

## An astronomer calls: extracts from the diaries of Charles Piazzi Smyth

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### Abstract

Charles Piazzi Smyth, who for forty-two years in the nineteenth century was Astronomer Royal for Scotland, was an indefatigable traveller who visited many observatories, amateur and professional, at home and abroad, during his years of office. An imaginative, artistic if somewhat eccentric character, he kept informal diaries in which he recorded his day to day experiences and impressions, personal as well as scientific. His reactions to people and places could be prejudiced, but were always interesting. The purpose of assembling these extracts is not so much to throw light on their author, whose story has already been told, as to provide glimpses of what life was like for working astronomers at that time, and of the extent of their collaboration and mutual support.

**Keywords:** *French astronomy, German astronomy, Italian astronomy, Lassell, Huggins.*

### 1 INTRODUCTION

The astronomical community – as is evident from the activities of the Inter-Union Commission for the History of Astronomy (see *ICHA Newsletters*, 2001 & 2002) – increasingly urges the importance of preserving archives including written documents of every kind, and encourages efforts to find and list them. Established observatories usually have their archives of formal papers, but private material such as letters and diaries, with their often uninhibited comments, are also of potential value and interest.

An example of such material are the copious diaries of Charles Piazzi Smyth (1819-1900) (Brück and Brück, 1988) which are preserved in the archives of the Royal Observatory Edinburgh (Brück, 1988). Piazzi Smyth (Figure 1) – who chose to attach his second forename to his surname in this manner – began his career as a young man of 16 at the Royal Observatory Cape of Good Hope. Ten years later he was appointed Professor of Astronomy at the University of Edinburgh and Astronomer Royal for Scotland, a post he held for forty-two years until his retirement.

He was a man of many talents. As an astronomer, he extolled the superiority of high altitudes for astronomical observation and conducted a pioneering site-testing expedition to Tenerife in 1856. He was also a gifted artist (Warner, 1983) who left behind many beautiful watercolours of scenes and meteorological phenomena, and liked to adorn his diaries with sketches of people and places. He had a great interest in mechanical things, and was a skilful experimenter. He was unfortunately not well-supported financially in his Edinburgh post, and in practice he carried out his research in solar and laboratory spectroscopy using his own equipment and at his own expense. He performed much of his solar work in favourable climates abroad. He published delightful book-length accounts of some of his travels, in Tenerife, Russia and Egypt (Piazzi Smyth, 1858, 1862, 1867) but notes made on other journeys remain largely unpublished. It is from these that the following extracts have been taken. I have selected in particular some accounts of visits to observatories and his meetings with well-known astronomers. From his marriage in 1855 December he was accompanied everywhere by his wife Jessie (Figure 2).



Figure 1. Charles Piazzi Smyth (Courtesy Royal Observatory Edinburgh)

### 2 PARIS 1855

[Piazzi Smyth was one of the British contingent at the Paris Universal Exhibition of 1855. He naturally could not be in Paris without visiting the Paris Observatory under its renowned director Urban J Le Verrier (1811-77). Le Verrier's part in the discovery of the planet Neptune in 1846 had caused a certain amount of envy in England where John Couch Adams had also predicted the unknown planet's position but had failed to have it observed. Le Verrier already had the reputation of being somewhat arrogant; and perhaps Piazzi Smyth was rather too pressing.]

#### 2.1 Paris Observatory

"11 May. Le Verrier rather ugly and French in looks, except the colour of his hair which is lighter than flaxen. Wife dark hair, good looking and sensible; one boy about 8, girl about 3, playing about; nurse or

poor relation in room working with needle and attending to children. Room richly filled up, but at end, though looking unlike it by reason of green silk curtains and coverlets, a bed. A small fire in the room, acceptable as evening was wet. Le Verrier, rather cool and Airy [a pun on the name of the Astronomer Royal, G B Airy] in manner, stood before the fire part of the time, went to sleep part of the time, attended to the children part of the time, and read the paper, paying little attention to the guest of his invitation. Conversed with Mme Le Verrier who speaks English rather better than her husband; she was, however, not quite well, had toothache. Her great admiration of Paris, as over London, still greater of the Emperor L Nap[oleon]. NB had never been in the Louvre.

"After a great length of time a little tea brought in, nothing to eat with it, but eau-de-vie offered which refused. After tea [Le Verrier] brightened up a little and with his wife and boy formed material for a pleasing picture. He was speaking of the importance of a good deal of sleep, 7 hours at least, also plenty of recreation and long demission of astronomical labour. He could not do anything on any other plan. But he allowed that each man must find out the particular plan which will suit him best; and the plans of two men may be very different though the ends be the same. I asked him presently to show me something of the Observatory, which he did." [Next pages missing]



Figure 2. Jessie Piazz Smyth (Courtesy Royal Observatory Edinburgh)

### 3 MALTA 1864

[In 1864 Piazz Smyth and his wife made a private expedition to Egypt to survey the Great Pyramid. Piazz Smyth had fallen under the spell of a strange theory that the Pyramid had been designed under divine guidance in Old Testament days, and that its dimensions were marked out in units of the Biblical sacred cubit. That cubit was alleged to be linked with the physical dimensions of the Earth and with

the British unit of length, the inch. The matter involved the debate on whether Britain should replace its ancient system of weights and measures by the French metric system, then being widely adopted in Continental countries.

Piazz Smyth's preoccupation with the mystical Pyramid became an obsession, which coloured his thinking for the rest of his life. It could prove an embarrassment in social intercourse, as is evident from the rather cool reception he got from William Lassell whom he visited in Malta when the steamer called there on its way to Alexandria. The wealthy English amateur William Lassell (1799-1880) was one of the great makers of speculum reflectors, who built a 24-inch instrument, the world's largest to be equatorially mounted, and later a 48-inch. He spent two periods in Malta, the second with the 48-inch in 1861-5, which is when the Smyths visited him. His principal discoveries were of planetary satellites (Chapman, 1989). His assistant Albert Marth (1828-98) observed nebulae. Marth, a German, was a university educated professional astronomer who spent most of his life in England as assistant to wealthy amateur astronomers but had offended the British establishment by publishing a critical account of astronomy at Greenwich in 1860 (see Chapman, 1998)]

#### 3.1 Lassell's Observatory, Valetta

"2 December. Valetta. Pass through Palau Gardens. Trees growing well in courts, Norfolk Island pine, oleander, pomegranate, oranges and a plant with its branches tipped with red leaves looking like bright red flowers. Down again on opposite side of ridge through streets where two modern English ladies can hardly pass with their hoops. Note the Maltese lace with the Maltese crosses worked therein; at last reach quarantine harbour, looks blue, bright but very lovely compared with the other. On opposite shore, see Mr Lassell's telescope, white and twin tower like. Take a boat and on landing find it on top of a bare ridge within a walled enclosure, a few houses and a few small streets in the way, all blazing yellow. Walled enclosure looks expensive and solid. Knock at small private-looking door, where is only a small keyhole, clearly an astronomer's night latch key. Man appears, half English, half Maltese; admits party and goes off with letters and cards to Mrs Lassell at the house, some half a mile off. We are then seated in the workshop which runs all along one side of the enclosure, guess length of room 70 feet, part being given to a steam-engine room; the engine shaft entering the other bigger room and capable of being connected with the polishing machinery which appears made in excellent engineering style; but cumbersome of course for mirrors 4 feet in diameter. Lathes, benches, work tables and side shelves with tools innumerable and rafter space stored away with all sorts of bar-iron and wooden planking.

"Mr Lassell presently comes in from Valetta; recognises and begins explaining. Mrs Lassell and daughters from the house, who carry off Jessie and Miss Stanley [their travelling companion] there, and Mr Lassell again explains that everything there within, including that enclosure, was put by himself. Steam engine and workshop, of course, for he cannot polish the speculum without steam engine. (At this point, amongst the bundles of iron bars, ask him for a piece of one, 1 foot long, for material for making a

standard rule for the Pyramid. He did not seem at first well inclined to part with anything but a scrap upon the floor straight on one side and cut into an arc on the other; but finally directed his man to file off a foot from a large double bar of this iron, about 20 foot long, which I thanked him for).

"Then to telescope again; 4 foot mirror, 40 feet long, his old Liverpool construction of Polar axis. Motion in AR given by a man turning an endless screw 1 inch in a second agreeably with motion of pendulum which he sees just before him. This rather wet; and this first screw and its handle have a large flywheel to equalise the man's efforts. The first second's worm acts on the endless screw of AR circle only through train of wheels and pinions. Tube of telescope novel in being open, formed of longitudinal laths of iron bar traced with rings; Mr L. says it decidedly performs better than the solid tube and eliminates most of the twirling and twitching of stars' images. Observer brought to end of telescope by a tower which has 3 separate observing stories one above the other and can be advanced to and from centre and all round centre on a great circular stage and railway.

"At this point came up his assistant Mr Marth, the German, with a paper of places for the next few nights of the 4 modern satellites of Uranus, for without the plans compiled beforehand it is very difficult to say which are satellites and which are small stars in certain parts of the sky. Consider Mr L. has settled the non-existence of 4 out of Sir W. Herschel's 6 satellites of Uranus, for 2 of the modern 4 will not answer to any of the old 6. Negative discovery seems all that has crowned Mr L.'s vast labour. He has found no new satellite of Neptune or Uranus and no rings; apparently nothing planetary. Obs[ervations] of nebulae going on also.

"This result apparently unsatisfactory in face of such appalling works, engineering and architectural i.e. appalling to anyone who has not the means (money) and whose hobby it is not. Seems to have had a depressing and rigidifying effect on Mr L. Wonder, with all his old deference to Mr Airy that he takes for an assistant Mr Marth, the German whose only great work hitherto has been his reputedly evil attack on Mr Airy and the Greenwich observations... But with all this assistance, no discovery yet.

"Went down to the house with Mr Lassell; really a splendid house, for size of halls, rooms and staircases, paved with stone and 20 feet high (the rooms). All had a very good luncheon or early dinner and family were very kind. Took notes of precession in RA and NPD for  $\alpha$  Draconis and  $\epsilon$  Tauri [significant stars to be observed in Egypt]. Mr Lassell only stiffer and stiffer and when at last Pyd [pyramid] and standard measures were introduced by Jessie he declared that he could not see any possible method by which the proportion of the Earth's diameter on any scale could be ascertained! And that was given out in a manner implying that it would be a waste of time for anyone to be occupying himself with any questions thereanent.

"So left them at 2.15 p.m., glad to have seen them and obliged to them, but with a something, somewhere, wanting in mental satisfaction."

#### 4 GERMANY 1869

[Piazzi Smyth was promised funds for a modern equatorial telescope, and went to Germany to consult

the great Munich opticians, Steinheil and Merz. The train brought the travellers through Bonn, where they stopped for several days. They visited the Observatory at Bonn, made famous by Friedrich Wilhelm Argelander (1799-1875), compiler of the *Bonner Durchmusterung*, a massive catalogue giving the positions and magnitudes of some 32,000 stars down to ninth magnitude. Piazzi Smyth was also anxious to meet Johann Heinrich Mädler (1791-1874), one-time Director of Dorpat Observatory in Estonia (Eelsalu, 1999), now retired in Bonn: he was the author of the theory of the "Central Sun" in 1846, no longer accepted, which proposed that the Milky Way system rotated around a central point situated near Alcyone in the Pleiades. The idea appealed to Piazzi Smyth, who believed that the Pleiades played a special role in the dating of the Great Pyramid.

The Director of the Royal Observatory at Bogenhausen near Munich, Johann von Lamont (1805-79), was a versatile astronomer and expert on terrestrial magnetism and magnetic instrumentation.]

#### 4.1 Bonn

"13 May. Golden Star Hotel in market place good and clean. Bonn clean and large for its 25,000 inhabitants; the houses very roomy and spacious; streets wide; trees umbrageous, public gardens frequent ... University buildings very extensive; museum of plaster casts very extensive; also a museum of Fatherland, chiefly Roman remains. Gardens remarkable for proof of little wind; long delicate leaves, flowers untouched by wind. Horse chestnuts white, also a pink one - splendid; also a creeper with blue flowers, convolvulus etc. etc. Frequent book and engraving shops.

"Sent out forenoon letter and pamphlets to Dr Mädler and to Argelander. A beautifully written letter from Dr Mädler. Called on him afterwards at Hofgartenstrasse 3, a house strangely decorated towards top with German medieval dragons in the plaster. He and Mrs M. are living here, pensioned apparently from Russia. He old and failed; she cheerful and pleasant - with half drawingroom filled with magnificent plants. Both enter kindly into the notion of Pyramid and Alcyone - both have suffered from or felt jealousies of astronomers as to his views on Alcyone.

"Call afterwards on Argelander at the Observatory. A huge building looming far and wide with one great dome and 4 small ones in a large garden delightfully adorned with plants. Doors, windows, halls, rooms, magnificently large, but not much money going to keep them up. Personal establishment only Argelander and an assistant Salem who was at Aden observing an eclipse last summer; and a son-in-law more a friend than an assistant. The instruments, a meridian circle with 4 inch object glass, and a 6 inch heliometer equatorial. The meridian circle good; has two circles and two sets of microscopes on arms to each pier though only one used at a time; has meridian collimators looking through central hole of telescope; they pride themselves much on the collimator error determination being accurate and no difference of 1.0". Their clock arrangements poor and simple as of old. Heliometer equatorial very dirty and rusty because they say that they cannot keep out the wet from shutters and windows. It is a brother instrument to Bessel's. Mounted on wooden stand.

They complain of the clock motion being imperfect, and say that Otto Struve also does, now; and well they may, looking at the ridiculously small size of the balls.

"As compared with Edin[burgh] Equat[orial] it is fearfully strong and heavy. The pillar of mahogany beams 6 inches square, the hours circle small in radius but with spokes 1 inch square of solid cast brass and a rim of 2 or 3 inches in the side. The wooden tube like the mast of a ship; the metal filings at the ends most massive.

"Argelander has no opinion at all of Steinheil's instrumental work though the first of his optical work, his object glasses long in focal length but very perfect, more so perhaps than Merz's.

"Argelander taken up almost exclusively with cataloguing stars; with his mer[idian] circle he can just see to 9th. An old, kindly looking, finished style petit old gentleman, but not likely to go far out of his way for anyone. Gave me a portion volume on proper motion stars."

#### 4.2 A Day with the Mädlers

"14 May. Took over to Mädlers by request a statement about Alcyone and Pyramid. At 12, to the Mädlers for an excursion; and they do it well, Mrs M being the active one. 1st class tickets to Godesberg, a few miles east of Bonn. ... Enter Table d'hôte room, only 1/3 of tables filled on account of the early season. We [are] guests of Mädlers. Dinner begins very well but presently Dr Mädler taken almost with fainting; led away; sees a doctor and after a rest of an hour is all right again and can return.

"Dr Mädler is 85 years old; has been married about 25 years; is a Berliner. She a Hanoverian and has seen much of the English and [was] partly in the train of a daughter of George 3rd [King of England, then also of Hanover]. He has been at Dorpat 25 years until the last three years. Was a well known astronomer and good friend of William Struve when in Germany – but on going to Dorpat, W. S[truve] wishes to take command of him but Mädler said No! he could do his own work in his own way. This gave mortal offence and there has been a war between the Struves and Mädler ever since. They have respect for W. Struve but none for Otto S. who they insist is living only on the fame of his father and having let the books of Pulkova get into confusion."

#### 4.3 Observatory at Bogenhausen

"20 May. [Munich]. In the afternoon, the N[atural] History Museum being closed went through drizzling rain to the Observatory intending only to leave a letter and parcels to announce a visit next day. Passed river; passed a large stalactite rookery; passed rows of some peasant houses; passed along roads, muddy and lined with larch poplars; enter a village SE of city; enquired at a country post office and found ourselves on the road to the Observatory. What a road to a Royal establishment! A track barely marked out by wheels of a few shingle stones, and fresh ploughed ground on one side, the observatory's wooden fence on the other. Observatory inside, a queer-looking one storied plebeian place, spite of two small domes and one large one separate; these are true domes, not the Pulkova drums.

"We tread through the wet track more wondering than ever. As we turn the western corner

the road track disappears under grass – alas, how long since the wheels of a patronising government have passed this way! A wooden fence all along, small and tumble down, as of backwoods. Presently a gate lodge, the man intent on his own affairs outside; we enter and walk through wet grass towards a dilapidated one stor[e]y building – half a dozen rabbits almost dispute the way with us. We approach the door and read a printed notice that admittance to see the instruments is given on two days of this week. Ring; and a woman servant appears who on receiving the letter and parcel for Dr Lamont insists on our entering. Enter accordingly into a dusty study, tables and chairs piled with papers and books and bits of telescopic apparatus; glass cases with reels of wire, insulated coils, bits of other instruments.

"Presently appears the Astronomer, Dr Lamont – serenely smiling, a philosophical old man, say 70 years, thin, acute, but kindly with close cropped head and shaven face, a dressing gown of dark colour and short fur worn inside, and a shirt perfectly innocent of both collar and starch, and nothing more visible! Heavens! Here is a philosopher at last. He speaks English admirably and pleasantly, and discusses for two hours and then takes us into the observatory – first into the workshops, then into the observing room. What a scene! Why, there is every possible variation of every known astronomical instrument – and unknown also, one might say, through all the range of optical, mechanical and electrical – and all designed, made too, by himself on slender means, furnished by Reichenbach or Fraunhofer – but such short plans and quick cuts to get high accuracy as these geniuses never knew. Registration hourly magnetical and meteorological is going on on all sides, with museums of old barometers, thermometers, clocks, early examples of heliometers, magnetometers etc. as have since become famous – dusty, oxidised, many of them; but evidently new work going on amongst them in every department almost of physics. A new zone-star observing instrument capable of observing or recording 4 stars per minute to 0.01 min. of RA, 0.1 of D and 0.1 of mag[nitude], of wood and iron and glass most bravely moving on knife-edges recording all three things electrically – a transit circle with reading microscopes magnifying 200 times, a second circle inside the first for getting mean of dec[ination]; but a totally different arrangement made on the plan for aiding zone observation by a single reading microscope.

"Never was an astronomer so independent of what the opticians chose to supply to him; never was an observatory so full of all sorts of things that none but the master could move about safely in it. Never were more star places observed by one man, more than 100,000 owe their records to him. Scientific, and theoretically mathematical to a high degree, here is a man who for practical astronomy is practical above all others – not only in using instruments for observation but designing and making them in every possible manner; and that, not by large funds, but by the help of young men selected for genius of the proper kind by him. He does not like to have as assistants educated astronomers.

"And who is this Dr Lamont? A Scottish boy, born in Braemar and at 13 carried away (probably from poor and Gaelic speaking peasants by the

priests) and spending the rest of his life in Bavaria. Almost as in bitterness of memory of another land, he said Bavaria was a country where no man ever died for want of food. He knew a Scotchman who could not speak a word of German but lived in Bavaria because he loved the country and the people."

## 5 ITALY 1872

[On a tour of the Mediterranean, the Smyths travelled from Liverpool, arriving in Palermo, Sicily, after a 12-day voyage. Piazzi Smyth who had successfully observed the spectrum of the *aurora borealis* in Edinburgh during the recent high sunspot maximum planned to observe the zodiacal light from the low latitude of Sicily in order to compare its spectrum with that of the aurora. It had been suggested that the two phenomena had the same spectrum. Piazzi Smyth believed otherwise.

Palermo Observatory was the home of Piazzi Smyth's illustrious godfather Giuseppe Piazzi, discoverer of the first asteroid in 1801. The current Director was Gaetano Cacciatores (1814-89), whose father was Piazzi's successor. His assistant was Pietro Tacchini (1838-1905), future successor of Angelo Secchi in Rome. The Italian astronomers, notably those in Palermo, were leading experts in solar spectroscopy and in eclipse observations. They used a visual spectroscope for systematic observing of prominences, something that Piazzi Smyth had never seen before. By chance, a blue sun was observed in Palermo on the day the Smyths arrived. The Palermo astronomers were extraordinarily helpful, collaborating with Piazzi Smyth evening after evening over a period of four weeks and introducing the visitors to scientists in other Departments of the University. Only a selection of the diary entries are given here.

The Smyths' contact in Palermo was an old friend Colonel Henry Yule, a geographer and well-known author of a *Life of Marco Polo*, who had lived long in the East before retiring to Sicily.

The Smyths' cruise continued, calling at Trieste and Venice. From Venice they went to Padua with an introduction from Tacchini to the acting Director of the observatory, Professor Giuseppe Lorenzoni (1843-1914) (Pigatto and Zanini, 2001), who was later to succeed Giovanni Santini (1787-1877) as Director.]

### 5.1 Palermo

"*Sunday 10 March.* Palermo Bay. A blue-white sun in an ominously watery looking sky. Messenger from Col Yule boards ship early; then the Colonel, looking like Marco Polo himself. With few words he contrives to get the ship's officer to send us and baggage off before anyone else, and before breakfast; then through the shipping moored end-on to mole. ...

"*12 March.* At 9 p.m. with Miss Yule to the observatory to see M. Cacciatores. Ascend to top of Palace by broad flight of low stairs generally constructed in marble; pass under a long verandah with glass ornaments and groves of shrubs to M. Cacciatores, finding him with a brother and brother-in-law, the former bearing the name of Piazzi and the latter holding a foundation situation called after Piazzi. He speaks French, the others not. Room abundantly decorated but with paintings mostly very bad. He then takes us upstairs and along gallery after

gallery floored and lined with marble all along. Shows two paintings and one bust of Piazzi, then shows the Ramsden alt-azimuth under a dome with white marble pillars beneath, and then to the new meridian circle room (Piston and Martin's), Equatorial by Merz (9.5 inch object glass), chronograph room, Secchi's grand meteorograph etc etc. – each room with the name in golden letters outside. Instruments in good state of preservation and cleanliness, and are generally kept under linen covers. Spectroscope is direct vision from Leipsic: no makers in Palermo.

"Return to Hotel at 11 p.m.; many shops still open.

"*20 March.* By cab to the Observatory. Saw S[ignor] Cacciatores and S. Tacchini. Spoke to former chiefly on meteorology, and to the latter on spectroscopy. Former to copy out for me the Met[eorological] journal for the first two weeks of March as descriptive of storm on SS Kedar [experienced on the voyage]. Touching the blue sun, he says that that came from dust in the atmosphere, for dust fell that day on the roof of the Observatory and was gathered up: he gave us a specimen. S. Tacchini similarly gave me a specimen from Genoa, collected similarly in 1870.

"On speaking of spectrum of zodiacal light. Signor T. has not observed it himself but speaks as though all Italian astronomers were sure the aurora, zodiacal light and solar corona gave one and the same spectrum line, and he gave me two papers and a mss page to prove the same [by Secchi and other Italian astronomers].

"*22 March.* At the Observatory 9.30. Sig. Cacciatores receives us urbanely. The dust on the roof of the observatory was caught on the morning of the 10th but might have fallen the previous night or day, but not the previous 3 days because the wind was so strong ... he supposes the dust came from Africa.

"To observatory to see Signor Tacchini. Spectroscope attached to the end of 9 inch equatorial. Two black curtains fitted up temporarily for eye end to move between and also [to shield] from sun. No clock work; used RA and dec[ination] handles combined with Sp[ectroscope's] own circle of position. Slit is used very narrow – solar prominence seen thus, in narrowest sections as it passes slit. ... Sp[ectroscope] only for mapping shapes and sizes or red prominences. Tacchini observes sunspots by projection on screen and fixes angles and draws circle on a board with circles of position and radii. Has observed Saturn [in the same way] and drawn it accurately ...

"At 9 p.m. return by invitation to observatory to look through equatorial. Tacchini works; Cacciatores looks on. Moon three quarters full ... Jupiter not very well defined, and from power 150 and its small disk Tacchini with a short sharp pencil puts in details on a circle drawn on paper 6 inches in diameter. The central zone is certainly rosy. I could not pretend to see all that he put down. ... He showed the Linnhe crater as a nebulous white spot on Mare Serenitatis.

"Jessie complains of the cold at the observatory, overwalks herself for warmth in returning and falls ill again.

"*24 March, Sunday.* Professors Cacciatores and Tacchini send enquiries after Jessie. ...

"Says Senator Professor Cannizzoni at Col Yule's

party: What is the matter with Mrs Piazza Smyth?

Col Y: She has overfatigued herself and brought on a slight fever. She was actually twice at the observatory in the course of one day.

"Sen.P.C.: (with utmost astonishment) What has a donna to do at an Observatory!

"28 March. Dejeuner at Observatory chez Signor Cacciatore. S. Tacchini in company. Neatly set out in room looking to Monreale and mountains. Eggs, bread, French wines and water, salt beef, bread butter and Marsala wine. Larks spitted on silver skewers like cupid's darts and the skin of a fowl or turkey stuffed with forcemeat. Coffee and tea. The tea in a silver coffee pot and the coffee in a china teapot.

"Visit equatorial. Tacchini works hard at prominences. We then unpack spectroscope and show its action with lamp spectrum and choose a window looking west.

"7.15 p.m. to Observatory for Z[odiacal] L[ight] observations.

"1 April. At R. Observatory Palermo with Signor Cacciatore. Z Light appears well in west; sky clear of almost every particle of cloud. ZL best seen without, rather than with, gathering objective and without telescope, or with prisms, collimator and slit only. [observations continue until 8.25] (Figure 3).



ZODIACAL LIGHT AS SEEN  
AT ROYAL OBSERVATORY  
PALERMO, 1 April, 8.40 P.M.

Figure 3. The "brilliant zodiacal light" at Palermo, 1872 April, sketched by Charles Piazza Smyth.

"3 April. 7 p.m. to Observatory. Present, Signor Cacciatore and Tacchini.

"Begin arrangements in plenty of time by twilight... from 7.15 to 8.50 good view of ZL.

"[They all record what they see, independently].

"[Tacchini] will write to Gasperi, Donati and others and confer with them. He is in a fix. ... But now I show him that all three spectra are different. ZL spectrum like any old residual twilight spectrum and also like sp[ectrum] of starlit sky or starshine. And why not? If ZL is the united glare of millions of

meteors shining by reflected solar light as I have always maintained.

"5 April. ... In spectroscope Jessie declares ZL spectrum as different from aurora spectrum as night from day.

"7 April. Brilliant zodiacal light now abundantly past Pleiades. Orion Nebula very bright.

"Two dozen casks of Marsala ordered through Col Yule."

## 5.2 Padua

"24 April. Venice to Padua by rail. Visit to Observatory at Padua, top of lofty old tower, 120 feet high. Santini, Director, 90 years old and absent (author of *Elementi in Astronomia* 1830 and *Teorica degli Stamenti Ottici* 1828). Telescope counterpoised from flexure in a Reichenbach Meridian Circle by Stark, Vienna. Lorentzini, the Acting Director, shows his equatorial and spectroscope. Small equatorial (4 inches), smaller dome. Sliding black cloth curtains tube. Telescope tube has silver scale and vernier to focus exactly for clear vision at any given part of the spectrum, as C, D3 or F, to see red prominences at those places distinctly at once. Telescope eyepiece carries perforated plate; turning the open slit with length along spectrum you see where you are; turning at right angles you have a good view of the required line and get rid of much needless light. Screw near C moves telescope to bring any part of the line on to the slit.

"Anemometer of Alexandria optician for registering both velocity and direction on one piece of clock-moved paper. Direction given by vane; velocity cup well of 4 feet, 5" cup. Chain from direction vane turns; horizontal axis with great sharp-edged worm. Clock moves a sling of paper under it. Velocity wheel winds up weight and lets it fall after completing every turn....

"Universal instrument by Repsold of Hamburg. Like Pulkova instrument but with microscope to both upper and lower circles; counterpoise; method of reversing.... Lorenzino took this instrument and equatorial to Sicily for eclipse [of 1870]. A pleasant quiet diffident man. He presents us with photos and conducts us over Padua. University has 44 professors, 1480 students.

"(NB Hotel charges 3 lire for bottle of Asti Bianco which is sold at a shop a few doors down the street for 0.8 lire; profit without trouble mainly 400 percent, if tourists will go on permitting it.)"

## 6 PARIS 1875

[Piazza Smyth and his wife were in Paris to visit instrument-makers and to order his solar spectroscope from his favourite optician, Salleron, with whom he had several meetings. They afterwards paid another visit to Le Verrier, now in his sixties, at the Observatory. Since their last meeting with him, he had been obliged to resign following trouble with his staff, but was reinstated in 1873.]

### 6.1 Paris Observatory

"7 July. Noon to Observatory Difficulty of finding Le Verrier anywhere. He comes at last from a bath. Extensive well-planted and shady gardens behind observatory. Numerous domes on observatory, high up, and also about the garden. He begins to show us

the new reflecting Equatorial in progress; is called off by a telegram and appoints 8 p.m.

"8 p.m. At Observatoire. The only building in Paris not inscribed with Liberté, Egalité, Fraternité, but simply Observatoire. Madame and M. Le Verrier seated on the terrace of the observatory. Presently Mr [H.C.] Russell of the Sydney Observatory announced. A herculean build of a man, of good natured rather stolid look, M. L[e Verrier] takes us to see the new reflecting equatorial again. Lightning storm coming on. After awhile he takes us 'to see the observatory' but only shows us some old instruments in a sort of hall. Return to Mme Le Verrier and Jessie; they are now inside house, and Mme L. much alarmed at the lightning closes first the door, then the window curtains. When we say that we have not yet seen the active instruments of the Observatory she gets her husband up again to show them to me, Mr R[ussell] and Jessie though M.L. does not much like that. He shows us only the transit circle. Boasts of it much over the Greenwich one; affects great acquaintance with instruments; sits down on the step of the basement and cannot get up without assistance. I find out for myself the portable collimators, reflectors *a la* Foucault. Great storm of lightning and rain. Afterwards we are all left to find our way home without any refreshments or assistance.

"9 July. Le Verrier made a grand speech at the Institute about the weather – 1st to explain how the Observatory had predicted dry weather just before the great inundation in the south of France took place; and 2nd to say that now all the probabilities were for fine weather. That was on Wednesday at 3 p.m. At 9 p.m. that evening came the great thunderstorm of our visit."

## 7 FRANCE 1876

[The Smyths came back to Paris a year later to collect the spectroscope from Salleron. It was not quite ready so they follow Salleron's suggestion that they should visit the observatories of Toulouse and Marseilles while they waited. The Director at Toulouse was the eminent mathematician François Felix Tisserand (1845-96), appointed in 1873, who later became a Professor in Paris and the author of *Traité de Mécanique Céleste*. The observatory at Marseilles was founded by Le Verrier, originally as a branch of Paris Observatory, its situation chosen as suitable for linking France geodetically with Algeria. Eduard Jean Marie Stephan (1837-1923) was put in charge, and was in due course named Director. The Observatory's programme was to observe comets, asteroids and nebulae. Stephan's name is well-known to posterity for his discovery of the group of nebulae known as Stephan's quintet. Stephan's assistant in the same programme was Henri-Joseph Perrotin (1845-1904). Piazzi Smyth became deaf in later years; presumably that is why his questions to Tisserand were written down and why Stephan wrote on the blackboard.

Back in Paris, having called briefly on E.D. Marié Davy at his meteorological observatory, they visit Pierre Jules César Janssen (1824-1907), solar spectroscopist and eclipse observer, famous as the first to observe solar prominences outside an eclipse by the use of a spectroscope on the day after the total eclipse in India in August 1868. Janssen was much concerned with the spectrum of Earth's atmosphere, and with distinguishing lines of

terrestrial origin in the solar spectrum. He also investigated the spectrum of water vapour in the atmosphere. Piazzi Smyth, who had tried the same experiment, was anxious to elicit details of Janssen's observations, but without much success. Janssen was the first Director of the solar observatory at Meudon in 1876, but at the time of the Smyths' visit was still in his private observatory in Montmartre.]

### 7.1 Toulouse

"20 May. Walk to Observatory, up the Allée L. Napoleon, now Allée Lafayette, cross railway and then up another street going up hill ... Observatory in a large garden enclosure with lodge gate at entrance. Large and roomy building. M. Tisserand the astronomer a little smiling sailor-like man, great upon his experience in Japan at Venus transit [1874]. The first assistant, M. Perrotin, has discovered 3 new planetoids. The work of the observatory is essentially extra-meridian; they have a large meridian room, with several openings and a number of instruments under them, but old: Lalande's great quadrant, Ramsden's Transit etc. The planet discoveries were made with objective 7", [focal] l[ength] 100", mounted so as to have eyepiece at centre, both movements given by pivots and handles, both circles have white divisions on black ground; can be read from a constant seat, no clockwork, no illumination of field or of wires; wires very thick showing dark on starlit sky. Planet discovery consists in checking star maps against sky. Instrument by Eichen.

"The great reflector is in a dome in the garden; said garden full of battle bones, and large portion collected in one place. Garden flourishing, roses and jessamine in flower, gooseberries and currants in fruit; vines promising.

"21 May, Sunday. List of 15 questions [regarding observatory and university duties] in readiness for M. Tisserand on visit to Observatory; answered that night. 8 - 8.30 p.m. walk to observatory. Steep hill. M. Tisserand obliging and merry as ever. He got 2 observations of Jupiter's satellites in the early hours of this morning. Had been spending his Sunday in preparing a mathematical-astronomical lecture to be given tomorrow at 8 a.m. in the university and was ready for a night's work now. He answered my questions; then with addition of M. Perrotin we enter the Reflector Dome in garden. They begin showing Venus, though it was low; no clamping; no clockwork; with power of 170. Very brilliant, very white and well defined but accompanied by ghost ... Next looked at Vega. No finding by setting of circles but only by pointing along tube (needs 2 men to turn dome). Companion to Vega surprisingly distinct. Nebula (annular) in Lyra a great triumph, so brilliant in so dark a field yet nebular in texture. [Observed] Jupiter [and] Polaris.

"What birds are these whose songs come in at the open shutter from the garden? asks Jessie. Nightingales, responds M. Tisserand; and so it is, they abound in this obs[ervatory] of dead men's bones. Most complaisant doorkeeper shows us half-way down the hill and we proceed, the fair and the shows and the cafés are still at 11 p.m. in full swing; a rotating system of wooden horses and carriage is in great request among men and women and children of all degrees. They revolve most quickly and most smoothly: an example to the dome revolvings of an

observatory. A horse turning in a small circle inside seems to do it all."

## 7.2 Marseilles

"26 May. Walk up a long street, continuation of Rue de Noailles. Tramway and perfectly open carriages for coolness. By broken ground we reach the Observatory which has no regular direct road yet, nor any distinct fence around it, nor any astronomer's house, nor any distinct observatory but a large number of detached buildings of all sizes and shapes. In the first of these surmounted by a cup anemometer and wind vanes on tall poles, we are shown into a very dark room out of the blinding sunlight, and presently M. Stephan appears – a very little man, middle aged – say 35 – prim, neatly got up in his dress; rather precise and severe in his manner but amiable and obliging withal. A follower of M. Le Verrier; this observatory founded by M. Le Verrier as Toulouse by M. Delaunay. This Observatory useful to M Le V. for longitude with Algeria and other parts. Three assistants here with a computing room for themselves and the Director with a room as big for himself alone. A concierge man, too, cap in hand to Director, and many workmen about the place. M. Stephan takes us first to the Great Telescope in its own building: a drum dome. Mirror back all naked and exposed, very green glass and supported merely by a bar of wood across a central pad. Thickness at edges 2.75" at centre 5" nearly. Silvering 18 months old; should be renewed every 12 months; is done by M. Stephan All the means at hand, rope rings for slinging mirror upside down ... Chair entirely novel and good. At top of wall under dome and level with the telescope centre is a circular fixed platform ascended by fixed side stair.

"Great telescope employed yesterday on nebula; its diagonal prism small. On either side of diagonal prism of telescope are two little prisms like ears, placed in reversed way; these receive light from the illuminating lamp at opposite side of tube to reflector which sends it back and illuminates the field. Clock motion found not quite strong enough, though said to be good otherwise. Whole instrument made under Foucault by Eichen when in Secretan's service.

"A large equatorial is next shown, under drum dome also; objective 10" splendidly complete instrument and such a chair – rolling around on wheels and pinions and slides for movement to and from centre and up and down. The instrument's clockwork – Foucault's fan fly, and said to work well in all temperatures and to hold star bisected [for] many minutes. Field dark with light wires. Micrometers with enormous box of frames of micr[oscope] but no movement of eyepiece; therefore only to ensure truth of motion over small space. Eichen is a prime mechanician to some astronomers.

"27 May. Mme Stephan to call on Jessie tomorrow. He apparently is really impressed by the Great Pyramid, the only great astronomer we have met who is. He visited the G Pyramid on his return from the Indian eclipse.

"7.15. Out to Observatory in closed fiacre. Conversation on definition of telescope. M. Janssen had not found definition on Himalayas better than on Indian Plains. I quite agree that that might have been so, though on Teneriffe result was different. M.

Stephan writes on blackboard splendidly to explain himself. Adjourn to telescope ... Look at stars; rain begins; back by carriage.

"29 May p.m. Observatory again. Venus shown, fairly defined crescent but with great patch of violet colour from residual chromatics. Star shown on meridian with Foucault's fly regulator or clockwork: it sometimes keeps bisected for long, sometimes varies and then some accident is found to have occurred to clock screw. ... Therefore leave equatorial and go to telescope. While chair of equatorial with all its wheelworks turns out to be adapted only for observing at low altitudes – the bridge chair for reflector to be specially adapted for zenith or near zenith work, or on the meridian; for meridian sweeping nothing could be better. But said chair ... is too heavy and slow to move. Attendant has very hard work, and astronomer could do nothing without him. M. Stephan has arranged a long series of double stars in order from 0.3" to 16", also clusters and nebulae to be looked at; but they would have occupied a week night and day; and as sky though clear has bad definition we look only at 1 or 2 of each. Want of clockwork a nuisance; also want of focussing screws. ...

"The setting of D[eclination] circle is all done by [light of a] hand-lamp. The instrument however is very awkward and its chair is too far out of meridian. [other difficulties with instrument] But M. Stephan abounds in amiability and devotion."

## 7.3 Janssen at Montmartre

"3 June. Back at Grand Hotel, Paris

"4 June. Attentive and polite letter from M. Marié Davy, also from M. Janssen.

"5 June. At noon start our long drive to Observatoire de Montsouris ... open country 2-3 miles out though within the fortifications. Marié Davy, stout, round-faced, flat-headed, abundantly grey-haired man. His observatory a relic of the exhibition of 1867, a sort of Alhambra palace affair. His experiments in meteorology numerous and praiseworthy, dealing with the chemistry of meteorology and agriculture as well. ...

"Long drive in search of M. Janssen after 9 p.m. Rue Labbat, beyond Montmartre, found at last ... home with a garden. House modest in size and character, and the old woman servant evidently has expected us and shows us straight in to the salon i.e. a small room more like a study and with one gentleman and two lady visitors besides us. M. Mme and Mlle Janssen sitting conversing. Jessie gets on well with Mme Janssen, I tolerably well with M. J.; the gentleman visitor wants to know about Teneriffe. When the visitors leave at 11 p.m., then M. Janssen begins on my points, gives me some [photographic] plates and pamphlets but is very obscure as to any drawings either in ms. or print of any spectrum of the vapour of water shown by a steam tube against gas-light only. What he shows are old things already printed on telluric lines in the Sun, and even if his chief plate of those was, as he seemed to say, sunlight through a steam tube against sunlight without steam, it is a little bit of the steam lines only, viz., from D to C cut off sharply and artificially at either end. He was only positive and clear on this, that a length of 36 feet of steam tube shows nothing, 100 [feet] a little, 250 feet grandly, and in his new observatory he will have 350 feet. But otherwise the



spectrum of the vapour of water is as unsatisfactory as ever; there is no existing drawing of it pure and simple.

"Returned 1 a.m."

## 8 LONDON 1876

[William Huggins (1824–1910), one of the pioneers of astrophysics, began his spectroscopy of stars in 1863 and soared to fame as the first to observe the emission line spectra of certain nebulae and of a nova (Hearnshaw, 1986: *passim*). Though an amateur, he had on loan from the Royal Society new modern instruments, erected at his private observatory in Tulse Hill, London, in 1871. His clever wife Margaret whom he married in 1875 became his collaborator in photographic stellar spectroscopy which they pursued for a further quarter of a century. The Hugginses' artistic lifestyle was recorded by many visitors. The dog Kepler was also famous. The glass door panels mentioned by Piazzi Smyth are preserved in the Whiting Observatory, Wellesley College, USA.]

### 8.1 Tulse Hill

"19 June. Off to Huggins.

"Far out among Clapham's bowery roads and gardens, a long way, too, from railway station; a small house, small garden in front, large behind, small rooms and long and narrow staircases, but all filled to overflowing with the most exaggerated ideas of medieval furniture: the painted glass at door however reproducing with the group from the Bayeux Tapestry *isti mirent* at the comet; a sun with red prominences and a nebula, and their respective spectra. Fernery and palm-house, though small, grandly successful. The dogs, the big yellow mastiff Kepler and the little barkly black terrier Tycho Brahe. Access through house to the observatory dome, carpeted floor, and large, with space for laboratory as well as driving clock, ... induction coil etc. ... He has much liking for his old pieces of apparatus and making up things himself, and was once beyond everyone else in sp[ectroscopy]. But now, even with Mrs H.'s assistance, he must see that others do not pass him in refinements of mechanics."

## 9 CONCLUDING REMARKS

Besides providing some charming vignettes of individual astronomers, Piazzi Smyth's informal on-the-spot impressions highlight how very hard the professional astronomers of the nineteenth century worked when observatory staff numbered no more than two or three – for example Tisserand at Toulouse and Stephan at Marseilles. They also show – as at Palermo where astronomers stunted neither

time nor energy in facilitating their foreign colleague's experiment – how much personal encounters mattered before the days of conferences and instant communication.

## 10 ACKNOWLEDGEMENTS

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