that you cease dabbling in shrinkoanalysis until you've mastered skills closer to home, such as arithmetic?)

C18 When challenged to make good on the suspected non-uniqueness allegation (i.e., to *produce* your fantasized alternate solutions), you can't cut it and are finally (11/14 — 10 months and stacks[44] of computer readouts after your receipt of the paper in mid-Jan) reduced to pleading that you have not had enough time (!) and that you need my help. . . .

C19 A review of your review's shiftiness:

[1] You say (1983/2/18) that . . . [you're checking] the paper's computations and add (3/17) that you're doing so with a "fine-tooth comb" for the *QJRAS* — and I respond with grateful encouragement (3/22).

[2] Months later, this assault has failed to find a single miscomputation, so [without warning or consulting DR, ere sending the ref report to the *QJRAS* you suddenly] recommend the paper's rejection (7/23) because: maybe the solutions aren't unique. Maybe, mind you.

[3] I brand this "pure bluff" and challenge you find *any* of the alternate solutions you've alleged (7/23, 8/26) were the determining factor in your rejection-recommendation.

[4] More months later, you've still discovered not a one, so now you claim (11/14) that you're too busy to search for them — & you supply no estimate of how long you'll stay "busy".

C20 Are you representing the Roy.astr.Soc. or Franz Kafka? The reason your stories have become phantasmagoric nonsense is elementary: you are [a] trying to censor, while [b] hoping to evade the onus of censorship. . . . I'm not going to sit still while you have it both ways. Choose [a] *or* [b].

C21 Your grossly incredible gyrations have rendered all-too-believable the unsavory hypothesis that . . . . All action since your assignment last winter as referee has merely been a search for a plausible technical alibi . . . [for rejection], an "intensive" (7/23) search that unexpectedly has become a year-long, frustrating, & sinuous[45] ordeal, since the paper turned out to have none of the errors your clique is so drearily accustomed to (and accustomed to publishing in its own sloppy output) — and thus quite naturally took for granted would be easy to find in this paper.

C22 . . . you have revealed yourself nakedly for what others have reported you are. I yet remain genuinely reluctant to believe this. But, for me, this is a simple crucial experiment.

C23 OG's suppression of this paper (which ended all OG-DR relations) was simply the dowry for a convenient political marriage, as *QJRAS* "Editor" D.Hughes[46] and the *JHA* joined farces — and shut down any further (skeptical) discussion of Ptolemy's fakery at either journal. The trifling cost: the inception of *DIO*. To this day, OG refuses — along with the entire Muffia — to admit the slightest misbehavior in this matter. And the miscalculations — implicit and-or explicit — of Pedersen 1974, Neugebauer 1975, Toomer 1977, & Gingerich 1981 (fn 38, §C17, or *J.HA 1.2* fn 56) have never been publicly acknowledged.[47] Isn't being a power-type wonderful? Reality is so: Arrangeable. . . .

[44] Shown to DR 1983/6/4: *DIO 1.1* ‡1 fn 9.

[45] Compact DR footnote in original letter: "No rule of law — as revealed by contrasts: [a] comparison to treatment of other papers, and [b] shifting (make-up-the-alibis-as-needed, as-we-go-along) criteria for [rejecting] this paper."

[46] Featured in *J.HA 1.1* ‡8. (0 had previously been a severe critic of Hughes' "editing": *loc cit* §B2.)

[47] Toomer 1984 App.C admits Ptolemy's solutions are wrong & cites RN (never DR); but forgets the long history of Muffia-supported false solutions: §C15. [*DIO* always alerts readers to & publicly corrects every one of its occasional errors. Some of the above turned out to be unhistorically erroneous. In 2003, A.Jones found better solutions for Mars & Jupiter: see *DIO 11.2*. This doesn't excuse suppression of the other 3 solutions (& the rest of the 1983 paper, whose revolutionary cyclic thesis Jones establishes firmer than DR), but it vindicates Gingerich's caution on 2.]

‡4 Tycho 1004-Star Catalog's Completion Was Faked

Summary

It is demonstrated that Tycho Brahe's famous "Thousand Star Catalog" (1598) — largely a genuine, hard-wrought marvel of its creator's perfectionism — contains 10 last-minute-added stars which are faked entirely (6 stars) or in part (4 stars). The method of these frauds is essentially Ptolemy's time-dishonored one (which is exposed right in the Tycho catalog's preface!): simply add a constant (for precession) onto a previous star catalog's celestial longitudes, while leaving the latitudes unchanged.[1]

A Tycho's Vice

A1 Tycho Brahe is properly ranked as one of the handful of genuine immortals in the history of astronomy. His school is responsible for a string of epochal advances[2] — especially in the lunar motion theory, which before Tycho had suffered from rapidly varying errors of c.1°, and which he left with accuracy spectacularly improved:[3] by an ordmag. The sad (if intriguing) tale that follows may alloy, but certainly cannot still, our gratitude for Tycho's invaluable heritage — a monument to the adventurous best in humanity.

A2 In 1597, having lost the royal patronage of willful[4] teener Christian IV, Tycho was kicked out of his longtime home-observatories,[5] "SkyCastle" (1580) & nextdoor "StarCastle" (c.1584), on his isle of Hven. (This island is in the channel between modern Sweden[6] & Denmark. Hven may be seen in the distance from our family's north Copenhagen home.) Hardly a stone of his observatories remains visible today on Hven[7] — a fate depressingly akin to that of the now-utterly-lost instruments of his great ancient star-cataloging predecessors Timocharis (c.300 BC) & Hipparchos (c.130 BC), whose (entirely speculative) portraits were hung, with Tycho's own, in StarCastle's warming room (Thoren 1990 p.184).

[1] See §C1.

[2] See, e.g., the list at Dreyer 1890 p.262.

[3] For years, there have been speculations regarding early use of the navigational method of lunar distances for longitude-determination. Only by post-exploration comparisons of observed (home&away) times of lunar conjunction would any such method be feasible before Tycho — this because of the gross inaccuracy of the celestial tables then available, e.g., those of Regiomontanus.

[4] Frederick II having died in 1588 with Christian only 11^y old, Denmark was ruled by a board of regents until 1596 Summer. It didn't take long after Christian's official "maturity" for Tycho to detect waning interest in astronomy at the Danish court. Christian IV is now curiously well-thought-of in Denmark, even though he lost Tycho & turf — to Germany & Sweden, respectively.

[5] Hellman 1970 pp.404-405. Thoren 1990 p.145 displays a romanticized image of Uraniborg (based on the contemporary woodcut reproduced at p.110): H.Hansen's 1862 painting, now hanging at Fredericksborg Castle, Denmark (Zealand). (Perhaps the Hansen was felt to atone partially for the loss of an original portrait painting of Tycho in the 1859 fire at Fredericksborg: Dreyer 1890 p.264.) Paying for such projects as Uraniborg may have been related to Christian's cutting the formerly generous flow of royal funds to Tycho, an act which led directly to the fake stars here revealed. The castle is named for Christian's predecessor, Frederick II, who (fortunately for posterity) had a greater interest in astronomy. Evidently, the horoscope (partly empirical — a rarity indeed!) which Tycho had produced at prince Christian's 1577/4/2 birth (Thoren 1990 p.120) did not predict the eventual schism nor Christian's archonal treatment of Tycho (Thoren 1990 p.380). Incidentally, throughout this paper, I have attempted to keep dates in the Julian calendar used by Denmark until 1700/2/19(J)=3/1(G) — an ideal time to switch calendars. (I was about to say "upgrade", since the Gregorian calendar is many times more accurate than the Julian. However, wouldn't we & Muffia capo G.Toomer [see *DIO 1.2* fn 24] be alot less confused about historical dates if the world had just stuck to the Egyptian calendar Ptolemy preferred?) It is no coincidence that the superior Gregorian calendar and Tycho's superior observations occurred just before (not after) the telescope's debut. All 3 advances were concurrent phases of an age in which original intellect, unleashed by printing & the decline of faith, was bursting forth in varied directions.

[6] Though correctly regarded as a Dane, Tycho was born in Skåne, which is now part of Sweden.

[7] On the buildings' rapid post-Tycho decay and dismantling: see Dreyer 1890 pp.375f.

A3 Tycho's work never fully recovered, after his 1597 downfall. Not a single accurate Tycho star position was recorded subsequent[8] to his leaving Hven. On 1598/1/2, he issued[9] his "Thousand Star Catalog" (supposedly[10] based entirely upon data observed before departure from Hven), which I will call "cat D" throughout this paper. Cat D's stars are grouped into 46 constellations; the entire catalog is printed in the Tycho *Opera Omnia* (abbreviated hencefore here as "OO") at vol.3 pp.344-373. Tycho died at Prague in 1601.

B Starstress

B1 Tycho's astronomer-biographer briefly provides[11] (Dreyer 1890 p.227) the relation between Tycho's traumatic 1597 eviction and his "1000-star" catalog (cat D), which was first distributed in 1598: "Most of his observations for determining accurate places of fixed stars were made before the end of 1592, and the results were embodied in a catalogue of 777 stars . . . ." Henceforth here, this 777 star catalog will be called "cat C". (The complete cat C is published at OO 2:258-280.) Both cat C and cat D were published after Tycho's death. Each catalog's star places were precessed to epoch[12] 1601.03 AD. Dreyer 1890 (p.266) notes that cat C was the edition preferred & published by Tycho's assistant, Christen Longberg, aka Longomontanus, while the full cat D was published in 1627 by another Tycho assistant, Johannes Kepler (Dreyer 1890 pp.266, 371) — whose perseverance & genius had by then transformed Tycho's planetary observations into the three groundbreaking Kepler Laws[13] (any *one* of which would entitle Kepler to first rank among astronomy's pioneers). Dreyer 1890 (pp.227-228) continues

> In 1595 observations of fixed stars were resumed in order to bring the number of stars in the catalogue up to 1000, and even in the first two months of 1597, immediately before leaving Hveen, some observations were taken in hot haste to make up the thousand (*pro complendo millenario* [§D5]), mostly only depending on a single measure of the declination and[-or] the distance from one or two known stars . . . . It must therefore be taken [with a grain of salt] when Tycho already in January 1595 wrote[14] to Rothmann that he had now finished "about a thousand stars," and when he writes in his *Mechanica* that the great globe was quite finished in 1595, exhibiting a thousand stars. It has been suggested that it was this completion of Tycho's star-catalogue which he wished to commemorate by the striking of a medal (or rather two, slightly different) bearing the year 1595. This is quite possible, and he may have wished . . . to have a memorial of the work carried on for nearly twenty years at Hveen.

B2 It is strange that, in the near 400 years since Tycho's publication of his catalog (well known to every astronomer), no one but F.Baily has attached a catalog number to each star (as we do here) — indeed, it is possible that no one has even just checked the total number of stars in the catalog. Tycho called it a 1000 star catalog in its preface (OO 3:340) and standard sources since agree: Dreyer 1890 pp.227, 259-266; *DSB 2*:471 (1970); Evans 1987 pp.167-9, Moesgaard 1989 p.313, Thoren 1990 p.296 n.130 . But the correct number[15] of stars in cat D is actually 1004. [Note added 1993&4: There are 14 star positions that are merely repeats of other stars already cataloged, 10 stars are listed twice and 2 more stars — 13θ Cyg & 57μ Oph — are listed thrice in cat D. Two more entries — D566&567 — are nonexistent-hybrid bungles. And there are 11 faked objects, 10 of them treated here. So the total number of genuine & distinct attempted objects is 977. Discounting 12 more places based on hybrid data — measures from two different stars, mis-taken as same — we have the final total of real single stars cat D recorded: 965. Details in *DIO 3*, 1993, §K4.]

B3 Cat D's four-star excess (over the stated 1000) suggests that Tycho tacked the southern constellation Centaurus (Cen) onto cat D at the very last minute before 1598/1/2 publication. (He lists only 4 stars in Cen. And they are the very last 4 stars in cat D.) When we also comprehend these 4 stars' *extreme* faintness (as seen from Hven, only c.50 m above sealevel), we have cause for caution. Even assuming null atmospheric dust[16] & humidity, the post-extinction visual magnitudes[17] μ from 1597.23 Hven would be (for the usual 3 mm of ozone at 22 km,[18] with mean Hven Jan-Feb sealevel P = 1013 mb, T = 271°K): μ = 6.02

[8] Fn 35; Dreyer 1890 p.259, Thoren 1990 p.372f.

[9] Dreyer 1890 p.266, Thoren 1990 pp.383f.

[10] Heretofore, it has always been assumed (fn 35) that all the cat D stars were observed at Hven. In his 1598 *Astronomiae Instauratae Mechanica* (dedication 1597/12/31: Dreyer 1890 p.261), Tycho said (*op cit* p.262 or Ræder & Strömgrens 1946 p.112) that his people had observed 1000 stars, not 1004, which (assuming the former figure was intended to be taken precisely) leaves open the interpretation that the final four Cen stars were observed at Wandsbeck and written into cat D only a few days before cat D was distributed 1598/1/2 (which in fact was very probably the case: §G2). However, [a] Tycho never stated that any star places were observed at Wandsbeck, and his Wandsbeck records (OO 13:105f) include no such data. [b] The preface (OO 3:340) to cat D says it contains 1000 stars, not the actual figure: 1004.

[11] See Dreyer 1890 p.265. *Ibid* p.266: "Tycho sent magnificently bound copies of the star-catalogue to . . . influential men in Austria & Germany, to the King of Denmark", etc. Thoren 1990 pp.383f speaks (contra Ræder & Strömgrens 1946 p.112) of Tycho hesitating about distributing these handwritten copies and suggests Tycho didn't print the Catalog because he had doubts about the "quality" of the post-cat C stars. Another possible explanation of apparent hesitancy is: Tycho himself knew on 1598/1/2 (or learned a little later) that cat D had been slightly fleshed out with fake stars.

[12] It is generally stated (e.g., Dreyer 1890 p.266 or Moesgaard 1983 p.311) that cat D's epoch = 1600 AD. Actually, Tycho says (OO 3:340, 344) that his epoch is for the end (not start) of the year 1600 (Julian cal). In the Hist.sci literature, I have not seen any mention of this, though Dreyer & P.Rybka understood Tycho's convention (e.g., Dreyer 1890 p.387). Operating out of a Protestant country, he was working in the Julian calendar. Thus, his 1600/12/31 was Gregorian 1601/1/10, so the Besselian epoch of cat D is 1601.03. (Besselian dating was officially discontinued 8^y ago; but, for its attractive traditional simplicity of expression, I will use it anyway throughout this paper — and in any future articles it seems apt for.)

[13] [Note added 1993: For a detailed and novel argument in favor of the consistency of Kepler's physical astronomy, see A.Davis *Centaurus 35*:97f (1992).]

[14] Tycho's eventual 1598 distribution of the padded "thousand star" catalog D is excused by Dreyer 1890 (p.266) thusly: "The handsome manuscript volumes . . . were chiefly intended as advertisements". Thoren 1990 p.383: "they were good enough for advertising purposes". (See *DIO 1.2* fn 266.) The dominant factor here (*Ibid* p.388): "Tycho was embarrassingly short of money in the early months of 1598."

[15] Dreyer's notes to cat D (OO 3:414, 416, 417) speak of the following regional star sums: 335 zodiac (correct), 480 north (vs. 481 actual), 185 south (vs. 188 actual); the stated total being 1000 stars (vs. 1004 actual).

[16] Number of dust atmospheres $D = \csc[h + 34/(65 + 54h^{1.1})]$ or $\csc[h + 51/(89 + 67h^{1.1})]$, for (exponential-model) dust scale-height 1.0 km or (the standard value) 1.2 km, respectively. (For moderately different adopted scale-heights, one may extrapolate the 3 constants.) These are DR's original formulae for D as a function of a celestial body's apparent angular altitude h in degrees. (For an observer well above sealevel, these formulae may be attenuated in an obvious crude exponential fashion. Both load & scale-height of atm dust are notoriously variable; thus, the formulae here are merely to be taken as rough estimates, not as rigorous representations of a fixed atmospheric model.) DR's extinction-calculation procedure here will (unless otherwise stated) use zero atm dust, because: [a] even in modern times, dust-extinction is fluky, & [b] in ancient (pre-pollution) times, dust's effect on clear dry winter seeing was probably small — perhaps nearly negligible on water-surrounded sites such as Rhodos & especially (near-arctic) Hven. (Objects transitting south of Hven are seen over c.100 nmi of water.)

[17] *DIO*'s procedure for computing atmospheric refraction: set $1/c = 5[1 + h^{1.5}/2]$, and compute $a = p^{c/3}/t^{7c/2}$, where $p = P/1013$ & $t = T/283$ (P in millibars, T in °K); then, using either $h' = h + 61/9[1/(h+4) - 1/94]$ or $h' = H + 2[1/(1 + H/4.5) - 1/21]$, atmospheric refraction $r = 58''.6a(p/t) \cot h'$ (with h = apparent altitude, H = true altitude — both taken literally in degrees). (For DR formulas to compute molecular atm mass A, ozone atm mass Z, & dust atm mass D, see fn 63, fn 18, & fn 16, respectively.) These new *DIO* equations are easily handled by pocket calculator or computer; they more than suffice (at the professional level) for all situations, 0° to 90° altitude, at all likely Earth-based heights above or below sea-level. Given the recent findings of Schaefer & Liller (*PASP 102*:796; 1990), on refraction's vagaries near the horizon: the precision of DR's formulas here is, if anything, overdone.

[18] Standard mean ozone cover, adopted here throughout. We use: R = sealevel radius of curvature of Earth's surface (6378 km is close enough), z = observer's height in km (above sealevel), κ = 2 km, h_Z = hgt of laminar ozone layer (22 km), $r_c = (R + z + \kappa)/(R + h_Z)$, & $X = \arccos[r_c \cos h]$. Then, ozone atm mass Z (normalized, like A, for unity at zenith), as a function of apparent altitude h, is here found via the DR approximation (efficient for $z << h_Z$): $Z = \csc X$. For the magnitude calculations of this paper (unless otherwise stated): using Vilnius

Table 1: Tycho's Fake Ophiuchus Stars

Oph	PK# D#	λ_H+24° β_H	λ_C+28° β_C	λ_T β_T	λ β
36A	247 675	254°20′ 2°15′	254°20′ 2°15′	254°23′ 2°12′	254°29′ -3°22′
40ξ	246 676	255°00′ 2°15′	255°00′ -2°15′	255°01′ 2°16′	255°19′ 2°06′
42θ	248 677	255°40′ 1°30′	255°40′ -1°30′	255°42′ 1°32′	255°50′ -1°47′
44b	249 678	256°20′ 0°20′	256°20′ -0°20′	256°23′ 0°20′	256°46′ -0°54′
51c	250 679	257°10′ 0°*30*′	257°10′ -*1*°45′	257°12′ 0°29′	257°54′ -0°38′
39o	251 680	25*8*°30′ 1°00′	257°30′ -1°00′	257°36′ 0°58′	254°53′ -1°08′

(1i Cen), 6.48 (2g Cen), 6.13 (3k Cen), 6.23 (4h Cen). It's hard to believe Tycho would (or could) record all 4: even assuming null dust, two of them would have the dimmest μ of any stars in the entire cat D — indeed, 2g Cen would be off in a class by itself.

C Isolating the Fakes

C1 Our next discovery is a startling jolt to me, as a fervent admirer of the Tycho school's genuine discoveries. I have found that the first 6 stars of Ophiuchus (Oph) in cat D are fakes. Simple recipe: [a] just add 28° onto Copernicus' longitudes λ, which is almost (fn 56) equivalent to adding 24° of precession onto Hipparchos' λ; [b] sprinkle a very few arcmin of random scatter[19] onto these results and onto Hipparchos' presumably-little-changed latitudes,[20] also adopted by Copernicus. (It is ironic that Tycho was a pioneer in precession, showing that prior astronomers' equinoctial "trepidation" was chimerical —

$v_\circ$ weighting for eye-sensitivity, visible starlight (0.48μ-0.68μ) was broken into 21 spectral components, at 0.01μ intervals (intensity from Planck blackbody curve, with T_c from B$-$V via C.Allen *Astrophysical Quantities* 1976 p.197). Molecular extinction (fn 63) was applied to each through a Rayleighesque exponential formula fitted to the standard table of Allen (1976 p.126), with a further diminution for Inn-Tanaka ozone extinction. The post-extinction components were remerged to yield the final magnitude. For high h, results are close to those for Evans' *JHA* formula with his $A_\circ$ = 0.13 for null dust, & (Evans' choice) $A_\circ$ = 0.2 for standard Allen dust. Which is a credit to both of us. And the credit for initiating taking-account-of extinction's color-dependence, during analyses of older star catalogs, goes to Evans not DR, since Rawlins 1982C ignored this factor, while Evans 1987 [a] included it, & [b] computed it correctly — at least for stars not near the horizon. In this connection: the 1597.23 light from 2g Cen (dimmest Hven μ of any allegedly-observed cat D star) came to Hven through A = 19.6 molecular atmospheres but merely Z = 11.6 ozone atmospheres. I.e., the key implicit premis for the *JHA* extinction formula of Evans 1987 (namely, that there is a single atm mass number A), breaks down for the very stars the *JHA* is arguing about: those of low altitude h. The dust atm mass D (fn 16) also parts company from A. But in the other direction. (E.g., 1591 Hven D = 24 for 2g Cen, thus its μ for Tycho, correctly computed according to the *JHA*-fantasized ancient dust density, would be even dimmer than 7.95, by ordmag 0.01 magn. Only ordmag 10% of dust is higher than 4-5 km, and below that we may use an exponential dust density of standard scale height 1.2 km, with Allen opacity.) Indeed, for stars on the horizon at sealevel: A = 39, while Z = 13, and D = c.100 ! For close approx to horizon A & D: atm mass = sqr[$\pi R'/(2h)$], where R' = Earth radius times 1.2 (adjustment for lightray-curvature: Rawlins *AmerJPhys* 1979/2) & h = scale hgt (8 km for molecular, 1.2 km for dust). As to Z: see above. The drastic low-altitude ratios cited here ($A/Z > 3$ & $D/A > 2$ at horizon) appear to be known little if at all. For Allen's standard dust opacity (adopted by *JHA* for antiquity), atm extinction at the sealevel horizon is about Δm = 11 magnitudes! I.e., Venus μ = 6, Sirius μ = 9. Are these apt for clear nights?? By DR's idealized null-dust math, Δm = 4 magns; ancient experience was something between our results, obviously (on the best nights) much nearer the latter. Overprecise data for B$-$V = 1.8, 0.8, $-$0.2: null-dust Δm = 3.96, 4.17, 4.36, resp. Including Allen dust, Δm = 10.32, 10.65, 10.95, resp. The molec + oz + dust contribs: 3.57 + 0.39 + 6.36 = 10.32; 3.79 + 0.38 + 6.48 = 10.65; & 3.99 + 0.37 + 6.59 = 10.95, resp. (At zenith: 0.104 + 0.026 + 0.070, 0.110 + 0.024 + 0.071, 0.115 + 0.023 + 0.072, resp.)

[19] Some may take scatter as more damning than none. MIT statistician P.Huber to *DIO* 1991/9/6, defending Ptolemy's less subtle frauds (‡2 §H14): "I do not contest that Ptolemy fudged his observational data. . . . If Ptolemy had seen anything wrong in what he was doing, I guess he would have added slight perturbations to his fake data (as present-day students do in physics lab courses . . .)." So, the clumsier the fraud, the less indictable it is? Obvious implication for those moderns now contemplating science fraud: merely can the scatter, and eminent professors will excuse your behavior! (Actually, Ptolemy did sneakily perturb c.10% of his data by 5′: fn 56.)

[20] Ulugh Beg's catalog (epoch = mid-1437 AD) was then unpublished and unknown to Tycho. There survives no other massive original star catalog between Hipparchos and Tycho. (See Thoren 1990 p.297 n.134.)

Table 2: Tycho's Fake Centaurus Stars

Cen	PK# D#	λ_P+21° β_P	λ_T β_T	λ β
2g	935 1001	211°30′ -21°40′	211°27′ -21°49′	212°29′ -21°34′
4h	936 1002	211°00′ -18°50′	210°59′ -19°08′	212°15′ -18°56′
1i	937 1003	210°10′ -20°30′	210°12′ -20°51′	211°10′ -20°32′
3k	938 1004	211°00′ -20°00′	211°03′ -20°12′	212°23′ -20°02′

since real annual precession was virtually unvarying.) The method of the fraud is (aside from Tycho's random-scatter embellishment) just that of Ptolemy himself: merely add a precessional constant to a prior observer's stellar longitudes while keeping the stellar latitudes as they were. Carrying irony to new heights: the astronomer who first published the fact & the method of Ptolemy's "usurpation" (Tycho's word) of Hipparchos' Ancient Star Catalog was Tycho! — right in the preface[21] to the very star catalog (cat D) containing the 10 stars here exposed as faked by just that same method, and using data preserved by that same ancient astronomer. . . .

C2 I will designate stars in cat D with the prefix D. The fake Oph stars are D675-680 (top of OO 3:364; see also OO 3:416); in Hipparchos' Catalog, the same stars are, resp, PK247, 246, 248-251 (listed at PK p.79 & Toomer *1984 Almajest* pp.354-355). We set out these six stars in Table 1, using λ = real celestial longitude & β = real celestial latitude,[22] with subscripts H for Hipparchos,[23] C for Copernicus, & T for Tycho.

C3 An unlikely chance factor that unambiguously exposes the pretension: it is well known that, in numerous versions of the *Almajest* (obviously including at least some of those used by Tycho), the negative latitude signs of 5 of these stars were accidentally lost. Thus, all 6 stars' latitudes β got listed as positive (see PK p.99; Toomer *1984 Almajest* p.354 n.151), though only the 2nd had originally been recorded (by Hipparchos)[24] with positive β. (PK p.99 quotes astronomer C.Peirce's opinion that the stars PK247-251 were "one of the greatest perplexities of the catalogue.")[25] And cat D faithfully copies all of these sign

[21] OO 3:337; Neugebauer 1975 p.280 n.1.

[22] For PK250 = D679, Tycho found discrepant $|\beta|$ in the source catalogs for his Oph fakes: 0° 1/4 in *Almajest* 7.5, as against 1° 3/4 at Copernicus 1543 p.50A. And the 2 main latitude variants on the ancient mss are 0° 1/4 & 0° 3/4. (These are noted on PK pp.99 & 187. Both values have been prominently printed. The former is the more common.) Evidently, Tycho judged (correctly, I believe) that Copernicus had adopted the 0° 3/4 option (with an inadvertent +1 error in the degree units place). So Tycho felt it safest just to average the two fractional endings, yielding β_H = 0° 1/2 (italicized in Table 1). For the next star, PK251, there are 2 prime ancient λ variants: 233° 1/2 & 234° 1/2. The latter is more frequent — and was Hipparchos' own value. (See fn 29.) But the former is that of Copernicus 1543 p.50A, and it was the value used in the Tycho fabrication.

[23] Except in the cases cited at fn 56 [note added 1993: & see *DIO 2.3* ‡8 fn 20], the λ_H are just 2° 2/3 less than the explicit Ptolemy values λ_P found in the unreconstructed *Almajest* 7.5-8.1 Ancient Star Catalog. [Note added 1993: For a brief review of the abundant evidence that Ptolemy got his Catalog's vast number of purported outdoor "observations" by indoors arithmetic (adding 2° 2/3 onto the ordmag 1000 λ_H in Hipparchos' catalog), see *DIO 2.3* ‡8 §C.]

[24] This star is D676 = PK246. Of the group of six, it was Hipparchos' 1st (Tycho's 2nd). Thus, presuming Hipparchos used a ditto system (something like PK's), a sign error for the β_H of PK247 (perhaps triggered visually by the equality of its absolute value with that of PK246's β_H) would carry a single sign error into all the following stars. (At PK252, we finally encounter a correctly-signed positive β_H.) That the sign-confusion problem here is partly Tycho's own is suggested by the positive β_T sign wrongly given (§E4) to D681-682. (Neither position was based upon Hipparchos' data. I point this out partly because the implication might be seen as contrary to the present paper's thesis.) Which suggests that this whole set of β_T was considered by Tycho to be of dubious sign. (A signless quantity defaults to positive.) I.e., I suspect that the sign miscue for D681-682 was merely a carry-over (via ditto), when the previous stars were stripped of their negativity. The six β signs, in later renditions or updates of the Ancient Star Catalog: Al Sufi (H.Schjellerup 1874 p.102) and PK have PK246&251 positive, remainder negative. Copernicus 1543 p.50A has only PK246 pos, rest neg.

[25] Dreyer (OO 3:416) ascribed D675-682 to negligence (bad computing) from Tycho's rushing to complete the desired 1000 stars. Dreyer could identify none of these 8 stars (OO 3:364).

blunders[26] — the plagiarist's plainest type of giveaway slip.

C4 Another long-shot fluke helps cinch our exposure of the fraudulence of one of the entries, D675: this star (36A Oph) happens to have a proper motion that is huge (especially for so dim an object), $-1''.1$ annually in declination. Of all the 404 objects in the Moesgaard-Kristensen 1976 catalogue of bright stars within 10° of the ecliptic, 36A Oph = D675 has the fastest shift of latitude. The star's actual β was $-2^\circ 35'$ in Hipparchos' day, disagreeing with Hipparchos' recorded $\beta_{\rm H}$ ($-2^\circ 1/4$) by $20'$, which is about equal to his mean $\beta_{\rm H}$ error (R.Newton 1977 p.216); however, by Tycho's time, the star's actual β had shot[27] to $-3^\circ 22'$. Thus, even aside from its wrong sign, D675's β was off by over a full degree: an error of $1^\circ 10'$. This because the position of D675 was plagiarized from data (PK 247: §C2) which were far more obsolete than the swiper had reason to suspect.[28]

C5 A final slip by the plagiarist: Hipparchos' star PK251 (from which D680 was copied) does not even exist. It is simply 39o Oph with $\lambda = 231^\circ 1/2$ accidentally written[29] as $234^\circ 1/2$ by Hipparchos. Tycho just copied the error.

C6 Having established this background, we now return to consider, in Table 2, cat D's four add-on Cen stars (D1001-1004; OO 3:373). To our astonishment, we find that the longitudes have been faked, in almost exactly the same way the Oph fakes were accomplished: 21° of presumed precession (fn 56) added onto Ptolemy's longitudes for stars PK935-938. (These stars are listed at PK p.71, Toomer *1984 Almajest* p.394.) Note: the Cen mean $\lambda_{\rm T}$ error exceeds 1°. Keep in mind the context: *Tycho's positional errors were normally about 1 or 2 arcminutes*. [Note added 1993: See §E5, and *DIO 3*'s forthcoming full edition of cat D: standard-deviation = c.$2'$. Another way of putting it: the Cen $\lambda_{\rm T}$ in Table 2 are roughly 30 times nearer the fabrication values $\lambda_{\rm P}+\,21^\circ$ than to real λ.]

C7 However, the latitudes β are no closer to Ptolemy than to reality. Evidently, declinations δ were genuinely[30] observed somewhere (poor rms error: $14'$) and then combined[31] with the fabricated longitudes λ (§C6), to yield latitudes (with Tycho's obliquity[32] ϵ = $23^\circ 31' 1/2$), using the simple relations:

$$\sin S = \sin\epsilon\cos\lambda\sec\delta$$
$$\tan x = \sin\lambda\tan\epsilon$$
$$\tan(x+\beta) = \tan\delta\sec S$$

C8 If the declinations were really observed, then: [a] for 2g Cen (even assuming zero atm dust), the Hven[33] post-extinction magnitude μ = 6.48 (§B3), which was the dimmest μ of the entire 1004 stars, or [b] the Cen observations were made after 1597/10/20-21 (Dreyer 1890 pp.258, 390), at Wandsbeck,[34] where cat D was issued[35] on 1598/1/2.

C9 Dreyer 1890 p.227 (§B1) says that Tycho deceived as early as 1595 regarding his having allegedly already recorded 1000 stars (though p.259 presumes that 1000 star places were actually taken before Tycho left Hven in 1597); Tycho mentions his prior 1000-star promise in cat D's preface (OO 3:340: "quas pollicemur"). But before he could quite complete his taking of 1000 stars, Tycho (having utterly lost royal favor) left Hven. (All Hven celestial data cease[36] 1597/3/15, shortly after the Vernal Equinox.) During the winter of 1597, just before eviction, he raced frantically to record enough stars to comprise 1000. So, at this desperate time, there was motive for somebody faking a few stars, to kick the total up to the sacred number 1000.

D Tracing the Post-cat C Stars

D1 After coming to the above conclusions & writing the foregoing[37] (largely as it now stands), I inspected Tycho's raw observations, published in OO vols.10-13. I learned that most of the 227 stars supplementing cat C to bring it up to cat D's total are found in the Appendix[38] to Tycho's 1596 data. This 1596 Appendix contains 156 of the 227 supplemental stars. (The Appendix contains 157 stars; but one star, 24ω Her, was omitted from cat D, as noted at OO 13:76 n.1.)

D2 This leaves 71 (227 minus 156) star places that appeared subsequently. (It is known that the observations of the supplemental stars began in 1595: §B1.) The 71 extra stars occur in 8 constellations; taking these data (fn 42) roughly in chronological order, the cat D numbers are: D565-569 (Cyg, 5 stars),[39] D399-411 (UMa, 13 stars), D481-482 (Boo, 2 stars), D675-687 (Oph, 13 stars),[40] D345-355 (UMi, 11 stars), D596-614 (Cas, 19 stars), D644-647 (Per, 4 stars), D1001-1004 (Cen, 4 stars).

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[26] So near the ecliptic, such mistakes by Hipparchos would be understandable, when using his ecliptical armillary astrolabe; see Włodarczyk 1987 p.184. (Though, see fn 24 for a more coherent explanation.) However, Tycho's main armillary was equatorial. (The Oph stars were not near the equator.) For those familiar with such instruments, this is a powerful independent argument against the genuineness of Tycho's Oph data.

[27] The declinational or latitudinal decrease during the intervening 17 centuries was: over $1^\circ/2$ from proper motion, plus almost $1^\circ/4$ more due to precession (largely obliquity-decrease). (In the Moesgaard-Kristensen 1976 catalog, 61 Vir has a higher β component of proper motion, but 36A Oph's greater precession in β overcomes this superiority.)

[28] Use of fabricated observations of 36A Oph perhaps contributed a little to keeping Tycho from realizing that the "fixed" stars had proper motion (a discovery which finally fell to Halley a century later). However, if even a prominent swift star such as Arcturus did not persuade Tycho to see the stars as unfixed, then it's reasonable to doubt whether dim 36A Oph would move him very much in that direction. (See also fn 47.)

[29] Confusion of 1 with 4 (alpha with delta) is the most common scribal error in ancient math (see PK p.9). Note that this simple explanation will not work if Ptolemy is regarded as the Catalog's observer, since that makes Catalog λ = $237^\circ 1/6$ for PK251 (*Almajest* 7.5). Decades of Muffia failure (*J.HA 1.2* fn 66) to realize that the original Catalog was Hipparchos' *and was ecliptical* helped keep this obvious identification (PK251 = 39o Oph) from being previously discovered. (See under Muffia-fogjam: *DIO 1.3* ‡9 §P3.) Various scholars' prior conjectures are cited at PK p.99 & Graßhoff 1990 p.218.

[30] The ten fakes' magnitudes disagree in two cases (D676 & D1003) with those of the Ancient Star Catalog. However, all ten agree with Copernicus' values, rounded to integers: Copernicus 1543 pp.50A&61A. (Tycho uses only whole magnitudes, not the finer Hipparchos-Ptolemy system, also adopted by Copernicus.) The use of Copernicus star data is consistent with our earlier suggestion that whoever faked the Oph stars was primarily depending upon Copernicus, with simultaneous consultation of Hipparchos-Ptolemy. See §C2 & fn 22. Note that the verbal descriptions of all 10 fake stars are virtual copies of those of Hipparchos-Ptolemy — with the revealing slip that, when Tycho reversed the order of PK246-247, (see §C2) and even reversed the magnitudes, he forgot to reverse these 2 stars' verbal tags. (There is no doubt that Tycho constantly touched base with previous star catalogs. For identification purposes, he frequently used the Ancient Star Catalog's star-numbers within constellations. And Tycho's use of earlier verbal star-descriptions is also immediately obvious from a comparison of OO 11:383f or OO 12:231f to Toomer 1984 pp.360f or Copernicus 1543 pp.52A f.

[31] Note our similar finding for the origin of hitherto-mysterious star D681: §E4.

[32] Tycho's publicly adopted obliquity was $23^\circ 31' 1/2$ (OO 2:85, 208), which was high by $2'$ in 1598. (This was an uncharacteristically large error for a Tycho parameter. His latitude estimate was far better: Thoren 1990 p.226.) But a K.Moesgaard statistical analysis has found (Thoren 1990 p.226 n.16, p.230, p.298 n.138) that Tycho used the value $\epsilon = 23^\circ 31'$ in numerous reductions. Moesgaard's finding was adopted for some of DR's detailed analyses here. [Note added 1993-1997: the ϵ values actually adopted for Tycho's work are investigated at *DIO 3* (1993) fn 190.]

[33] Uraniborg's geographical latitude $L = 55^\circ 54' 25''$N, longitude $12^\circ 41' 55''$E (OO 10:xxvi; & see OO 12:102-103), height (above sealevel) z = c.50 m. (Dreyer 1890 p.93 & n.2 provide estimates of 49 m & 53 m. JOG's map puts a nearby point at 45 m.) For mean applicable sealevel $P\&T$, see §B3.

[34] Wandsbeck latitude $L = 53^\circ 34'$N, longitude = $10^\circ 04'$E, z = c.30 m; 2g & 4h Cen magn = 5.66 & 5.81, respectively, for 1598 transit (assuming null dust), mean Wandsbeck-area sealevel winter P = 1015 mb, $T = 273^\circ$K.

[35] Dreyer 1890 pp.265-6; p.259 denies that any data for placing stars were taken at Wandsbeck (fn 10); and OO 13:105f appears to support this. See Thoren 1990 pp.372f. But see also here at §G2.

[36] Dreyer 1890 p.235.

[37] For the record: DR isolated the tiny class of ten faked Tycho star places well before confirming that they were from the only two (small) post-cat C sections in cat D for which no records exist. Indeed, in all of cat D, there are only 21 stars which lack data records: D370-371, D379-380, D675-687, D1001-1004. Which means that the fakes (1% of cat D) entirely reside in the dataless 2% of cat D. The coincidence leaves no doubt that these stars' origin was conscious fabrication. Another way of putting it: the odds that all 10 suspects would fall by mere luck, into the very fraction (21/1004) of cat D which happens to lack records, is: 21/1004 to the 10th power — i.e., about one chance in 60 quadrillion.

[38] OO 13:61-77. The mss are compilations of accurate raw equatorial data (with ecliptical places computed therefrom, using a 5^y precession correction of $4' 1/4$) of observations taken near the end or 1595 & the start of 1596, of which the original daily log records are not now extant. See OO 13:61 n.2.

[39] [Note added 1993: D565-569 are actually just 2 stars, 13θ Cyg and 54λ Cyg. Full analysis in *DIO 3*.]

[40] The fake star D675 accidentally slipped into cat C as star C553 when (after Tycho's death) cat D was pruned of questionable objects to form cat C. From the scanty information given by Dreyer 1890 p.266, I reconstruct:

D3 I have searched through the Tycho star observation records later[41] than early 1596. The search turned up 54 of the 71 extra stars,[42] accounting for *all* the stars in 6 of the 8 post-cat C sets of §D2 — but *none* of the stars in the remaining 2 sets: in Oph and Cen. I.e., of Tycho's last[43] (post-cat C) 227 stars, these 17 stars (the 13 Oph supplemental stars & all 4 stars in Cen) are the only ones for which no empirical records of any sort appear in Tycho's surviving mss materials. I need not add that these are the very 2 sets (17 stars in all) which contain all of the 10 faked star places. And, looking beyond the final 227 stars: in the entire cat D, almost no other stars lack supporting data.[44]

D4 We have already fully discussed the four Cen stars, noting that they are actually additional to the 1000. (Recall that the Cen quartet brought the total to 1004 stars: §B3.) Thus, if we fix our attention on the 1000 Tycho stars, we should temporarily set aside the Cen foursome and scrutinize just the Oph set of 13 star-places — which has now been isolated here as virtually (fn 44) the sole set of the 1000 stars for which no data have been found in the Tycho mss.

D5 In order to reconstruct how this Oph supplemental set of 13 came into being, we start with a simple question. When Tycho was informed of his full loss of royal patronage (in a letter of 1597/1/20; Dreyer 1890 p.231) and realized his days on Hven were numbered, just how many more stars did he believe he needed to make his desired 1000 stars? The answer is explicitly stated in a note written right on the manuscript of the final series of star-position data ever taken at Hven under Tycho (1597/2/4-3/10). At the beginning of these last star data is written (OO 13:98; §B1): "Desiderantur 60 pro complendo millenario." Just 60 more stars would do the trick. Tycho had claimed he had about 1000 stars as early as 1595 (a claim his astronomer-biographer rightly regards as a lie: §B1). It seems that Tycho was expecting (§B1) a commemorative medal for the 1000 stars (which would of course enhance his prospects for future funding).

D6 To qualify for this honor, he needed 60 more stars. But a count of these last Hven data (OO 13:98-100) shows that he only acquired 47 new listed stars before leaving Denmark. So, how did he get the last 13 stars (all Oph)?

E Stars Without Sources

E1 We now turn to the set of 13 supplemental Oph stars, for which no records exist. These 13 are listed at the top of OO 3:364. They are separated from the rest of the constellation by the heading "sequentes pertinent ad Ophuichum et eius Serpentem".

Longomantanus, when editing the Tycho star catalog, intended to use D701 (as the cat D order indicates), but noticed that D701 was just an identical repeat of D699. Noting that both D701 & D675 were labelled "in dextra tibia", he substituted the (nonrepeat) data of D675 into the slot for C553. The result is that C553 is probably the sole faked star in cat C. (No real 3rd magnitude star is close to C553's coordinates — which surely makes it a rarity in the generally excellent cat C.)

[41] I've examined previous data as well in OO vols.10-13, finding none of the 10 suspects listed in Tables 1&2. The seeming 1591/10/10 observation of D678 at OO 12:171 is just a scribal error: for Tycho's reference to Hipparchos' 16th star of Oph, instead read 16th star of Ser — cataloged in the "1588" Appendix (complete until much later than 1588) to the 1592 observations; see OO 12:254. The original Tycho mss reside in the Royal Library at Copenhagen; but the full observational records are printed in OO vols. 10-13.

[42] All 54 of the real data are found in OO vol.13 [note added 1993: they will be traced in *DIO 3*]: Cyg, pp.59-60; UMa, pp.59&72-74; Boo, p.74; UMi, p.76; Cas, pp.98-99; Per, p.99. The total number of outdoor stars (added to cat D by these data) shrinks to just 49 stars, after certain repeats & slipups are accounted for. (*DIO* will round & henceforth refer to this set as the Final Fifty.) [Note added 1993: See Tables 19&20 in *DIO 3*'s upcoming contribution: the 1st critical edition of cat D.]

[43] The actual chronology of cat C's compilation was not simple; see Thoren 1990 p.297 n.133.

[44] [Note added 1993: Of the 777 stars (cat C) recorded by Tycho before his final gleanings (the 227 stars we are now scrutinizing), only 4 stars' observational data are missing. These are: D370-371 & D379-380. (In cat C: C328-329 & C337-338.) These were evidently observed (accurately) with Tycho's rarely-used semicirculus (Ræder & Strömgrens 1946 p.96, Thoren 1990 p.177), using Sirius & Algenib as reference stars. The data presumably got misfiled due to the highly exceptional (probably experimental) mode of observation. Detailed analysis in *DIO 3*.]

E2 The thirteen Oph stars are indeed precisely those that close our gap between the 1000 (pre-Cen) stars produced in cat D (just months later: 1598/1/2) and the 987 stars that existed (according to the extant mss record) when operations ceased at Hven (1597/3). By Tycho's own count (§D5): 1000 minus 60 = 940 total stars before 1597. So, add the 47 taken (§D6) between then & his exit from Denmark: 940 plus 47 = 987. Or, by our other accounting: 777 (cat C: §B1) + 156 (1596 Appendix: §D1) + 54 (subsequent data: §D3) = 987. Let us now review the 13 suspect Oph stars.

E3 The first 6 stars were (as already shown: Table 1) transparently and clumsily faked by adding 28° onto Copernicus' longitudes. (The original celestial records of these 6 "observations" will never be found since they never existed.) Perhaps this may be said to illustrate the corrupting effect of grantmanship.[45]

E4 The last 5 stars (of the Oph 13) are all inexact repeats of other Oph stars already listed in cat C. But the two stars listed prior to them have remained unidentified, until now. These are the stars D681-682. (They are sandwiched between the 6 fakes D675-680 and the 5 repeat-stars D683-687.) I have reconstructed their origins, as follows.

D681 is evidently a primitive position for the low star 45d Oph: the Tycho longitude (precessed to 1597.23) of Ras Alhague (D688), $\lambda = 256°47'$, grafted onto the observed-guesstimated crude declination $\delta = -30°$. (We have already encountered 4 other Tycho examples of real declination data merged with appropriated longitude data: §C7 & fn 31.) Using Tycho's obliquity $\epsilon = 23°31'1/2$ (fn 32), the eqs of §C7 yielded $\beta = -7°10'$. (Actual 1597.23 coordinates of 45d Oph: $\lambda = 257°15'$, $\beta = -6°34'$.)

D682 is 3 Sgr, which was observed (correctly within 0°.1) at $\lambda = 261°42'$, $\beta = -4°20'$. (Actual 1597.23 coordinates of 3 Oph: $\lambda = 261°37'$, $\beta = -4°22'$.)

The β of D681&682 were both wrongly printed without their negative signs (fn 24).

E5 The upshot is that the 13 star tacked-on Oph set is a disgrace. I suspect that (at the very least) Tycho's assistant Longomontanus (the self-cited actual supervisor of the construction of cat D: Thoren 1990 p.297 n.133) was privy to inside gossip that some of the supplemental stars fattening cat C into cat D were obtained in discreditable fashion. (See §B1.) Perhaps not knowing which were faked (or, if he knew of some fakes, being unsure if these were all there were), he threw out the whole lot (§B1) — and later printed (as cat C) just the 777 stars he trusted. Most of the ejected star-places were probably perfectly valid (as a test, I have checked the post-cat C stars in Crt and found that they are largely good to 1′-2′) — genuine data[46] lost to contemporary scientists, yet another cost[47] of scientific fakery (which Hist.sci orthodoxy continues to regard as of no particular account).

F Final Hven Dawn

F1 The extreme roughness of the δ ($-30°$) underlying D681's published coordinates suggests last-gasp desperation (as does the null-dust post-extinction magnitude, $\mu = 5\ 2/3$). It is possible that D681 & 682 (45d Oph & 3 Sgr) were the last Tycho observations at Hven, as dawn began breaking on the morning of 1597/3/16 (1597.23).

F2 One of the more amusing arguments to be found in Evans 1987 is his attempt to alibi Ptolemy's notorious (e.g., Rawlins 1982C) omission of all the low southern stars visible from 137 AD Alexandria but not visible from 128 BC Rhodos (Hipparchos' place & epoch). In extenuation of this, Evans 1987 (p.168) triumphantly points to Tycho's allegedly mysterious omission of the low but geometrically accessible stars γ^2 Sgr (which we will

[45] See fn 14 & §D5. Modern scholars are all too familiar with this phenomenon. But few are doing much about it — besides shouldering briskly for a firm personal place at the trough. Most institutions handle the attendant stink (not by reforms but) by suppressing & damning reformist criticism. Classic public relations priorities.

[46] Tycho's principal stars' errors averaged less than half an arcmin. See Dreyer 1890 pp.351-358, 387-389; also Wesley 1978. [Note added 1993: See also *DIO 3*.] The worst of the 5 add-on Crt stars was D993 (24ι Crt). Though its null-dust post-extinction magnitude was dim ($\mu = 5.82$), its position error was less than 5′.

[47] See also fn 28.

just call γ Sgr), δ Sgr, & ζ Sgr. So, we will next examine the exceedingly unmysterious causes for Tycho's passing over these three stars (at OO 11:401 & OO 12:77-78).

F3 First off, it is obvious that these are *summer* stars — and Tycho reminds one (Ræder & Strömgrens 1946 p.113) that dim stars cannot be taken in the summer (since it never gets completely dark then in Denmark). Thus, capturing Evans' three Sgr stars would require special, felicitously timed post-sunset autumn observations or (§F4) pre-dawn spring observations.

F4 Further possible mundane causes of Tycho's omission become equally obvious when we reconstruct his record of the suspect 13 star Oph addendum (OO 3:364) — according to the simple hypothesis that all 13 were recorded during the last panicky observing night on Hven: 1597/3/15-16. The 1st quarter Moon (near the Summer Solstice & a north anti-node of the lunar orbit) was up most of the night, dampening prospects for capturing dim stars. As the Moon descended, observations of easy stars commenced (by sextant,[48] thus no need for precise transit): 10λ Oph, 53ν Ser, 55ξ Ser, 56o Ser, 57μ Oph (D683-687). The six eventually-faked Oph stars (§C2) may have been vainly attempted, after initially-innocent consultation of the Hipparchos-Ptolemy Ancient Star Catalog (*Almajest* 7.5-8.1), to rustle up some new stars (i.e., ones not already recorded by Tycho). But the six were mostly dimmer and lower than D683-687. For the faked six (D675-680), the records were: [a] never made, [b] poor (from moonlight), or [c] unrelatable to the highly erroneous *Almajest* positions expected: see §C3-§C5, & fn 28. (Against any option but [a]: it's hard to make a record any worse than D681's: §E4. But Tycho retained & published it anyway.) For D675-680, Tycho presumed that the *Almajest* places better-represented-reality (‡2 fn 28 or Graßhoff 1990 p.215) than whatever record he might have of them. So he faked all six stars.

F5 On 1597/3/15-16, Tycho's last Hven night, the Moon was beginning to set at about the start (Sun 18° below horizon)[49] of astronomical twilight — about Local Sidereal Time 15:50 (shortly after 3:30 Hven Local Mean Time). Only a few minutes of total dark remained, of Tycho's epochal 2 decade observing career at Hven. In this final, pathetically narrow slice of time, the stars 45d Oph, 3 Sgr, and 10γ Sgr were all about 6th magnitude (post-extinction), if we assume a perfect[50] sky. (Approximate altitudes h at this time: $3^\circ 1/2$, $4^\circ 1/2$, & 1°, respectively. Pre-extinction magnitudes: 4.29, 4.54, & 2.99, respectively.)

F6 The attempt at low 45d Oph led to the very rough place, D681; but higher 3 Sgr was pretty well recorded, so D682 became Tycho's last creditable star place. The failure to record the lowest star (of the 3 stars suggested at §F5), 10γ Sgr — an omission which [see §F2] so furrowed the brow of Evans 1987 (p.168) — was obviously just due to: [a] twilight's onset (after time had been taken to record D681-682), [b] star not noticed at altitude barely 1°, and-or [c] low haze or clouds at the horizon.

F7 Thus ended Hven star-work — with a 13 star record so sloppy and so salted with fakes, that the entire night's data-sheet was destroyed, to cover (successfully for nearly 400y) the scientific sins here revealed for the 1st time since their commission.

G Last-Minute Centaur

G1 Presumably the four Cen stars were later added onto the previously-assembled 1000 star catalog, as insurance against a miscount (or detection of repeats). But why fake (in whole or part) 4 dim Cen stars, when brighter real quarry beckoned? — e.g., the 3 "middling", easily-visible Sagittarius stars (γ Sgr, δ Sgr & ζ Sgr), which Evans 1987 p.168 thought (§F2) redeemed Ptolemy, since Tycho missed them. (Evans here uses the *Journal for the History of Astronomy*'s brilliant & novel abbrev of Sagittarius: "Sag". *DIO* urges astronomers' general adoption[51] — as a prominent reminder of *JHA*'s rightful guardianship of refereeing standards for the rest of us: *J.Hysterical Astron 1.2* fn 5.) The likely explanation for their absence from cat D is: timing.[52] (See §F5 & fn 50.) During the very end of Tycho's pre-cat D observing period[53] at Wandsbeck, the north tip of Cen culminated near night's end, while Sgr was below the horizon all night.

G2 There are several reasons why I will speculate that the four Cen fakes (Table 2) originated at Wandsbeck, and may indeed have been produced just a few days before the 1598/1/2 date of cat D's release. (Fn 10 contains a hint that only 2 days earlier, on 1597/12/31, these four Cen star positions were not yet entered into cat D.) [a] From Hven, the (null dust) culmination post-extinction magnitude of the most difficult of the four Cen stars (2g Cen) was $\mu = 6.48$ (§B3); from Wandsbeck, the most difficult (4h Cen) had $\mu = 5.81$ (fn 34) — almost twice as bright. Tycho's normal outer-limit for μ lies either between these two figures or near the latter. (Not one star of the frantic Final Fifty, cited in fn 42, had μ as dim as 5.81.) [b] The crudity of the underlying declinations (1601.0 rms error[54] $14'$: §C7) is not typical of Tycho's output when he used his mounted instruments at Hven. But, when cat D was issued, Tycho had yet to make observations at Wandsbeck with anything but his primitive cross-staff (or "radius": Ræder & Strömgrens 1946 pp.96-97; Dreyer 1890 pp.19-20, 258; Thoren 1990 p.18-19). [c] The Cen foursome would not be visible except near transit and in complete dark; but such conditions did not exist at Wandsbeck until virtually the date of cat D. On 1598/1/2, when the last of the Cen foursome transitted (LST $= 13^h 30^m$, a bit past 6 AM Local Mean Time), the Sun's altitude $h = -18^\circ$ (total dark). Only a week earlier, at LST $= 13^h 30^m$, solar $h = -14^\circ$ — which would probably wipe out any possible naked-eye observations of the four dim Cen stars. So near the horizon (at Tycho's latitudes), these objects would have been difficult enough even in complete darkness.

H Lessons & Phags

H1 Some concluding thoughts on the Tycho fabrications. Against Tycho's personal involvement (in the Oph starfaking here exposed) is the following important point: Tycho, well before he produced cat D, argued evidentially for the obliquity's secular shift — indeed he claimed this as his own discovery.[55] So one would expect a faking Tycho to alter the Oph stars' Hipparchan latitudes, to account for this precessional effect. Yet no such alteration is found.

H2 Apologists tend to excuse embarrassments such as the foregoing (Tycho's fake stars) as perhaps due to underlings.[56] But this alibi betrays frying-pan-to-fire smarts, by

[48] Illustration at Ræder & Strömgrens 1946 p.72 or Thoren 1990 p.169.

[49] *Explan Suppl to AENA* (1961) p.399.

[50] In the real (dusty atmosphere) world, the order of visibility-ease at this time would obviously be: 3 Sgr, 45d Oph, & 10γ Sgr. And this order is reflected in these stars' rôle in cat D, namely: good (before un-signed), crude, & nonexistent, respectively. The actual coordinates of these three stars follow. (The 3rd is the one, 10γ Sgr, whose absence from cat D so worried Evans: §F2 & §G1. Its place is found here via the excellent ecliptical star tables of K.Moesgaard & L.Kristensen, *Centaurus 20*:129; 1976.) The λ & β (E&E 1601.03) were, respectively: $257^\circ 19'$ & $-6^\circ 34'$ (45d Oph), $261^\circ 40'$ & $-4^\circ 22'$ (3 Sgr), $265^\circ 42'$ & $-6^\circ 55'$ (10γ Sgr).

[51] Yes, there is a problem about the constellation Sagitta, the celestial arrow (current IAU abbreviation: Sge). Easily resolved: contract the official name to 'Gitta, and IAU-abbreviate this lofty shaft as "Git" — in order to ensure celestial commemoration of the long & the short of the *JHA*'s attitude toward dissenting lowlife (*DIO 1.2* §B2).

[52] I doubt (§G2) that the four Cen stars were taken at Hven; but I'll mention that, during the final frantic Hven star-gathering period (1597/2/4-3/15): [a] Cen transitted every night; [b] Sgr didn't transit during a single one of these nights. (From Hven, the stars could be recorded at other times than transit; but, for stars this low, a time near transit would be preferable.)

[53] Tycho observed at Wandsbeck from 1597/10/20, and cat D's date was 1598/1/2.

[54] The four Cen stars' mean (not rms) δ error for 1601.0 is $+12' \pm 4'$, which is about right for Wandsbeck (assuming refraction-correction neglected), but Hven is not statistically excluded on this account.

[55] See Moesgaard 1989 p.313, Thoren 1990 pp.290f. However, there is evidence — hitherto ignored — that the obliquity's gradual decrease was known by the 2nd century AD: see Plutarch *Moralia* 411A. And Tycho may have swiped even his later discovery of this: §H3.

[56] Thoren 1990 p.383: "At Wandesbeck, Tycho's assistants quickly incorporated [the last-minute stars] into the primary catalogue, to produce an elegant manuscript version suitable for presentation to the emperor. On 2 January

immediately raising an even worse question. When surveying the history of discovery, it is worth keeping ever in mind a certain caution: how often were labors & novel finds, now attributed to the chief of a team or of an academic school, actually made by lower-echelon figures?[57] There is no reason to suppose that this alternate form of "usurpation" is entirely a contemporary phenomenon. Moreover, the underling whipping ploy may not even apply here. Let's face the obvious: [a] Tycho was himself more desperate than anyone to complete the promised thousand stars, thus it is incredible[58] that he would not have supervised these proceedings. [b] At the start of the final push towards this completion, his records state (§D5) that he needs 60 more stars, but these same records contain only 47 stars (§D6), a deficit of 13 stars — thus, to excuse Tycho is effectively to say that he couldn't count to 60. (See the reflections of Thoren 1990 p.298 upon Tycho's conscious responsibility for the faults of his star cataloging.)

H3 For several reasons, I expect certain factions to downplay the import of the foregoing discovery of fraud in the output of one of astronomy's giants.[59] Indeed, I hope (other) chroniclers of the Hist.sci movement will keep careful record of the descent of the usual establishment-sycophant phagocytes, upon the open wound this article will represent to them, as they attempt the usual career-serving damage-control, allegedly to protect-the-reputation-of-academe — oblivious to the fact that archonal phags' own censorial behavior is far more substantially damaging to academe's integrity than what they hope to cover up. A tempting alibi for Tycho will be: the faked stars constitute merely 1% of cat D (fn 61). One might respond in the tradition of Samuel Johnson's legendary crack at David Hume. Instead, let's simply note that Tycho has been suspected previously[60] of plagiarism. (It seems that the idea of the obliquity's variation — fn 55 — came originally from C.Rothmann.) The charge has been generally regarded (e.g., Thoren 1990 p.293) as not finally provable. However, the matter of the faked cat D stars (examined here) is unambiguous as to the fact that plagiarism indeed occurred in Tycho's output.

H4 Thus, the revelation of Tychonian star-fakes has the same rôle for an evaluation of Tycho's integrity as the case of "Crocker Land" later had for explorer R.Peary. Peary's N.Pole claim is baseless & absurd, but much of the hard evidence of deliberate fakery in that case requires expertise and-or close attention to evaluate. By contrast, one needs no special wisdom or effort to understand the significance of his repeatedly published 1907 claim that he had on 1906/6/24 discovered his important "Crocker Land" (now definitely known to be nonexistent) — at the very moment & place for which DR discovered his 1906/6/24 diary states: "No land visible". (Details: *DIO 1.1* ‡4 §B1-§B2.)

H5 So, as in the Peary case: once the capacity for fraud is established beyond doubt, discussion of other suspicious cases can proceed without undue shyness of frankly pointing out (if the evidence warrants) the likelihood of dishonest scholarship. Another Tycho-Peary analogy: both men were among history's best at their specialty (& both worked 23^{y} at it); but, when they were forced by circumstances to fall slightly[61] short of a goal[62] that promised fame and riches, they were willing to resort to deliberate exaggeration in order to make up the difference between hope & reality.

H6 A comparison to Ptolemy: most of the Tycho school's work was genuine. E.g., while Ptolemy's star catalog was up to 99% faked, Tycho's was about 99% real. (And we *know* that Tycho's epochal discovery of new lunar terms was entirely original with his school. We have no such assurance regarding the discoveries sometimes attributed to Ptolemy, who in truth probably contributed nothing of value to astronomy, that was original with him.) It is curious that my attention was first drawn to the Tycho star catalog by Evans 1987, which attempted (pp.167f) to defend Ptolemy's authorship of the Ancient Star Catalog by mock-demonstrating that the RN-DR arguments against him could just as readily be used to prove that Tycho's catalog was also suspect. Indeed, it was Evans 1987 (p.168) which specifically brought up the four Cen stars as a bothersome (but nonetheless surmountable) glitch in his otherwise magnificent strawman-pseudoargument for Tycho's apparent-but-of-course-illusory-fraudulence! The ironies here are so extreme as to require no comment. But there is additionally an awful implication-by-analogy: if so fine an astronomer as Tycho could publish indoor-fabricated data (not merely fudged but simply computed wholecloth from theory, for the Oph half-dozen), then it is hardly incredible that a professional astrologer of Ptolemy's ilk was capable of doing so.

H7 Evans 1987 (p.168) even notes how strange it is that Tycho gives the four Cen stars in exactly the (curiously irrational) order in which they appear in the Ancient Star Catalog (*Almajest* 8.1). In fact, Evans 1987 p.168 remarks that the lowest of the four Cen stars (2g Cen) would be only c.2° high at Hven transit, which makes its magnitude suspiciously low (6 1/2) even presuming correctly computed extinction (& null dust). Yet, it never occurs to Evans that these stars might be fabrications. (Is it possible to come any closer to a discovery without making it?) What renders Evans' oversight particularly inexplicable is that, if we use the over-opaque extinction formula *which Evans himself develops at such length & with such seeming authority in this very article* — the same formula which is used to attack DR throughout Evans 1987 — we find that 2g Cen would

1598, Tycho dedicated the catalogue to Rudolph as a New Year's gift". Later (§B1), Longomontanus published cat C (while Kepler published cat D: §B1). Perhaps Longomontanus knew something. However, though Longomontanus spent years at Hven (Oph fakes), he did not arrive at Wandsbeck (Cen fakes) until late 1598 (Dreyer 1890 p.272), well after cat D had been completed & distributed. The different additive constants, used for the Oph & Cen fakes, might suggest 2 hands at work. (The implication is discouraging, namely, that fakery is more ubiquitous in science than most of us wish to accept is the case. If a small group of assistants felt pressed to produce data, the result might be: Table 1 & Table 2.) However, there is a simpler explanation. (And the uniform taking of magnitudes from Copernicus for both sets of fakes also suggests a single fabricator — perhaps inventing the two fake-star sets ordmag 1^{y} apart.) This is suggested by the common crudity of the additive constant: whole degrees in both cases. The two constants are simply integral roundings of the figures Tycho himself gives at OO 2:254 for the mean difference between his longitudes λ and those of Hipparchos & Ptolemy: 24° for the former & 21° for the latter. To manufacture the Cen stars' λ, the faker added 21° to Ptolemy's λ (Table 2). For the Oph stars, either of two theories works (§C1 & §C2): [a] The faker simply added 28° to the λ of the Copernicus 1543 star catalog. (This constant is the integral rounding of cat D's $\lambda = 27°37'$ for D1 = γ Ari, the star which is the λ zero-pt of the Copernicus 1543 star catalog. Copernicus' λ are just 6°2/3 less than Ptolemy's — and they are 4° less than Hipparchos', except for the ordmag 100 stars whose longitudes Ptolemy deliberately altered by 5', in order to hide his criminal plagiarism of Hipparchos' great Catalog: R.Newton 1977 pp.250-252. [See also *DIO 4.1* ‡3 §C1.]) And-or: [b] The faker just added 24° to Hipparchos' λ. (Note: option [a] fits D680's λ, while [b] doesn't, for most *Almajest* mss: fn 22.)

[57] The names of those persons attached to Tycho's observatories are listed at Dreyer 1890 pp.381-384.

[58] Rather like pretending that Reagan didn't know about the Iran-Contra fiscal shellgame, even though he cared more about it than anybody else.

[59] Despite my high admiration for Tycho's monumental achievements, his opposition to heliocentricity constitutes an offense which hard-whiggist DR cannot pass over in silence. Tycho's arguments at Thoren 1990 pp.250 & 304 are comparable in folly to Ptolemy's, though Tycho creditably went as far as having the planets revolving around the (Earth-circuiting) Sun: Thoren 1990 p.252. (See *DIO 1.1* ‡7 §C3 & fn 2.) And one may speculate (in total absence of textual support) that Tycho's high praise for "Incomparabilis Vir Nicolaus Copernicus" (OO 3:337) hints that Tycho may have harbored more doubts of geocentricity than he published.

[60] See Thoren's alibi at *DIO 1.2* §H2.

[61] Tycho's cat D (1598) lacked only about 1% of his announced 1000 star dream. Peary's final (1909) sledge-trip fell roughly 20% short of his longsought N.Pole.

[62] I notice that Noel C. Swerdlow 1979 p.529 heaps scorn upon R.Newton for the latter's then-moot suggestion that Ptolemy faked data to agree with previously existing round-number parameters. (Curiously, NCS himself later learned that Ptolemy did precisely that! — see *J.HA 1.2* fn 123 on Ptolemy's use of Pliny's integer-degree max elongations. The integrity-required apology to RN in this NCS paper was no doubt accidentally printed with invisible ink.) Yet we see that Tycho's goal was an even thousand stars, so his fake stars were brought on by his desire to seem to have attained this round number. (Recall that, as early as 1595, Tycho had fatefully boasted that he already had 1000 stars in hand: §C9.) Also, *DIO 1.3* (§N11 & fn 235) showed that Hipparchos twice faked a math proof to assure that two parameters came out to traditional integral-degree values. Therefore, though I do not myself accept the particular RN theory which NCS attacks, it is not an inherently unreasonable one. Thus, NCS' lordly sarcasm is as apt as ever.

appear[63] at magnitude[64] μ = 7.95 for Tycho, while (again by the *JHA* formula), Tycho recorded nothing outside of Cen dimmer than μ = 6.42 ! (For the dimmest real cat D stars, D194 & D234, DR finds μ = 6.19 & 6.23, resp, while the *JHA* formula produces 6.38 & 6.42, resp.) Question: how could Evans 1987 take his putative readers through page after page of fancy-looking extinction math (Evans 1987 pp.259-260 & 267-271) — while not using his resultant extinction equation (p.260 eq.2) for any of the stars he attacks DR with on p.168?[65] One partial answer: eq.2 (Evans 1987 Part 2 p.260, published *JHA* 1987 Nov) was not yet known to Evans when p.168 (Part 1) was written. (Evans 1987 Part 1 was rushed by OG into the 1987 Aug *JHA*, in hot rage that the *Amer J Physics* had just the previous March published DR's exposure of Muffia misarithmetic, including OG's. See the paper's nn.30&35 on p.239.) Thus, it escaped the ever-alert *JHA*'s attention that the formula (eq.2), so neatly designed & massaged into readiness for attacking DR in Evans 1987 Part 2, unluckily entailed the destruction of Evans' own key conclusions in Part 1 ! (The *JHA* costs institutional subscribers merely $134/year.) By the way, in the fine print, at Part 1 n.41, Evans admits[66] that the extinction-attack on DR ultimately fails. Thus, besides bulking up the deliberate-thickness of the alleged *JHA* case against DR, Evans' lengthy extinction excursion makes no gain — while, in Part 1, it instead unambiguously

[63] Using the original formula $A = pa\,\csc[h+ (8/3)/(9/5 + h^{1.1}/2)]$ (where a & p are as in fn 17), and following Evans 1987 (p.168) in adopting epoch 1591 & latitude 55°.91, we find that the light from 2g Cen passed through A = 19 1/2 molecular atm before arriving at Hven. (Our A is Evans' ζ in his eq.2.) See above at fn 17. (Note that setting T = 273°K in the above formula will produce A values close to those given by Rawlins 1982C eq.6.)

[64] And we have not included sky-brightness, which, even on the best nights, can add ordmag 0.1 magns of visual difficulty.

[65] More hilarious post-extinction magnitudes yet are demanded by other Evans 1987 p.168 statements of possible-visibility, the wildest being the claim that in 1591, 1ζ CMa = C475 (star #475 of the Tycho cat C which Evans is testing) would have been visible (through 35.5 atm . . .) from Bergen, Norway (latitude 60°.4 N). By Evans' own extinction formula (his eq.2), this star would appear at magn μ = 10.1 in Bergen! Finally, by the same formula, Fomalhaut (through 16.8 atm) would have post-extinction magnitude μ = 4.54 from Hven, whereas Tycho should have seen it as μ = 1st (!) magnitude, according to this massive *JHA* paper's central (sole) pro-Ptolemy "evidence" (pp.258-267, based squarely upon its eq.2). This paper's magnitude & extinction assessments purport (Evans 1987 p.275) to have been turned out with the meaningful assistance of an impressive flock of prominent scientists. (Curiously, the *JHA*'s top-ranking Ptolemy adulator, O.Gingerich, who saw this astonishing article all the way through from its 1st draft to its handsome *JHA* publication, is nowhere thanked in the paper.) I wonder if any of these scientists will have the integrity now to publicly distance themselves from the many-ways entertaining paper they once innocently signed onto. They have lent entirely unmerited credibility to a paper aimed at killing and (*J.HA 1.2* fn 144) swiftly burying valid scholarship. Will any of these men even have the decency to write *DIO*? Regardless, perhaps they will learn, from this experience, the degree of enhancement of their prestige which may be effected by involvement with typically open-ended Gingerich-inspired *JHA* "research". (I should add that the here-remarked gross problems with Evans 1987 were apparent to DR upon a first reading of this article.) *JHA* double-*LEAD* paper Evans 1987 also wears (directly opposite both its massive sections' opening pages) the prestige of the window-dressing *JHA* Adv Ed board: Cambridge, Harvard, Polish Academy Sci, Edinburgh, Czech Acad Sci, Frankfurt, NYU, USSR Acad Sci, Tokyo, Groningen, Aarhus, BrownU, Leicester, Pennsylvannia [*sic*], Indiana, & London's Imperial College. Since none of these universities appear to have the slightest concern that their names are being attached to funny science, the effect on their reputations is fully merited. The *JHA* allegedly has 2 top Editors (officially attached to Harvard Univ, Cambridge Univ, Roy Astr Soc, & Intern Astron Union), over a dozen prominently displayed supposedly-expert Advisory Editors, and c.750 subscribers (many of them libraries, so there should be alot more than 750 readers). And this paper's magnitude-extinction treatment specifically enjoyed consultation from no less than *six* experts here & abroad (listed in detail at p.275: Brigham Young, Battelle Pacific, Nat Obs Athens, Univ Thessaloniki, Israel's Wise Obs). I.e., an article could not be better dressed. So, how is it that, both before publication *and for the five years since publication*, neither the author, nor 2 distinguished Editors, nor 15 *JHA* Adv Editors, nor 6 extinction experts, nor ordmag 1000 evidently-silent *JHA* readers ever took TEN MINUTES to compute the crucial magnitudes which are exposed here as incurably insane? — thus undercutting the attack which *JHA* launched against Delambre & DR? (By contrast, the *JHA*'s contacting these experts must have required *weeks* — hundreds of times more labor & delay than it would take to compute a magnitude.) Again (as at ‡3 §C16): is anybody actually *reading* the handsome journals? (Indeed, are they so handsome & so festooned with inside-cover assoc-editor brag-lists precisely *because* the inside cover is all that gets looked at? And ‡1 §A7 suggests even *that* isn't being read. . . .) It would appear that only one scholar on Earth has ever carefully read Evans 1987. And DR isn't even a *JHA* subscriber.

[66] I suspect that Evans 1987 n.41 was hurriedly added in press, since its preferred extinction-constant ($A_\circ$ = 0.20 mag/atm) destroys his p.168 attacks on DR — just as thoroughly as does his later eq.2, where he prefers the very same $A_\circ$ = 0.20 mag/atm: Evans 1987 p.260. [Like preference also at Evans 1987 p.269 & esp. p.271.]

self-piekills Evans. . . . [Further on piekill-suicide: *DIO 1.2* fn 29.]

H8 Thus, perversely, the abortive *JHA* attempt (Evans 1987) to save Ptolemy from the charge of faking his star catalog has not only made his theft much more believable (§H6) but has directly resulted in exposing the far greater figure Tycho, engaging in the very same utterly dishonest practice — and by exactly the same scheme RN&DR (& Tycho!) had charged against Ptolemy (disbelieved by Evans & his Muffia pals): simply adding a precession constant to celestial longitudes. *DIO* must of course thank the ever-courageous *JHA*'s massive if ineffectual Evans 1987 sneak attack on DR, for handing *DIO* such an important discovery. But DR's thanks to the extremely handsome *JHA* will be as nothing compared to establishment archons' eternal (& eternally silent) gratitude to *JHA* Editor-for-Life Lord Hoskin for assisting so generously with: [a] spreading the stain of proven science fraud even wider among famous astronomical figures than had been the case before the *JHA*'s Evans 1987 assault on DR (note that it was also a *JHA* paper — by A.Jones — that triggered DR's discovery of Hipparchos' hoaxes: *DIO 1.3* §N11), and [b] the Tycho case's public demonstration of establishment-belovéd DR's inductive and fraud-detecting abilities. (Imagine the sheer bulk of Muffia chopper-enamel that'll grind down, before admission of the latter item. Dentists will mass-vacation on the restoration-proceeds.)

H9 Of course, to anyone outside the immediate Muffia, it is obvious that Tycho stands so far above Ptolemy as to be in virtually a different phylum. But a comparison of the ten Tycho stellar hoaxes to real astronomers' work is not flattering to Tycho: [a] the proof is certain, & [b] there is no question of an innocent interpretation. It will only add more scholars' disgrace to Tycho's if modern Hist.sci archons attempt to brush aside the fact that a deliberate hoax (even if one of modest proportions, in context) has been discovered in the work of an astronomical giant: data fabrication by indoor computation from theory. Note: none of the much-publicized fudgings, which modern scholars have demonstrated (as against speculated) in the work of Galileo & I.Newton, involve actual wholecloth computation of fake astronomical data from theory and publication of it as real. The commission of that ultimate scientific crime appears to be restricted to a very few astronomers, Ptolemy & Tycho being the most famous. (And astrologer-mathematician-quackser Ptolemy wasn't even an astronomer.) Thus, the Tycho stars here exposed must now rank as the fakest data ever published by an astronomical Immortal. Nothing like the Tycho fabrications have ever been found in the work of such other premier astronomical observers as Hipparchos,[67] Walther, Bradley, Herschel, Bessel, etc.) I must comment just as I have upon Ptolemy's similar behavior, which is condemned by R.Newton 1977 & Rawlins 1982C, but defended by Muffiosi — who claim (§H10) that Ptolemy is not unethical when he plagiarizes hundreds of stars (in a few days of indoor arithemetic) and then instead explicitly pretends in detail[68] to have himself made laborious, delicate outdoor observations of these stars (a task that would require years of time, plus more years spent acquiring the requisite expertise). DR's view: if this is not science theft-fraud, then there is no such thing.

H10 I must add the warning: Hist.sci archons' easy ethics (on such matters as plagiarism) suggest that the wise modern scholar will not leave unattended, within their reach or eyesight, any new discoveries of his own. Careful readers of *DIO* may come to suspect that this is a not-entirely-theoretical point. If such archons represent the sort of scholar that major universities wish to harbor and promote, then each of these institutions must share credit for the diffusion of their ethics — and such pioneering Hist.sci notions as: Ptolemy's merely stealing ordmag 1000 stars from Hipparchos (without attribution) is not dishonest. (See Harvard's Gingerich 1981 p.43; also [Muffia 1990] pp.215-216.)

[67] Hipparchos' math hoax (*DIO 1.3* §N11) constitutes: pretense to a complex math method, when a simpler one was actually used. But Hipparchos did not fake empirical data. (Though, he did indicate that he had: [a] used data which were actually left out of his math processes, and [b] empirically confirmed prior astronomers' parameters which were in truth pre-assumed at the outset.)

[68] [Note added 1993: See *DIO 2.3* ‡8 fn 22.]

H11 My own attitude is uncomplex: fraud in science is to be denounced, not alibied. Even in Tycho's work. (See Thoren 1990 p.293, excusing Tycho's suspected plagiarism of a key astronomical discovery: quoted *J.HA 1.2* §H2.) No, it's not pleasant to acknowledge either the ten fabricated Tycho star-places — or the implications of data-faking having occurred at such a rarified level among astronomical greats. But these are the stark truths. And I do not propose to pretend otherwise.

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[69] Prof.Emeritus, Classics, Johns Hopkins University. A generation ago, Jimmy's sister and our old friend, Anne Poultney Taylor, made us a gift of her own summery painting of our family's longtime Ruxton house. It has now hung in our Baltimore home for over a decade.

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