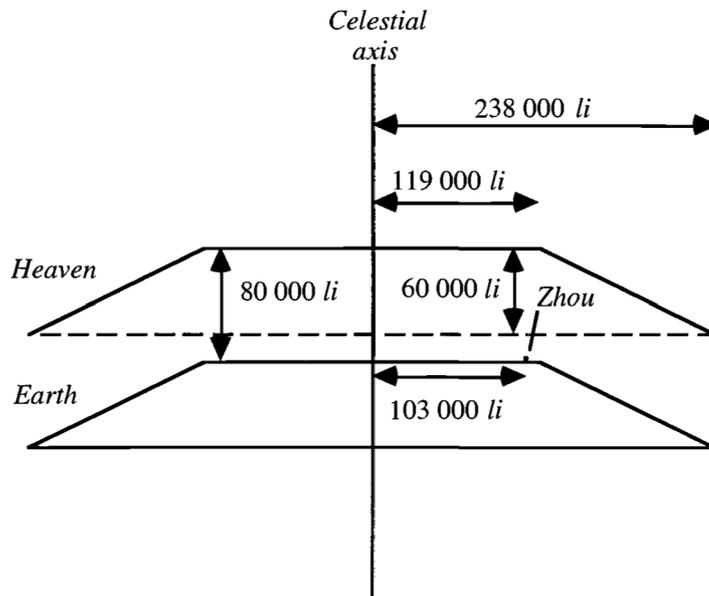
⁸ *Jiu Tang shu*, 35.1307. On the Ge-Wang debate, see Note 6. Yixing’s argument rests on two observations. The first—that ‘the *du* gradually narrows as you go south’—refers to the fact that, as observed on an armillary sphere, one *du*-degree of pseudo-angle gets smaller the closer you measure from *each* pole (the same reason, for example, why planes fly north over Russia and Canada to get faster between continents. The disk or umbrella shape, however, has only

Figure 1: *Lingxian* sphere heaven, modern interpretation



Source: Cullen (1996: 65, fig. 6)

Figure 2: *Zhou bi* umbrella heaven, modern interpretation



Source: Cullen (1996: 136, fig. 13)

This, but for differences of nuance and detail, is the story of Chinese cosmology that one finds in essentially every piece of modern scholarship on the topic.⁹ It is not a particularly good story, as far as stories go, so we understand

one pole and would thus imply *du*-degrees that that got *wider and wider* beyond the equator-centre. The second observation—that ‘the pole steadily rises as as you go north’—refers to the fact that the altitude of the north celestial pole is determined by (and in fact equals) one’s geographic latitude and, in the northern hemisphere, increases visibly the further north one travels. The problem is that flat-earth ‘spherism’ has heaven inclined at a *fixed angle*—36 *du* altitude, an angle chosen to place the observatory of the capital (Luoyang 洛陽 34°40’N; Chang’an 長安 34°16’N) at the centre of the world. On Yixing’s argument, see Jin Zumeng (1986).

⁹We find this narrative, for example, in all of the studies mentioned in Notes 1 & 2. Important exceptions to this sweeping statement include Cullen (1977), which treats third- to eighth-

why the sinologist hesitates to tell it. There is no real tension, no build-up, and no surprise. The story just stops, multiple times, skipping from the second century to the eighth and from Han China to Enlightenment Europe. Nor is there any character development, as we care mostly about an idea's true original form and not what later people did with it. In short, the story is that China was a bubble every bit as static and self-contained as the sphere-world dreamt up by the intelligentsia of its ancient Yellow River capitals.

Chinese Cosmology, Medieval Modern

If this is not a good story, we sinologists are not entirely to blame, because we are retelling a story written twelve centuries ago in, needless to say, a very different context. The near entirety of what survives of this discourse, which actors labelled 天體 (heaven's form) or 天論 (discourse on heaven), survives in **four extant sources**. Three of these sources are histories: the 'Heavenly Patterns Monograph' 天文志 of the *Book of Song* 宋書, the *Book of Jin* 晉書 and the *Book of Sui* 隋書. The other is a compendium of astral omens: the *Kaiyuan zhanjing* 開元占經 (Kaiyuan Era Omen Classic). These sources were compiled by **three men**. The *Book of Song* monograph was written by **Shen Yue** 沈約 (441-513), a Buddhist southern poet, statesman, historian and omen enthusiast of high birth then serving the Southern Qi 南齊 court (479–502).¹⁰ Shen, who does not himself seem to have been an expert on astronomical matters, clarifies that he is 'following' 因 the celebrated astronomer He Chengtian's 何承天 (c. 370–447) now-lost historical monographs of the period.¹¹ The *Book of Jin* and *Book of Sui* monographs were written by **Li Chunfeng** 李淳風 (602–670), a celebrated Daoist polymath deeply involved in every facet of the astral and mathematical sciences.¹² The *Kaiyuan zhanjing*, lastly, was written by **Gautama Siddhārtha** 瞿曇悉達 (fl. 729),¹³ a Chinese-born member of one of the three 'Western' lineages that ran the early Tang 唐 (618–907) astronomical office.¹⁴

century cosmology in significant detail, Cullen (1996), which makes a substantial argument for the relationship between cosmologies and observational instrumentation, and Chen Meidong (2007: 128–532), which makes a valorous effort to take us beyond the eighth century and the 'three schools' framework. The current paper is, needless to say, heavily indebted to these three studies.

¹⁰ On Shen Yue, his historiography and omenology, see Lippello (2001).

¹¹ Specifically, Shen Yue explains in the preface to his monographs that:

元嘉中，東海何承天受詔纂宋書，其志十五篇，以續馬彪漢志，其證引該博者，即而因之，亦由班固、馬遷共為一家者也。其有漏闕，及何氏後事，備加搜采，隨就補綴焉。

In the Yuanjia reign-period (424–453), He Chengtian of Donghai 東海 received an edict ordering him to compile a *Book of Song* and its monographs, in fifteen chapters, picked up after [Si]ma Biao's 司馬彪 (d. 306) monographs of the [Later] Han 後漢 (25–220). The comprehensiveness & breadth of its evidence & citations [are why I] have gone to and followed them and what places him alongside Ban Gu 班固 (32–92) and [Si]ma Qian 司馬遷 (c. 145 – c. 86 BCE) as a single school (of historiography). Where there are omissions & elisions, and when we come to events *after* Mr. He, [I] patched things up as [I] go by repletion of what [I myself] have gathered (*Song shu*, 11.205–06).

¹² On Li Chunfeng, see Chen Meidong (2003: 350–57) and Goodman (*forthcoming*).

¹³ The name 瞿曇悉達 is composed of a common sinified abbreviation of the family name **Gautama**—瞿曇 (MC *Kju-dom), also rendered 俱譚 (MC *KjuH-dom), 具譚 (MC *GjuH-dom), and 喬答摩 (MC *Gjew-top-ma)—followed by a common sinified abbreviation of the given name **Siddhārtha**—悉達 (MC *Sit-dat), also rendered 悉達多 (MC *Sit-dat-ta), 悉多 (MC *Sit-ta), and 悉多頹他 (MC *Sit-ta-at-tha). His name is clearly a stylized Chinese version of Siddhārtha Gautama, and I have chosen to "translate" it accordingly, rather, for example, than giving the name's *pinyin* transliteration of its modern Mandarin pronunciation (Qú-tán Xī-dá). For the abbreviations 瞿曇 and 悉達, see Hirakawa Akira's 平川彰, *Bukkyō kanbon daijiten* 佛教漢梵大辭典 (Tōkyō: Reiyukai, 1997), items 0482 & 0884. Middle Chinese (MC) reconstructions are those of Jeff Tharsen's Digital Etymological Dictionary of Old Chinese (<http://http://edoc.uchicago.edu/>).

¹⁴ On Gautama and the foreign lineage experts at the Tang astronomical office, see Jiang

Cosmology in state histories

Let us speak first of Shen Yue and Li Chunfeng, since they were writing in the same genre. Though their histories are constituted primarily by extensive overlapping citations, Shen and Li, as I shall argue in a forthcoming article, gave their histories both shape and direction.¹⁵ Where they agreed was on their their point of departure. Both of frame their histories around Cai Yong's 蔡邕 'three schools, one winner' claim of 178:

論天體者三家，宣夜之學，絕無師法。周髀術數具存，考驗天狀，多所違失。惟渾天僅得其情，今史官所用候臺銅儀，則其法也。

The discourse on heaven's form is comprised of three schools (家), but the study of **expansive night** (宣夜) has died out and has no master method. Both the procedures and numbers of the *Zhou bi* 周髀 (**umbrella heaven** 蓋天) survive, but when examined (考) and verified (驗) against the case of heaven, there is much that misses the mark. It is only **sphere heaven** (渾天) which completely grasps the true circumstances (情). The observatory bronze instrument employed by the Clerk's Office (史官) of our day is patterned upon this model (法).¹⁶

Where they also agreed was that the history of cosmology *after* 178 was mostly marked, in Shen Yue's words, by schools of 'curious chatter that missed the mark by some distance' 好異之談，失之遠矣.¹⁷ Neither historian deigns to give us more than a couple sentences on these 'schools' 家 or 'explanations' 說.

Where Shen Yue and Li Chunfeng go their different ways, however, is in the direction that history takes and the epistemology implied therein. **Shen** places 'the sphere' first and attributes its invention to sage kings at the dawn of man. He then argues that *Zhou bi* umbrellism is a later fabrication and places it with the absurdities of post-178 times, which he saves to criticise at the end. Working with the exact same sources, **Li Chunfeng** places *Zhou bi* umbrellism back in the early Zhou 周 (1045–771 BCE) and debunks claims about the antiquity of 'the sphere' as a myth begun in the first century CE and perpetuated by bad historians (i.e., Shen Yue). In the *Book of Sui* monograph, after cutting back to 'curious chatter', Li then concludes with an account of how spherists progressively solved the problem of apparent solar diameter from the sixth century BCE to the sixth century CE by moving from (1) ignorance to (2) discovery to (3) 'reasoning' 理 from anecdotal observation and *finally* to (4) falsification by mathematical proofs and instrument-guided measurement. **In other words**, Shen Yue assumes a history of knowledge that begins with ancient suprahuman revelation and proceeds by decay, loss, and misdirection, while Li Chunfeng assumes that knowledge is the cumulative work of humans, and, thus, that good knowledge must be 'modern'.¹⁸

It's easy for an expert like Li Chunfeng to win a debate on astronomy, especially when his opponent is dead; and judging from the frequency of citation by the later textual tradition, Li indeed seems to have won. The reason he won, however, probably had less to do with the vision of knowledge that he used the medium of state history to substantiate but the genius and ruthlessness of his writing strategy: he took *the entirety* of Shen Yue's text on cosmology, reorganized it into an argument against Shen's every claim and filled it

Xiaoyuan (1992) and Lai Swee Fo (2003).

¹⁵ Morgan (*forthcoming*).

¹⁶ *Song shu*, 23.673; cf. *Jin shu*, 11.278, and *Sui shu*, 19.505.

¹⁷ *Song shu*, 23.680. In the same vein, Li Chunfeng describes post-178 cosmology saying 'everything is whimsical and fantastical explanations (說), these are not people who discussed heaven by plumbng numbers' 皆好奇徇異之說，非極數談天者也 (*Jin shu*, 11.280, and *Sui shu*, 19.508).

¹⁸ For more on the topic of 'progress' and 'empiricism' in first-millennium accounts of the history and legend of *li* 曆 mathematical astronomy, see Morgan (2013).

Table 1: The ‘eight schools’ of cosmology according to Li Chunfeng’s *Yisi zhan*

no.	School	Notes
1	渾天 sphere heaven,	that which [I] record here from Zhang Heng’s <i>Lingxian</i> ;
2	宣夜 expansive night,	which has died out and has no master method;
3	蓋天 umbrella heaven,	recorded in the <i>Zhou bi</i> ;
4	軒天 baseboard heaven,	explained by Yao Xin 姚信 (fl. 3rd cent.);
5	穹天 vault heaven,	dreamt up by Yu Song 虞聳 (fl. c. 265);
6	安天 secure heaven,	described by Yu Xi 虞喜 (fl. 335-342);
7	方天 square heaven,	discoursed by Wang Chong 王充 (27 – c. 100);
8	四天 quadruple Heaven,	sayings attributed to (the?) Yao Hu 祆胡.

Source: *Yisi zhan*, 1.1a-b. Note that this list is comprised of the usual ‘three schools’ (1–3), three ‘curious chatterers’ (4–6), Wang Chong (7), who is here no longer identified with ‘the umbrella’, and an eighth mentioned nowhere else in any other source but referring potentially to a foreign people.

out in terms of details and historical scope into *two* bigger and better monographs. That is devilish by today’s standards, and the fact that Shen Yue’s name alone is excluded in reference to Li’s historiographic exemplars, inspiration and sources suggests that it was devilish too in their own day.¹⁹

Cosmology in omen compendia

It is better to be hated than ignored. As hard as Shen Yue’s monograph has had it, the real loser in this story is Gautama Siddhārtha, since his omen compendium *Kaiyuan zhanjing* would have disappeared completely were it not for a single copy accidentally rediscovered in a Buddha statue around the turn of the seventeenth century. To be fair, he was writing in a different genre that saw different circulation and *prohibition*, as the case may be, but it is otherwise safe to say that Gautama’s work was of negligible historical impact up to the twentieth century.²⁰

The *Kaiyuan zhanjing* of 729 opens with two ‘rolls’ 卷 on cosmology. This is not unprecedented for a ‘heavenly patterns’ 天文 omen compendium, for **Li Chunfeng’s** own *Yisi zhan* 乙巳占 (Omens of [Year] *Yisi* [645]) begins the same way. By comparison with Li’s *Book of Jin* and *Book of Sui* monographs, it is clear that the point here is simply to tell the reader what he needs to know about the universe without questioning or historicizing how we came to know it. In ‘**Part 1: Heaven’s Appearance(s)**’ 天象第一, Li lists *eight* ‘schools’ but explains that ‘of these eight schools, sphere heaven is dearest (to the truth), [which is why I] have selected it alone so as to document here’ 凡此八家，渾天最親，今獨取之，以載於此.²¹ What follows is an extended citation of Zhang Heng’s 張衡 (87–140) *Lingxian* 靈憲 (Constitution of the Numina). ‘**Part 2: Heaven’s Numbers**’ 天數第二 then cites and adds to Wang Fan’s 王蕃 third-century spherist account of the dimensions of the cosmos, the *Huntian xiang shuo* 渾天象說 (Explanation of the Appearance[s] of Sphere Heaven).²²

Gautama Siddhārtha likewise prioritizes spherism in **roll 1**, ‘The Ancestry of the Sphere as Heaven’s Form’ 天體渾宗, which lists extensive citations of primary sources on spherism in chronological order from the first to seventh century. He does this with minimal editorial, but what editorial there is accords with the Shen-Li historical frame, e.g. ‘the explanations beyond this on [coordinates] & [eclipses] are all the same as Mr. Cai [Yong] and Zhang

¹⁹ On the Li Chunfeng’s appropriation and dialogue with Shen Yue’s history, see, again, Morgan (*forthcoming*).

²⁰ On the history of prohibiting ‘heavenly patterns’ 天文 omen literature in China, see Wu Yiyi (1990) and Lü Zongli (2003).

²¹ *Yisi zhan*, 1.1b.

²² On Wang Fan’s cosmic dimensions, see Kalinowski (1990).

Heng, thus I abridge’ 自外諸說，度次交會，與蔡氏張衡同，故畧云。²³
Roll 2, ‘Discoursing Heaven’ 論天, is somewhat harder to penetrate. It begins with a promisingly pluralistic approach:

夫言天體者，蓋非一家也。世之所傳，有渾天，有蓋天。
Now, those who speak about heaven’s form, however, are not all of one school. In what has been passed down through generations [we] have sphere heaven and [we] have umbrella heaven.²⁴

From there, however, it goes on to cite the spherist sources already found in roll 1, but in a different order, and with ellipses, in the middle of which one finds a brief summary and condemnation of the *Zhou bi* and Zheng Xuan’s 鄭玄 (126–200) umbrellism. Near the end, a rather odd ellipse leads us back to Gautama’s opening statement:

...渾天之義，蓋與此同。云云。餘已見前篇，至與蔡氏張衡同，故畧云。

... the meaning of sphere heaven should thus be the same’—and so on and so on—the rest already appears in the prior chapter, up to ‘are the same as Mr. Cai and Zhang Heng, thus I abridge’.

故曰：言天體非一家也。

And thus do [I] say that ‘those who speak of heaven’s form are not all of one school.

吳時，廬江王蕃，字興元，為中常侍，善數術，嘗造渾儀及渾天象說云...

In the time of the [Sun-]Wu 孫吳 (222–280), Wang Fan of Lujiang 廬江, who was styled Xingyuan, was a regular palace attendant; he was adept at numbers & techniques and once constructed a sphere instrument (a demonstrational armillary sphere) as well as the *Huntian xiang shuo*, which says...²⁵

The point that Gautama is making in ‘Discoursing Heaven’ is clear: there is not only the Zhang Heng, Cai Yong and Wang Fan school of spherism, *there is and always has been a plurality of cosmological theories*. The amount of text that he devotes to this point, furthermore, and the degree to which he goes above and beyond Li Chunfeng’s omen compendium to make it highlight just how important plurality is to him.

What medieval historians of astronomy are not telling us

The fact that the *Kaiyuan zhanjing* frames its argument for plurality around the dichotomy between ‘the sphere’ and ‘the umbrella’ is classic, but it reads extremely odd coming from Gautama Siddhārtha. It is odd because *we know the author to have known yet other cosmologies—foreign cosmologies—by the date of authorship*.

At the other end of the *Kaiyuan zhanjing*, in rolls 103 & 104, we find the procedure text for the *Jiu zhi li* 九執曆 (‘Nine Seizers’ or *Navagrāha* system), which Gautama, as director of the state astronomical office, translated from Sanskrit by imperial decree in 718. The text is in Chinese, and it uses some Chinese coordinates and terminology, but it is otherwise as foreign as Gautama presents it to be in the opening of his preface:

臣等謹案：『九執曆』法，梵天所造，五通仙人承習傳授。肇自上古，百（白）博義（叉）二月春分朔。

[We] servants [of His Majesty] state humbly: the method of the Nine Seizers system was constructed by Brahma and received,

²³ *Kaiyuan zhanjing*, 1.12b.

²⁴ *Kaiyuan zhanjing*, 2.1a.

²⁵ *Kaiyuan zhanjing*, 2.7a.

practised and transmitted by magicians of the five powers. It commences from [a conjunction of] the spring equinox and new moon of [white] *pak[sa]*²⁶ month II, in high antiquity.²⁷

Among other things, Gautama's text presents for the first time in any extant Chinese text the 360-*du* (degree) circle and sexagesimal *fen* 分 ('minute'); the 360-*ri* (*tithi*) year and 30-*ri* (*tithi*) 'month'; the zero (written 〃) and other Indian numerals; as well as a sine table (間量命 'Interval quantity counting' [?]), which runs from 0° to 90° in 3°45' intervals using the very Indian radius of 3438. The contents of Gautama's *li* 曆 astronomy are of clear Indian origin, and Yabuuti (1979) identifies them as derived primarily, though not exclusively, from Varāhamihira's sixth-century *Pañcasiddhāntikā*.²⁸

Now we have him! First, as a (albeit Chinese-born) member of the predominately Buddhist Serindian expatriate community living in eighth-century Chang'an, and as someone sufficiently well-read in Sanskrit to conduct such a translation, it is *inconceivable* that Gautama would have been ignorant of Indian-origin religious cosmology(s). Second, given his apparent mastery of sixth-century siddhantic astronomy, Gautama would have necessarily been familiar with the Hellenistic-origin cosmology of concentric spheres upon which its mathematics were based. 'If God really wrote the Bible', a comedian once asked, 'you'd think he'd mention somewhere that the earth wasn't flat'. We should ask the same of Gautama's *Kaiyuan zhanjing*.

But Gautama was not the only medieval Chinese expert complicit in the simplification of the history of cosmology to his own day. Shen Yue reduced it to 'three schools', discarding the 'curious chatter' to follow, so as to support his classicist argument for 'sphere heaven'. Li Chunfeng kept the 'three schools' frame but inverted the contents of his predecessor's work as an argument for his own *progressivist* case for 'sphere heaven'. *Historiography* has been consistent about the 'three schools, one winner' frame since the second century CE. When we look at what experts were saying outside of historiography, however, none of them—not even the history-writers—seemed to agree on just how many 'schools' there were. In a memorial of 604, **Liu Zhuo** rails against the existence of 'different schools' 異家, listing 'three explanations' 三說 and 'four heavens' 四天 for a total of 'seven distinct varieties of explanation' 七種殊說.²⁹ In his omen compendium of 645, written around the time of his histories, **Li Chunfeng** lists 'eight schools' (above). In his *Li yi* 曆議 (Opinions on *li* Mathematical Astronomy) of 727, lastly, **Yixing** mentions 'six schools of explanation' 六家之說.³⁰ Nowhere in any of these lists is mention made of 'Western' authors or texts.³¹ A part of the story

²⁶ Bill Mak suggested that I read 百博义 (又) 'hundred *pak[sa]*' as 百 (白) 博义 (又) 'white *pak[sa]*', referring to the *Sanskrit* term for the half-month counting from new moon corresponding to *Chinese* civil calendar conventions.

²⁷ *Kaiyuan zhanjing*, 104.1a; tr. modified from Yabuuti (1979: 11). Note that, in addition to the *Sanskrit* terminology deployed here, beginning the year and astronomical *yuga* from spring equinox is a convention completely foreign to *Chinese* astronomy, which anchored all cycles instead to the winter solstice.

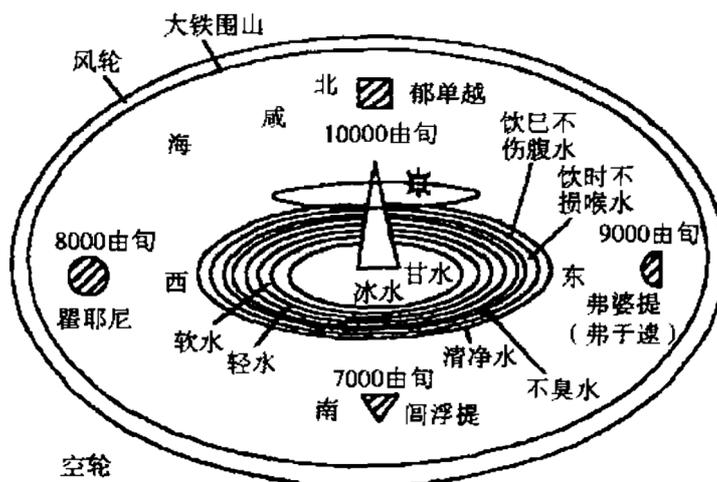
²⁸ For the *Pañcasiddhāntikā*, see Neugebauer & Pingree (1970–71).

²⁹ *Sui shu*, 19.521.

³⁰ *Jiu Tang shu*, 31.816.

³¹ Yixing does not enumerate his list. Liu Zhuo's list, with reference to Table 1, places sphere (1), umbrella (3) and expansive night (2) under the 'three explanations' and 'flat' 平 (?), base-board (4), secure (6) and vault (5) under the 'four heavens'. Liu's 'flat heaven' may be one and the same as 'the square' (7), which Li Chunfeng attributes to Wang Chong, but it may also refer to any number of known or unknown sources, e.g. Zhu Shi's 朱史 (6th cent.) *Ding tian lun* 定天論 (Discourse on Fixed Heaven), recorded in 3 rolls in the *Book of Sui* bibliographic monograph (*Sui shu*, 34.1018) and briefly cited in *Kaiyuan zhanjing*, 1.37a-b. Li Chunfeng's 'quadruple heaven' (8), by 'Yao Hu' 祆胡, presents us with a bigger problem. The latter term appears nowhere else in the written tradition, so we have no idea of who or what it is. Parallelism would imply that 'Yao Hu' is an author. The problem, however, is that *yao* 祆 'bewitching' is not a typical surname, and while *hu* 胡 is well-precedented be a given name, it is also a term used in vague reference to bearded foreigners. It is conceivable, therefore, that Li is attributing 'quadruple heaven' to 'bewitching bearded foreigners', and that this refers to some Serindian cosmology, but the evidence of this connection is, in my opinion, tenuous.

Figure 3: the Chinese ‘Buddhist model’, modern interpretation



Source: Chen Meidong (2007: 162, fig. 2–5)

is evidently missing.

Where India Went

There is the material here somewhere for a joke: Four astronomers write the history of Chinese cosmology, three of which are Buddhist. Someone asks ‘Wait, where’s India in all this?’ and one of the Buddhists complains, ‘We invited *Siddhārtha* and the Daoist, how much more diversity do you want?’

We get a *very* different Chinese-language narrative about cosmology if we turn, for example, to Monk Daoshi’s 道世 Buddhist encyclopaedia *Fayuan zhulin* 法苑珠林 (Forest of Pearls from the Garden of the Dharma), finished (near the end of Li Chunfeng’s life) in 668. There we are treated to a classical description of Indian-origin religious cosmology culled together from famous *sūtras*. The world, in short, is a flat disk at the centre of which lies Mt. Meru 須彌山, and the perimeter of which is established by the ‘Iron Enclosure Mountains’ 鐵圍山 or *Cakravāla*. On the great world ocean between the *Cakravāla* and the eight mountain [ranges] and eight seas surrounding Mt. Meru lie four continents 四洲 in each cardinal direction, humanity occupying the (triangular) southernmost continent—Jambudvīpa 閻浮提, ‘the Land of Rose Apples’. The sun, moon, planets and stars orbited around Mt. Meru carried by their own accord rather than by the sort of great rotating surface postulated and disputed by men involved in ‘heavenly patterns’ astronomy (fig. 3).³²

There is nothing new about Daoshi’s treatment of the topic, he simply excerpts from important and long-available sources within the Chinese Buddhist corpus. Specifically, he cites the *Longer Āgama-sūtra* (*Chang ahan jing* 長阿含經), translated by the Kashmiri Buddhayaśas 佛陀耶舍 and Chinese Zhu Fonian 竺佛念 in 412/13 Chang’an under the Tibetan rule of the Later Qin 後秦 (384–417), as well as the *Sūtra on the Arising of Worlds* (*Qi shi jing* 起世經), translated by the Gandhāran Jñānagupta 闍那崛多在 a Chang’an newly under the Chinese rule of the Sui 隋 (581–618).³³ One finds concise descriptions of this world-model in these texts, but it is an idea that one finds diffuse throughout Buddhist writings, stories, art, architecture and so on, as their very doctrine, practice and experience were intertwined with Mt. Meru cosmology. And the more Chinese that Buddhism became, the

³²On Buddhist religious cosmology in East Asia, see Okada (1997), Sadakata (1997) and Lopez (2008: 39–72).

³³For a detailed history of Buddhist translation and the flow of ideas and people through China during its confusing middle period, see Zürcher (2007).

more Buddhist the Chinese, elements of this cosmos seeping not only into the politics, festivals, public life, vocabulary and skyline of every city, but into the very indigenous religions marginalized begrudgingly thereby.³⁴ Ironically, Mt. Meru was in medieval Chang'an enormous and everywhere and yet somehow invisible to us.

It might well serve us to insist on a distinction here between 'religious' and 'natural' cosmology—between mythic settings and explanations for the stories that give human life spiritual purpose and experiments to save or discredit astronomical, climatological and optical phenomena. These are different worlds, after all, and if the modern mind is capable of keeping them separate, we should expect no less of the premodern mind. The Chinese myth of Pangu 盤古, for example, who hatched from a cosmic egg at the beginning of time to separate yin and yang and heaven and earth from one another has no place in first-millennium accounts of 'heaven's form' cosmology, so why should an invisible mountain separating heavens from hells? Perhaps it is not strange then that we find Mt. Meru absent from 'heaven's form' except where insisted upon by someone absent the sense of the unspoken boundaries between professional categories.

This happened at least once that we know of in the first millennium. At some point in his reign (502–549), the avidly Buddhist Liang Wudi 梁武帝 is said to have summoned the expert astronomer and mathematician Zu Geng 祖暅 (fl. 504–510) to court to speak about cosmology. Zu delivered a long spherist account of the importance of the observational-inductive and mathematical-deductive approach and the detailed mathematical proof of the failure of both his opponents and predecessors in this regard. 'The principals of sphere heaven are credible and have evidence' 渾天之理，信而有徵，he confidently announces to the emperor.³⁵ The emperor responds by at once modestly and condescendingly presenting his own solution to the problem. The emperor's solution is clearly grounded in Buddhist cosmology: he has the 'four great seas' 四大海; he has the 'Iron Enclosure Mountains' at their edge, which he calls the 'Vajra Mountains' 金剛山; he has 'Me[ru] Summit' 彌峻 in the north/centre; and he has the sun and moon orbiting around a mountainous *axis mundi*. What Liang Wudi adds to this picture is the assertion that heaven is simply 'pure & floating *qi*' 清浮之氣, some climatology and the 'Black Mountain(s)' 黑山, whose sloping shape (combined with up-down and in-out variations in the sun's orbit) explain seasonal changes in daylight and solar rise, set, and culmination. Content with his own explanation, the emperor then ordered a group of academicians to go 'calculate its *du* numbers' 算其度數, which they did (or probably produced from elsewhere), and which they appended to the written version of this the first and only imperial proclamation on 'heaven's form' cosmology.³⁶ We can only assume that agreement from more knowledgeable men like Zu Geng was demanded at least tacitly for the remainder of Liang Wudi's decades-long reign.

This would have been felt as a clear abuse of power and academic propriety, we can imagine, and the way that later scholars present the mater speaks

³⁴ On the integration of Buddhism and Buddhist cosmology into Chinese social and religious life in this period, see Zürcher (1980), Teiser (1988) and Bokenkamp (2007).

³⁵ *Sui shu*, 19.511; cf. *Kaiyuan zhanjing*, 1.29a. Note that here Zu Geng is citing word-for-word the final conclusion of Ge Hong's lengthy argument against 'the umbrella', for which see *Jin shu*, 11.284.

³⁶ That the extant fragments of Zu Geng and Liang Wudi's cosmology derive from a single early sixth-century oral exchange is not something that subsequent historians make particularly explicit, but it can be pieced together from clues. First, Li Chunfeng identifies Liang Wudi as having publicized his cosmology in a 'speech at the Hall of Eternal Spring' 長春殿講義 (see block quote in next paragraph). Second, we know from repeated mention in sources like imperial annals that the 'Hall of Eternal Spring' was a space within the imperial palace at Jiankang 建康 where the southern emperors held audience and banquets. Third, the *Book of Sui* and *Kaiyuan zhanjing* both introduce Zu as 'Liang audience attendant Zu Geng' 梁奉朝請祖暅, which would place him in regular attendance at the Hall of Eternal Spring (*Sui shu*, 19.514; *Kaiyuan zhanjing*, 1.29a). Fourth, the *Kaiyuan zhanjing* introduces Liang Wudi's speech immediately after Zu's with, simply, 'Liang Wudi said' 梁武帝云 (*Kaiyuan zhanjing*, 1.33a). For more on this point, see Note 38. On Liang Wudi's cosmology, see Yamada (1975), Cullen (1977: 364–72), Chen Meidong (2007: 169–76) and Yuan & Qu (2008).

volumes to their contempt. Mostly, that is to say, no one ever spoke about it again. Shen Yue, who lived through the first twelve years of Liang Wudi's reign, had nothing to say, but he had finished his *Book of Song* for the prior court. Li Chunfeng, who must deal with the episode in his *Book of Sui* monograph, places it under the rubric 'umbrella heaven' and devotes all of 32 characters to the topic:

逮梁武帝於長春殿講義，別擬天體，全同周髀之文，蓋立新意，以排渾天之論而已。

And then [we] come to Liang Wudi's speech at the Hall of Eternal Spring: [he] dreamt up his own heaven's form (cosmology), which was completely the same as the text of the *Zhou bi*, for the sole purpose, probably, of establishing [some] fresh idea to dismiss the discourse on sphere heaven.³⁷

It is a miracle that Liang Wudi's speech is extant: it is recorded only in the *Kaiyuan zhanjing*, where it was nearly lost to history; and it is recorded there only by fluke of context, as an appendix to Zu Geng's speech (which speaks to Gautama Siddhārtha's opinion about its legitimacy).³⁸ Were it not for all this, we would have only Li Chunfeng's word to go on.

If Li Chunfeng's approach to Shen Yue's writing be any indicator, it is probably better that we do not take him always at his word. Simple comparison reveals that Wudi's speech is *not at all* 'completely the same as the text of the *Zhou bi*'. As for their *ideas*, there is a certain amount of overlap between the two, but so too is there between statements of 'spherism' and 'umbrellism'.³⁹ Where Liang Wudi was at once 'umbrellist' and 'counter-spherist' is that both he and the *Zhou bi* posited a world with dynamic luni-solar orbits and but one celestial pole. That, however, is where the resemblance ends.

Whatever its grounds, Li's identification of Wudi with *Zhou bi* 'umbrella heaven' clearly succeeded in the long term, because we see it repeated throughout **scholastic discourse** to our day.⁴⁰ What is strange and noteworthy here is that, prior to Li's involvement with the *Monographs of the History of the Five Dynasties* (*Wudai shi zhi* 五代史志) project in 641, we actually see a parallel **monastic discourse** appear in commentary to the *Mahāparinirvāṇa-sūtra* (*Daban niepan jing* 大般涅槃經). Where the *sūtra* arrives at a description of the moon, Guanding's 灌頂 (561–632) Sui commentary supplies brief descriptions of our 'three schools' followed by extended citations from the aforementioned *sūtras*—the *Longer Āgama* and *Arising of Worlds*. His description of the *Zhou bi* is as follows:

『周髀』者，是周公問殷齊論天地義，云：天如圓繖，邊下中高，為「蓋天」義。日月橫行，同於佛法。

As to the *Zhou bi*, it [recounts how] the Duke of Zhou 周公 asked the Yin 殷 (the remnants of the former dynasty) for a level discourse on the meaning of heaven & earth. It states that heaven is like a round parasol—low at the rim, high at the centre—thus the meaning of 'umbrella heaven'. The sun & moon travel in

³⁷ *Sui shu*, 19.507.

³⁸ Gautama's placement of Liang Wudi's speech is odd in several respects. First, it clearly does not belong by itself in a roll titled 'The Ancestry of the Sphere as Heaven's Form' and otherwise completely devoted to excerpts of 'sphere heaven' writings. Second, the *Siku quanshu* 四庫全書 edition of the text does not place a paragraph break between Zu Geng and Liang Wudi's presentations, as it typically does when moving from one written source to another, nor does it introduce the latter with any more than 'Liang Wudi said'—all of which suggest that the two constituted a *dialogue* within a single source to the compiler (see Note 36).

³⁹ There is perhaps no better example of the confusion in even experts' minds between the two 'schools' than the case of Wang Fan's work, treated in Kalinowski (1990).

⁴⁰ We find Li Chunfeng's identification repeated word-for-word, for example, in Zhang Ruyu's 章如愚 (fl. 1198) reference work *Qunshu kaosuo* 羣書考索, 56.10b, and Wang Yinglin's 王應麟 (1223–96) encyclopaedia *Yuhai* 玉海, 2.50b–51a.

heng 橫 (concentric tracks), the same as the Buddhist model.⁴¹

Guanding's identification of 'umbrella' and 'Buddhist' cosmology is then carried down in subsequent editions and subcommentaries, earning a permanent place in the hermeneutics of this important *sūtra*.⁴² Though they probably had a difference of opinions as to *why*, in the early seventh century, the fourth patriarch of Tiantai 天台 Buddhism and the premier Daoist mathematician of the day could at least both agree that 'umbrella heaven' and 'the Buddhist model' belonged to the same category.

What then happened with the *other* cosmology known by Gautama and other 'Western' directors of the eighth-century Tang astronomical office—the Greco-Indian cosmos of epicycles and concentric spheres? It would seem that nothing happened, judging by the complete lack of written evidence. That said, *if* a Gautama, for example, discussed the matter with his Chinese co-directors and colleagues, one wonders if it too might not have been categorized by all involved in terms of extant 'schools' of cosmology, i.e. under 'sphere heaven'. If this too was hidden, the way that medieval scholars hid 'the Buddhist model', and modern scholars the very topic of 'cosmology', then how would we go about finding it?

I have an irresponsible idea. What would probably stand out the most about 'Western sphere heaven' to a first-millennium Chinese expert is the spherical earth required by its eclipse models and metaphysics. I say 'probably', because the 'heaven's form' tradition is, as the label suggests, so focused on 'heaven' 天 that 'earth' 地 tends to get lost in the equation. Not only is the Chinese 'earth' a neglected topic within a neglected field, it is a political question that the post-1970s historian of science tries to avoid. Why? Over the course of the twentieth century, there was considerable debate about indigenous evidence for the concept of a spherical earth prior to the arrival of the Jesuits, and the Muslims before them, in the second millennium: 'Did the Chinese have *it* too? Did they have *it* first?'. The stakes were high, and the fight was ugly, so we try to forget. Later scholarship is mostly content to assume Zhang Heng's second-century proclamation that the earth is 'flat to be still' 平以靜 while heaven is 'round to move' 圓以動 to hold true for subsequent speculation.⁴³ This position unfortunately requires us to downplay or ignore scattered hints of *other ideas* in our texts, e.g. Yu Xi's opining that 'if one is square/flat they must both be square/flat, and if one is round then they must both be round' 方則俱方，圓則俱圓, and the 'rounding off' of the earth into later readings of both the 'sphere' and 'umbrella heaven' traditions.⁴⁴ What I suggest is that we take up the question of the sphericity of the earth again in first-millennium China, and that this time we do so not with a modern eye to 'East vs. West' but a medieval one.

Conclusion

Chinese cosmology lies dead and discarded as a topic of discussion. What I would like is to breath life into it again and to ask it sympathetically how it came to be in this state. We are quick to blame the twentieth-century historian and his/her categories for any such wrongs of the past, but it is important that we recognize the culpability of our own twenty-first-century sophistication—the rigidity of *our* categories—at the same time. We have collapsed the idea of 'science', 'magic' and 'religion' in ancient history, but what has arisen in its place (in sinology) is an idea, commensurately absolute, of a world

⁴¹ *Daban niepan jing shu*, T no. 1767, 112:19–20a.

⁴² See, for example, Zhiyuan's 智圓 (976–1022) *Niepan jing shu sande zhigui* 涅槃經疏三德指歸, X no. 0662, 0462:21a–1b.

⁴³ *Lingxian*, cited in *Hou Han shu*, zhi 10, 3215 (comm.). For examples of the twentieth-century debate around the sphericity of the earth and how it was settled around the *Lingxian*, see Tang Ruchuan (1962) and Jin Zumeng (1991: 36–41).

⁴⁴ For Yu Xi, see *Song shu*, 23.680; *Jin shu*, 11.280; *Sui shu*, 19.507. On the 'rounding off' of the earth, see Chen Meidong (2007: 255–70).

without distinctions—a world with as little space for the discussion of ‘cosmology’, in its original and generally-accepted sense, as that left for Indian ideas in medieval ‘heaven’s form’. This, I believe, is an injustice to the plurality and sophistication of premodern Chinese thought every bit as grave as those committed earlier under the precepts of positivism and nationalism.

More than anyone, however, it is the medieval historian who is to blame here for what has happened to the history of Chinese cosmology. It was writers like Cai Yong, Shen Yue, Li Chunfeng and Gautama Siddhārtha who were ultimately responsible for crafting and maintaining a single, centuries-long narrative about the death of the topic while the topic was still very much alive. Their categories were rigid and narrow too, and their intentions were equally complicated—equally human. For Cai Yong and Shen Yue, the historicization of the debate and the closing of its history in the second century was, in my opinion, their own way of making a case for ‘sphere heaven’ against its living rivals. Li Chunfeng, if anything, highlights the explosion of post-mortem theorizing and experimentation in his writings, but he maintains the Cai-Shen framework of ‘three schools, one winner’ by default in taking and perverting his predecessor’s writings.⁴⁵ Gautama’s motivations, beyond sticking to (Chinese) tradition, are somewhat harder to understand.

In all of this history-writing, amid categories modern, post-modern and medieval, Chinese thought has emerged here implausibly pure of ‘Western’ influence. It is pure, I argue, because it was *purified*, and this was done so consciously by all involved. This is relatively easy to see; what I would like to suggest in conclusion, however, is that to rediscover the messy impurity and plurality of Chinese thought we must grapple not only with the essentialising tendencies of modern and post-modern categories, we must take seriously *and critically* actor’s categories like ‘sphere’, ‘umbrella’ and ‘heaven’s form’ as well.

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⁴⁵ These claims are more fully developed in Morgan (*forthcoming*).

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