

Reviews of the first edition

'[This] fascinating new book charts the short but dramatic life of an extraordinary man who became the father of modern astronomy.'

Michael Hanlon, *Daily Mail*

'Tells, effectively and unpretentiously, a story which has everything: entertainment and instruction, drama and discovery, poignancy and importance. Aughton genuinely retrieves a lost hero and an almost unknown episode of the scientific revolution. You can go on reading the book until the summer sky darkens and Horrocks's cosmos begins to gleam.'

Felipe Fernández-Armesto, *The Times*

'Aughton ... relates the story of Horrocks's life in a clear if businesslike style. Flights of fancy he leaves to Horrocks, who ... was not only a brilliant astronomer but something of a dab hand at blank verse.'

Steve King, *Spectator*

'Tells the story of the first [transit of Venus] and of the extraordinary man who saw it ... Horrocks was a man ahead of his time.'

Andrew Crumey, *Scotland on Sunday*

'Horrocks ... was lucky to live in what was for astronomers an exciting period of transition. In antiquity and until the early seventeenth century, astronomy had been little more than applied geometry ... charmingly done, with no stone left unturned ... an admirable book.'

Michael Hoskins, *The Tablet*

'I take my hat off to Peter Aughton for having produced such an excellent biography of that amazing young man who was Britain's first research astronomer of truly international standing ... a thorough, well researched and argued and highly readable work.'

Alan Chapman, *Astronomy Now*

'A first-class biography of Jeremiah Horrocks, by a researcher who has delved just about as deep as it is possible to go. No stone seems to have been left unturned and no manuscript unread in a quest for information about the life and work of this young genius ... Aughton's extremely readable, well-researched, and well-referenced biography provides us with a thorough review of the work done by Horrocks in his few years of productive astronomical life.'

David W. Hughes, *Observatory magazine*

The Transit of Venus

*The brief, brilliant life of Jeremiah Horrocks,
father of British astronomy*

PETER AUGHTON



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CHAPTER ONE

The Royal Society

THERE WAS GREAT CONSTERNATION at the Royal Society. The Polish astronomer Johannes Hevelius had published an astronomical paper from his observatory at Danzig. It was a fascinating paper and it described an event from over twenty years earlier, namely the one and only transit ever to be observed of the planet Venus across the Sun. The paper was quite unlike any scientific paper ever seen before. It was elegantly written and full of youthful enthusiasm. It contained humour and even poetry. The author was a brilliant astronomer who had used his measurements of the transit not only to correct the orbit of Venus but also to estimate a value for the distance from the Earth to the Sun. It was an amazing paper by any standards, but the problem which faced the Royal Society was that it had been written by an Englishman. How had it come about that such an elegant and valuable publication had first appeared in a foreign country?

There was much discussion. Christopher Wren, the professor of astronomy at Oxford University, was consulted. He confirmed the great merit of the treatise and the observation. There were a few problems and conclusions with which the learned society begged to differ. For example, the author put the Sun much further away than any other astronomer: a distance of over sixty million miles from the Earth to the Sun had been calculated. The writer also thought that the planets Jupiter and Saturn were so large that they were much greater than the Earth. But his

reasoning had compelling logic. Who was the author of this marvellous paper on astronomy? He was a Mr Horrocks who, according to the information in the publication, had made the observation of Venus from a place eighteen miles to the north of Liverpool. He was long deceased, but surely there must be somebody in England who knew something about him?

When enquiries were made, there were at least two people who knew a little about Jeremiah Horrocks. One was John Wallis, an active and respected member of the Royal Society. Back in the 1650s, Wallis had been a member of the pioneering Oxford Philosophical Society. He was a mathematician who had become a founder member and a leading light at the Royal Society. Another man who had known Horrocks was the Revd John Worthington, who held the living of Barking in Essex and also the living of Needham in Suffolk. He was a regular preacher at St Benet Fink's in London and he was well known in academic circles as a former vice chancellor of the University of Cambridge. Both these men had known Jeremiah Horrocks in their student days at Cambridge, before the war broke out. When John Wallis first saw the paper written by his old college friend, he naturally took a great interest in it. His comments echoed the view of the Royal Society:

I cannot help being displeased that this valuable observation, purchasable by no money, elegantly described, and prepared for the press, should have laid hid for two-and-twenty years, and that no one should have been found to take charge of so fair an offspring at its father's death, to bring to light a treatise of such importance to astronomy, and to preserve a work for our country's credit and for the advantage of mankind.¹

Yes, John Worthington and John Wallis both remembered their friend Jeremiah. All three had been colleagues together at Emmanuel College. They remembered the carefree days of

their youth, the long evenings when the day's chores were over, when they put the world to rights and discussed what they were going to do with their lives and their futures. Those halcyon days before the war when there was peace and prosperity, when political conflict was no more than a debate over a glass of ale in the taverns and colleges. They remembered the freedom of university life when the world was a younger and better place. From their college days they remembered the great preacher John Cotton who moved from Boston, Lincolnshire to Boston, Massachusetts. They remembered the academic John Harvard whose legacy had founded the first university in the New World. They remembered others from their college who had left England on those small, frail vessels to found the thriving colony of Massachusetts on the other side of the Atlantic Ocean. They had all wanted to change the world for the better. Yes. Jeremy Horrocks. A boy full of the joy of life, a youth as much at home with his poetry as with his beloved astronomy. He alone at Cambridge had had horizons even further away than the New World. Even then, his ambition was to study the heavens, to measure the stars, to follow the wanderings of the planets in the skies. In those days, he was the only person at Cambridge to believe in the revolutionary theory of Copernicus which put the Sun at the centre of the universe, with the Earth orbiting around it. He wanted to discover more about the universe. He wanted to know how and when the world had been created. He wanted to understand the forces which drove the planets around the Sun. He wanted to know how far it was to the Sun and the distance to the stars. He wanted to measure the Moon and the stars at a time when the telescope was a new invention. He wanted to expand his chosen subject of astronomy as far as it was possible to go in those nostalgic times, before the outbreak of the Civil War upset the peace of old England. His work was a whole generation ahead of the establishment of the Royal Society.

John Worthington actually knew something about the works of Jeremiah Horrocks before the Royal Society became involved. Worthington had been instrumental in getting the paper on the transit of Venus published. For several years, he had been trying to obtain information about his old college friend. His quest began in the 1650s and his enquiries led him to Broughton, near Manchester, where he knew that another astronomer called William Crabtree had been a great friend and correspondent of Jeremiah Horrocks. Crabtree, too, was gone, having died soon after the battle of Marston Moor, but Worthington discovered some astronomical papers amongst Crabtree's estate. They had been written by Jeremiah Horrocks and he was able to purchase them. One of these papers was Horrocks's account of the transit of Venus in 1639. In fact, it seems there were two drafts of the paper. A few years after making his find, on 28 April 1659, Worthington wrote a letter to Samuel Hartlib, a man he knew to be well connected in scientific publishing. He enclosed both copies of Horrocks's papers, explaining how and where he had come by the manuscripts:

I have, as you desire, sent you Mr. Horrox, his discourse called 'Venus in sole visa'. Here are two copies of it, but neither writ to the end. I lent them some years since to a friend who promised out of both to make out one, and then to print it; but other business it seems would not permit him to go through with the work. In some other loose papers I perceive that the author began his tract again and again (so curious was he about it), but these seem to be his last, written with his own hand. He lived at Toxteth Park near Liverpool, in Lancashire, was some time of Emmanuel College, Cambridge, admitted the same year I was. These papers of his, with many others of astronomical observations, I found in the study of one Mr. Crabtree (a Lancashire man, and his great correspondent in these studies), and I bought them after his death. By

sending to some friend about Liverpool or Toxteth, it may be known whether any of Mr. Horrox's kindred have any of his papers.

Yours, &c

J. Worthington²

Worthington does not seem to have visited Jeremiah's birthplace at Toxteth. Many of Jeremiah's family were still living at this time. Their business of watchmaking was prospering and they had expanded their trade to London. The area around Liverpool had suffered badly from looting during the Civil War and the evidence implies that the looting had destroyed all that was left of Horrocks's work in Toxteth. He had a brother, Jonas, who, it seems, had fled to Ireland to escape from the war, taking some of Jeremiah's papers with him. The papers had been lost and never seen again. None of his work seemed to survive from Jeremiah's home at Toxteth.

But Samuel Hartlib was very interested in the paper on Venus which John Worthington showed him. He showed it in turn to the prominent Dutch astronomer, Christian Huyghens, a respected scientist who was not slow to appreciate the value of the work. The interest of the European scientific world became aroused. Huyghens was a great friend of the Polish astronomer Hevelius and he knew that the latter was preparing to publish a paper on a transit of Mercury across the Sun, an event which he had recently observed at Danzig. Huyghens knew that Hevelius would jump at the opportunity to include an account of the transit of Venus with that of Mercury.

In the meantime, Samuel Hartlib took a long time to return the copies of 'Venus in Sole Visa' to John Worthington – so much so that Worthington was moved to write and ask for their return: he was concerned that they might be the only surviving copies of his friend's work. He need not have feared. When Hevelius received the manuscript, he expressed great

satisfaction that the two tracts, his own and that of Horrocks, were to be made into one volume. His wording was fulsome and elegant:

How greatly does my Mercury exult in the pious prospect that he may shortly fold within his arms Horrox's long-looked for, and beloved Venus. He renders you unfeigned thanks that by your permission this much-desired union is about to be celebrated, and that the writer is able with your concurrence to introduce them both together to the public.³

Hevelius was as good as his word, publishing both treatises for the whole scientific world to read. He ensured that at least this part of Horrocks's work would be known to posterity. It was May 1662 when Hevelius sent the newly published treatise to Huyghens. His accompanying letter was coloured by the fact that he was in mourning, having recently lost his wife, whom he refers to as 'my own beloved Venus'. He apologized for the delay that his bereavement had incurred:

You have doubtless heard, much honored friend, of the severe domestic calamity by which I was prevented from more quickly fulfilling my promise; and I am sure you will not only readily excuse me, but sympathize with me in this trial, when you understand how grievous an affliction has befallen me. I have sent you by Dr. Peltrius my Mercury produced amidst great mental anxiety, together with Horrox's Venus, happily risen for the public good, whilst alas! my own beautiful Venus has set to my infinite sorrow! I pray you to consider them carefully, until I am able to send you something better. The learned world is particularly indebted to you for bringing Horrox's Venus to light, thus having cheerfully bestowed a gift so excellent and acceptable as to demand the thanks of the latest posterity. When you have read the book, I beg you will give me your

opinion of its merits, which I shall esteem a great kindness, and in turn you will always find me desirous of serving you.⁴

The reply from Christian Huyghens to Hevelius was written on 25 July 1662. He sent his thanks to Hevelius and his sympathies over the bereavement. Hevelius had managed to publish the work in spite of the grievous loss of his wife and Huyghens greatly appreciated his efforts:

Your most acceptable letter, and shortly afterwards the volume of the new observations reached me safely, and although I ought to have thanked you before for the valuable gift, I have been so hindered that I could not until now discharge this duty. The illustrious Bullialdus informed me of the great affliction you have sustained by the death of your dearest wife, on which account I feared that this little work, which was then in hand, would be delayed. But you have acted rightly in not suffering your private loss to become a public misfortune: for I cannot say how highly astronomy is indebted to you for so accurate a description of your beautiful observation. Posterity cannot adequately repay you with its thanks. Touching the posthumous work of Horrox now brought to light, it is more satisfactory that it should have been undertaken by you, than by me; especially as you have prepared an excellent and elegant edition, and increased its value by a commentary.⁵

It was thus John Worthington who set up the chain of events which led to Jeremiah Horrocks coming to the notice of the Royal Society. The response of the society, when they discovered the merits of their deceased countryman, can only be described as moving and magnificent. They knew that there must be other works by this remarkable astronomer and they made a unique decision to publish posthumously the works of a scientist who had been dead for a whole generation. There

was something romantic and emotional about a young genius cut off in his prime, but their decision involved more than pure sentiment. The Royal Society realized that many years before its foundation there had been in England a man who had fully appreciated their aims and *raison d'être*. He was a man who had sprung from nowhere but who understood instinctively the differences between the scientific method which the society existed to promote and the charlatan world of alchemy, astrology, magic and witchcraft in which the great majority of people still believed.

The search continued for any surviving works by this young astronomer. The plan was to collect them, prepare them for the press and publish them under the title of 'Posthumous Works' – the *Opera Posthuma* of Jeremiah Horrocks. In John Wallis the Royal Society had the ideal man to edit this publication. He was a man in his mid-forties, not only a founder member of the society, but most importantly he had a personal interest. He was, like John Worthington, a friend of Jeremiah Horrocks from college days.

There were other parties who were interested in the quest for the remains of the works of Horrocks. One of these was a young man called John Flamsteed. Whereas Worthington and Wallis were contemporaries of Horrocks, Flamsteed was not born until five years after his death. He was only seventeen when *Venus in Sole Visa* was published but by the time the *Opera Posthuma* was being prepared for the press he was in his twenties and had already made his reputation as an excellent astronomer. He was destined to become England's first Astronomer Royal. Flamsteed had read *Venus in Sole Visa* and understood it better than anybody else alive, even John Wallis. He deserves more than a passing mention as one of the few who rescued the works of Jeremiah Horrocks from oblivion.

The Royal Society was based in London, but saw itself as a national society and had many country members. One of

these was Richard Towneley of Towneley Hall, near Burnley in Lancashire. The Towneleys were wealthy landowners and dedicated scientists, but they were Catholic recusants at a time when the Puritan movement was in the ascendancy and for this reason they tended to keep a low profile. They were among the first in England to make systematic recordings of rainfall and meteorological phenomena and as a result of these experiments Richard Towneley has a place in the history of science. It was he who discovered a simple relationship between the pressure and volume of a fixed mass of gas at constant temperature. Robert Boyle called this 'Towneley's Law' and he made much of it in his own experiments – so much so that it became known as 'Boyle's Law'. This was not a deliberate act of plagiarism on the part of Boyle; his fellow members at the Royal Society insisted on naming the law after him.

Flamsteed knew that some of Horrocks's manuscripts had found their way to Towneley Hall. Once again, the war had much to answer for. Charles Towneley, father of Richard, had been killed at the battle of Marston Moor in 1644, in the company of many other royalists. At this time, some of Horrocks's astronomical papers were in the possession of Charles's brother, Christopher Towneley. Flamsteed decided to make the journey to Lancashire. After several days' travelling, he arrived at his destination only to find that Christopher Towneley was in London. But Flamsteed's journey was not in vain:

I made a journey into Lancashire, and called at Townley, to visit Mr. Christopher Townley, who happened to be then in London. But one of his domestics kindly received me, and shewed me his instruments, and how his micrometer was fitted to his tubes; and from this time forward we often conferred by letters. I procured Mr. Gascoigne's and Mr. Crabtree's papers from him, and Mr. Horrox's theory of the moon, to

which he had begun to fit some numbers; but perfected none that I remember. About this time Mr. Horrox's remains and observations, having been collected by Dr. Wallis, were in the press. I found his theory [of the lunar motion] (of which a correct copy had fallen into my hands) agree much better with my observations than any other. Hereupon I fitted numbers to it, which with an explanation of it were printed with his works. Mr. Collins advised me to print my discourse concerning the equation of natural days with them: which I consented to do; and sent it up to him for that purpose translated into Latin.⁶

Flamsteed was delighted to discover one of the objects of his quest: more of Jeremiah Horrocks's papers. The account of his theory of the Moon's motion was a very significant find in that years later, when Flamsteed became Astronomer Royal, he would have to find a way to predict the Moon's motion in order to solve the problem of finding the longitude at sea. John Flamsteed also discovered the data for an eclipse of the Sun which took place on 22 May 1639, observed by William Crabtree. There were observations of an eclipse of the Moon on 10 December 1638 by William Gascoigne, the inventor of the micrometer which was fitted to Towneley's telescope. The lunar eclipse had also been observed by Jeremiah Horrocks and he had tried to use the data to calculate the longitude of a point on the American continent by comparing his timings with the observations of Thomas Horrocks, his American cousin. There were, of course, many observations of solar and lunar eclipses which had been recorded elsewhere, but Flamsteed knew the value of accurate observations from the past. They could never be repeated and they gave information and positions which could be used by future astronomers. He was able to purchase the papers and they eventually found their way into the collection at the Royal Greenwich Observatory. He made himself known to John Wallis, who was responsible for the

publication of Horrocks's *Opera Posthuma*. He wanted his new findings to be added to the publication.

Flamsteed was told that more of the papers had survived but that they were no longer in the north of England. They had been transferred to the safe keeping of Jonas Moore at the Tower of London. Flamsteed was working from his home in Derby, but he was a regular visitor to London and he had contacts at the Royal Society. He was already indebted to Jonas Moore and did not think he could persuade him to part with the Horrocks documents, even for publication by the Royal Society. He wrote to John Collins of the Royal Society, asking for his support. Collins lived at William Austin's house against the Adam and Eve in Petty France, Westminster:

Sir

with these I send you my promised Solar tables by my scholefellow Mr Sargeant: tho I have not added the Suns diameters yet I intend before these may be printed to send them to you: to be annexed to them or included with the rest: Sir I understood by Mr Townlys Unkle [ie Christopher, uncle of Richard] that Mr Jonas Moore has severall of Mr Gascoignes and Mr Crabtrees papers or letters which having one part of them in my hands I would gladly see because they often make reference to some others that I have not and which Mr Christopher Townly thinkes are in Mr Moores hands, but I do not know how to move Mr Moore about them I am an egregious debtor to him already and such manuscripts I know to be a treasure of that nature as is not to be trusted to every one. And I can not tell how with civility to demand them of him, but you haveing given mee notice of these and some information of his I would entreat you when you have a convenient opportunity that you would please to speake to him about them what your owne discretion may dictate to you so that they may come safe to my hands: I desire to know whether some partes or the