

Neptune's Predictive Discovery

Magician Who Discovered a Planet With the Point of His Pen

Chauvinist Priority-Claim by 2nd-Place Nation

www.dioi.org/np.pdf

Dennis Rawlins 2019 March 30

dioi@mail.com

A Leverrier's Achievement & Courage to Go Public — Vs British Cantab Secrecy

A1 From deepest antiquity, the beautiful sea-blue giant planet Neptune circuted unknown at the edge of the Solar System's main masses. [The author, married near 60^y, always compliments Neptune as his 2nd favorite celestial body.]

A2 Most people are unaware that Neptune is the only planet whose existence and very position were predicted before its telescopic apprehension. The full story of its unique 1846 discovery was hidden for 1 1/2 centuries because a few high British astronomers suppressed documents. Now that they are in hand, a true account is possible.

A3 On 1846 August 31, the Paris Observatory mathematician Urbain Leverrier had the nerve to announce on the French Academy's floor: a hitherto-unknown giant planet lurked near the bound 'twixt Capricorn&Aquarius, waiting to be revealed by the world's telescopes. Nobody looked, not even at the Paris Observatory. The press was skeptical (e.g., London's *Athenaeum* September 13 p.612: a planet "which nobody has yet seen"), not appreciating that Leverrier, intellectual descendant of celestial-mechanics' inventor, P.Laplace, had spent months mathematically analysing the green giant planet Uranus' long-notorious deviations from astronomer's predicted path, concluding (as A.Bouvard & F.Bessel before him) that Uranus was being gravitationally perturbed by an unknown major planet beyond.

A4 On 1846 September 18, frustrated at world inaction, Leverrier wrote the Berlin Observatory's keen-eyed observer Johann Galle (discoverer of Saturn's faint crepe ring), providing an exact predicted celestial longitude. The letter arrived on the fateful date, 1846 September 23. Galle (and perhaps Leverrier) knew that the most reliable star-maps were published at his observatory, the Berlin Sternkarten (a project started by the late, great Bessel to search out planets, yet omitting over half the ecliptic by limiting declinations to $\pm 15^\circ$). Galle and his young colleague Heinrich d'Arrest took the aptest chart, Karl Bremiker's scrupulous Hour 21 — which no other observatory yet possessed — from the observatory's files and boldly advanced to the superbly made Berlin Fraunhofer 25 cm achromatic refractor that very evening.

A5 To their incredulous delight, it was just a matter of minutes before Galle spotted a "star" only 1° from Leverrier's predicted place: "that star is not on the map!" The next night, they found it had moved about as predicted and measured its diameter at something over 2" (roughly as predicted); so, the next day, Galle wrote Leverrier (Galle's emphasis): "the planet whose place you have [computed] *really exists*." The resultant celebration in Paris can be imagined. Of the six previous planet&asteroid discoveries, none had been by France, which now could claim the smartest of them all.

A6 But immediately, British astronomers of Cambridge University announced that one of their own, Cantab John Couch Adams — a genuine math-genius (www.dioi.org/j239.pdf, §I12) but then of scant acquaintance with practical astronomy — had done all this back in 1845. But . . . somehow it never got published!

A7 There followed 150^y of Brit promotion of a saga attempting to alibi this incredible oops. It turned out that in 1845 Autumn, Adams had transmitted his results to fellows only of his Cambridge University persuasion. In Paris, 1845 September 22, Airy had learned of Leverrier's planet project (www.dioi.org/j911.pdf, §H4). So the Cantab clique knew of French plans, while the Brits kept mum — while an equally secret sky-search, initiated by Airy 1846 June 29 at the Royal Greenwich Observatory board meeting, was begun in July by James Challis, director of the the Cambridge Observatory, using its less than perfect Cauchoux 30 cm refractor, originally funded by the Duke of Northumberland at the behest of Cantabs Airy & John Herschel.

A8 After Leverrier's coup, Challis was blamed for delays. Astronomer Royal George Airy was blamed for snubbing Adams. John Herschel was blamed for not announcing Adams' name at a recent BAAS meeting. The one person the myth never blamed was Adams. British science had for decades longed to boast a mathematical hero, and Adams seemed an ideal underdog, seemingly robbed of credit by inertial ogres. And this prole-myth was durably effective. For over a century, Neptune's capture was routinely referred to as the "Adams-Leverrier" discovery, in that order.

A9 Recent revelations have melted the legend. E.g., Adams gave a talk at the Royal Astronomical Society in 1846 April. Not a word about his 1843-1845 planet project.

A10 When Airy corresponded with Leverrier on his prediction that summer, he never mentioned that fellow-Cantab Adams was working towards the same goal. Simultaneously, the world's leading celestial mechanist, Peter A. Hansen, was staying at Airy's home for weeks: yet no mention of Adams' project or Challis' sky-search. When Hansen and Airy went out walking 1846 July 2, they chanced to encounter Adams: nothing was said — this, though Adams was using Hansen's math for part of his planet project, as may be seen from photos of Adams' mss reproduced at *Memoirs of the Royal Astronomical Society* 54 (1904) plates 3&6, even explicitly citing Hansen's name there.

A11 Further, no continuous records of the 1845 Summer-Autumn period make mention of the Adams project or Challis' search; RGO board-meeting minutes, the diaries of Airy and J.Herschel. Nothing.

B Starting Vs Finishing

B1 The British claim of priority rests entirely on a hypothetical *elliptical* orbit Adams allegedly left at RGO for Airy in 1845 October. There are several anomalies connected to this document, including the peculiarity that the date [a] is in Airy's hand, not Adams' and [b] specifies only the month of October, not the day thereof. Which bears on the lethal question lately asked of Adamsians (www.dioi.org/sca.htm#wdpd): if Adams discovered Neptune, on what date did he discover it? In truth, Adams had no rôle whatever in the planet's actual 1846 September 23 capture at Berlin.

B2 Moreover, the proposed planet's eccentricity e was 0.14 when Adams wrote to Challis in September just a month before, allegedly altered (with unAdamsian celerity) to 0.16 for Airy by October. In any case, this highly *elliptical* orbit was for 150^y the sole basis of Brits' priority claim. But in 1988 the ephemeris of positions which Adams was feeding to Challis for aiming his mid-1846 optical search — months after the 1845 orbits left with Challis & Airy — were tested and found to be computed from a *circular* orbit (www.dioi.org/j911, Table 1), indeed, one virtually identical to that proposed in Leverrier's 1846 June 1 preliminary paper. Obviously, Adams had no confidence in the earlier elliptical orbits, the very orbits which historians had previously believed proved his priority.

B3 Requests in the 1960s of Astronomer Royal R.Wooley for access to RGO's long-hidden Neptune file produced dodges but no documents (www.dioi.org/j911.pdf, pp.3-4). Meanwhile, Wooley's confidante, Olin Eggen (recently Chief Assistant to the Astronomer Royal), removed the whole file (which ultimately ended up in Chile where he was stationed). In 1988 January, Britain's *Popular Astronomy* asked (p.5): "Who stole the Neptune papers?"

B4 In 1994, *DIO* 4.2 †10, www.dioi.org/j42a.pdf, fingered Eggen, who pretended innocence. But when he died in late 1998, the whole file was found in his home. With the assistance of NOAO's Elaine MacAuliffe & Nick Suntzeff, and the encouragement of Myles Standish, Rob Smith, Eliot Marshall, & Nick Wade, copies of the over-500pp file were sent to *DIO*'s Standish (CalTech) and the author, at last revealing the long-missing dimensions of the history.

B5 The myth that Airy snubbed Adams originated as a byproduct of his natural disappointment at losing the race, causing him to tell too-gossipy friends that Airy had refused to see him in 1845. This fantasy crested fullblown with James Newman (*World of Mathematics* 1956, e.g., p.821), who called Airy a "school-bright, hapless donkey . . . unusually conceited" (*Scientific American* 1963 March). In truth, impedimenta to Adams' progress were instead due to his own self-doubts (www.dioi.org/j239.pdf, §F).

B6 Having praised Frenchman Leverrier's undeniable victory 1846/11/13, Airy, not wishing to demean Britain's Neptune hero Adams (and sensitive from some questionable actions of his own, e.g., above §A10), stayed quiet publicly as Brit public disappointment at Adams' loss concentrated (thanks to Adams: §B5) blame on Airy&Challis, but wrote in rage privately December 11 of "rank fibs" (www.dioi.org/j911.pdf, §J8), having already exploded in a December 8 letter to Adam Sedgwick, both copies of which were hidden for 150^y, surfacing almost simultaneously c.2000.

B7 Knowing that Adams had had ample opportunity to air his hypotheses on his own (e.g., §A9), Airy savagely spoofed the myth's silliness: "Every Cambridge man is a Baby, and cannot walk out except he has a Nurse to trot him out. . . . The regular duty of the Nurse is, to divine the unexpressed wishes of the Baby to walk. . . . This responsibility of the Nurse is not removed even though the Baby take a fit of the pique and refuse to answer questions. . . ."

B8 This key letter was deliberately suppressed for 150^y due to an Airy blast at Adams, predicted in 1992 as "extremely blunt" at www.dioi.org/j239.pdf, fn 12. *DIO*'s 1999 July 7 telephone request for the letter's full text led to Nicholas Kollerstrom's deft physical capture of this central document of the entire case, thanks also to the assistance of atypically open RGO archivist Adams Perkins. Kollerstrom later organized and annotated the entire RGO Neptune file, which is available exclusively on the *DIO* website: www.dioi.org/kn.htm.

B9 Traditional histories never thought about Adams' own 1846/9/2 statement (www.dioi.org/j239.pdf, fn 5) that he had no satisfactory solution until he'd tested his theory for more than one mean distance from the Sun (the orbital element which unevadably had to be assumed at such work's outset). So he computed for Uranus/planet mean-distance ratios of 0.5&0.515 (resulting $e = 0.16\&0.12$, resp).

B10 From these 2 results, he extrapolated proportionally by 14-to-11, finding (*ibid* fn 65) a final distance-ratio of 0.57, celestial longitude 315°20', trivial eccentricity e . These data were transmitted to RGO 1846 September 2.

B11 Adamsians' priority-case's problems: E.g., [a] Adams' extrapolated final solution was sent 2^d *after* Leverrier's 1846 August 31 French Academy final announcement (& presumably triggered by it, since Cantabs kept close track of French activities: above §A7, & www.dioi.org/j911.pdf, fn 47). [b] The final Adams orbit's heliocentric longitude (§B10) was 12° off the mark (since Neptune was actually at 327° heliocentric longitude), while Leverrier's 326° was off only 1°. Various Adams&Leverrier hypothetical orbits' longitudes from 1800 to 1850 are compared to reality at www.dioi.org/j239.pdf, Tables 1&2, heliocentric&geocentric, resp. (Misled by the Titius-Bode "Law", both men had initially assumed too large a mean distance, but their able solutions for other elements largely compensated for that: *MonNotRoyAstrSoc* 147:177-186 p.186, 1970.) [c] The long-insistent British dream of priority emphasizes that Adams started ahead of Leverrier, but: who do we say wins a race, the one who starts first? Or the one who finishes first?

B12 Urbain Leverrier dramatically demonstrated the power of math & of R.Hooke's inverse-square gravitation law. After so long an injustice, his priority has finally been unambiguized. He will be ever-remembered as (F.Arago 1846):

"the man who discovered a planet with the point of his pen."