SHELLEY'S COSMOLOGICAL SUBLIME: WILLIAM HERSCHEL, JAMES LIND AND '*THE MULTITUDINOUS ORB*'

BY CHRISTOPHER GOULDING

Percy Bysshe Shelley's verse-drama *Prometheus Unbound* (1819) has long been recognised as a work in which Shelley makes extensive use of astronomical imagery as a metaphor for revolutionary political ideas. Hitherto, critics have largely had to rely on conjectural readings by Shelley of various contemporary scientific publications, magazines and digests that have been proposed as possible sources for his understanding of this subject. This article introduces Shelley's Eton mentor James Lind MD, FRS (1736–1812) as a more likely and more direct conduit for much of the poet's astronomical knowledge. As well as being an accomplished astronomer himself, Lind was a friend, neighbour and correspondent of Sir William Herschel (1738–1822), the greatest astronomer of the age. Here, excerpts from Shelley's verse are re-interpreted as incorporating Herchelian visions of a huge cosmic life cycle at work in the universe, encapsulating the organic process of formation of all things, from the greatest stars to the smallest particles of matter.

Percy Shelley's first major work to be subjected to a close analysis of its use of astronomical imagery was *Prometheus Unbound* (1819), a lengthy verse-drama in which spirits and figures from classical mythology are placed in the setting of an otherwise recognisably Newtonian universe.[1] Grabo drew attention to the work of William Herschel (1738–1822) as a possible general influence on Shelley's astronomical knowledge, though no specific links were suggested linking the astronomer to the poet and his writing. More recent commentary continues to suspect Herschel's influence at work, though no basis for such conjecture has yet emerged.[2]

However, continuing research into the life of Shelley's childhood mentor James Lind MD, FRS (1736–1812), who was a personal friend of Herschel, has pointed strongly towards him being a probable conduit for much of the poet's astronomical knowledge.[3] New readings of Shelley's verse now reveal passages

1 Carl Grabo, *A Newton Among Poets: Shelley's Use of Science in Prometheus Unbound* (Chapel Hill: University of North Carolina Press, 1930), p. 87.

2 Desmond King-Hele, *Shelley: His Thought and Work* (London: Macmillan, 1970), p.189; *The Poems of Shelley*, ed. by Geoffrey Matthews and Kelvin Everest (London: Longman, 2000), II. 625.

3 Christopher Goulding, '"An old, old man with hair of silver white": a more scientific view of Shelley's mentor at Eton', *Keats–Shelley Review*, 14 (2000), pp. 52–5; Christopher Goulding, 'A Volcano's Voice at Eton: Percy Shelley, James Lind MD, and Global Climatology', *Keats–Shelley Review*, 17 (2003), pp. 34–41.

The Review of English Studies, New Series, Vol. 57, No. 232

doi:10.1093/res/hgl128

bearing a distinct Herschelian character; which is particularly apparent in the poet's use of lunar and volcanic imagery.

Herschel's discovery of Uranus in 1781 transformed his astronomy career from that of a very talented amateur (*cum* musician) to that of full-time professional. It brought him to the attention of not only the scientific community, but of King George III, who bestowed on him a grant of £2,000, a pension of £200 per year, and the position of King's personal astronomer. With this level of patronage Herschel was able to build his own telescopes, bigger than any ever constructed before, the largest of which was a giant 40-feet long. It has been noted that after Herschel's telescopes: 'The tools for penetrating space became vast machines . . . that readily captured the popular imagination'.[4] This made him 'the only astronomer in the world capable of seeing out to cosmological distances': a unique position in the history of his science that he would hold until the end of his life.[5]

Whereas other professional astronomers of the day were concerned almost exclusively with the solar system, Herschel's exploration of more distant objects and the universe at large increased interest in descriptive astronomy and fuelled cosmological speculation. His study of the relationship between stars and nebulae as physical systems under gravitational influence led to space itself being regarded as an inherently dynamic rather than a static medium. Moreover, the findings of his systematic observation of deep space and his unrivalled perspective enabled the development of new theories owing much to the originality of his thought, and a level of insight shared by few of his contemporaries. Where the Astronomer Royal at Greenwich, Sir Neville Maskelyne, served navigation and commerce as 'chief timekeeper' and celestial cartographer, Herschel laid the foundations of modern exploratory astronomy from his house at Windsor.[6]

In this way, Herschel has been said to have added a 'third dimension' to space.[7] Though recognised in theory by earlier astronomers, it was only after Herschel that the concept began to spread of stars as bodies occupying a vast three-dimensional void, rather than the persisting view of them as points of light forming the patterns of zodiacal constellations on the two-dimensional canvas of the night sky. Herschel's measurements helped establish the immense distances from the earth at which stars were positioned.

James Lind remained a friend of Herschel's for many years, and they shared mutual friends such as the musicologist and astronomer Dr Charles

4 J. A. Bennett, '"On the Power of Penetrating into Space": the Telescopes of William Herschel', *Jnl. Hist. Astronomy*, VII (1976), 75–108 (pp. 75, 88).

5 Michael Hoskin, 'William Herschel and the Construction of the Heavens', *Proceedings of the American Philosophical Society*, 133 (Sept. 1989), 427–33 (p. 429).

6 *The History of Astronomy: an Encyclopaedia*, ed. by John Lankford (New York & London: Garland, 1997), pp. 61, 241, 259.

7 Michael A. Hoskin, *William Herschel and the Construction of the Heavens* (London: Oldbourne, 1963), p. 11.

Burney, who visited Windsor in 1797.[8] As recognition of Lind's influence on Shelley increases, we might now reassess the likely incidence of Herschelian imagery in his poetry, and identify several hitherto unrecognised references.

Act IV of *Prometheus Unbound* particularly resonates with echoes of Herschel's work. In one passage, the Moon speaks to the Earth, comparing their similar geologies in terms of mutual love:

> *The Moon*
> The snow upon my lifeless mountains (356)
> Is loosened into living fountains,
> My solid Oceans flow and sing and shine
> A spirit from my heart bursts forth,
> It clothes with unexpected birth
> My cold bare bosom:

Matthews and Everest note that these lines are in keeping with contemporary lunar theory. This held that though the moon had little or no atmosphere, it may have had frozen seas of water, in which suspended life might be revived if enough heat could be retained from the sun or reflected from the Earth, and then supported by air produced by lunar volcanic activity.[9] They cite Erasmus Darwin as a writer who had referred to this in literary form, noting in his *Botanic Garden* that the moon; 'seems to have suffered . . . much by volcanoes'.[10] However, Lind provides a closer and more direct link to such theories via his shared interest with Herschel in volcanic activity, and further to a curious incident involving Lind's wife.

Some four years earlier, Herschel had noted in 1787 that, not only did the moon exhibit signs of volcanic activity in the past, but also was probably the site of active eruptions which he (incorrectly) thought he had observed:

> (19th April) I perceive three volcanos in different places of the dark part of the new moon. Two of them are either already nearly extinct, or otherwise in a state of going to break out . . . the third shows an actual eruption of fire, or luminous matter.
>
> (20th April) The volcano burns with greater violence than last night . . . we may compute that the shining or burning matter must be above three miles in diameter . . . The other two volcanos are much farther towards the centre of the moon, and resemble large, pretty faint nebulae . . . These three spots are plainly to be distinguished from the rest of the marks upon the moon, for the reflection of the sun's rays from the earth is, in its present situation, sufficiently bright . . . [11]

Lind had had taken a close interest in Herschel's observations, having been actually present on several occasions. Indeed, according to Baron von Zach

8 Edward S. Holden, *The Life and Works of William Herschel* (London: W. H. Allen & Co., 1881), p. 104. Also, see Patrick Wilson's letter subsequently.

9 Matthews and Everest, *Poems*, II. 636.

10 Erasmus Darwin, *The Botanic Garden*, 2 vols. (London: J. Johnson, 1791), II. 82.

11 Sir William Herschel, 'An Account of Three Volcanos on the Moon', *Phil. Trans.*, LXXVII (1787), 229–32.

(a fellow German astronomer), Herschel acknowledged that it was Lind's wife who had accidentally alerted him to what he subsequently thought was volcanic activity on the moon. The story is told that, one evening when the Linds were visiting Herschel, the two men were looking through Herschel's telescope to watch an expected occultation of a star behind the dark limb of the new moon. Mrs Lind, asking if she might be allowed to see, stepped up to the telescope:

> Scarcely had the star disappeared before Mrs Lind thought she saw it again, and exclaimed that the star had gone in front of, and not behind the moon. This provoked a short astronomical lecture on the question, but still she would not credit it, because she saw differently. Finally, Herschel stepped to the telescope, and in fact did see a bright point on the dark disc of the moon, which he followed attentively.[12]

This story is borne out by Lind's reference to his wife's 'discovery' in one of his letters from Windsor to Sir Joseph Banks at the Royal Society in London:

> I am just now informed that Dr Shepherd was last night at Dr Herschel's to see the volcano in the moon, and that the lava had advanced 52 miles from the burning mountain. I think the philosophical world is indebted to Mrs Lind's good eyes, as well as Dr Herschel's excellent telescope in spying the first volcano that was observed in the moon in the year 1783. It shows us how much chance has to do in the discoveries of men.[13]

This account by his Eton mentor places Shelley much closer to the chief source of contemporary lunar theory in Britain; forming a basis whereby he would later have the Moon exclaim: 'A spirit from my heart bursts forth', mirroring the Earth's earlier descriptions of her terrestrial volcanos as; 'the caverns of my hollow mountains/My cloven fire-crags, sound-exulting fountains' (332–3). The hope is expressed that the lunar volcanos will not only become fountains of lava, but of new life.

In an earlier passage in Act IV, Ione, a spirit, is describing the appearance of the moon, as seen through the 'enchanter's glass' (213) of a telescope:

> . . . solid clouds, azure and gold, (214)
> Such as the genii of the thunderstorm
> Pile on the floor of the illumined sea
> When the sun rushes under it; they roll
> And move and grow as with an inward wind.

It has already been suggested that Shelley may be making an obscure reference here to the nebular theories of Herschel.[14] Matthews and Everest go into no further detail, but this would mean that the poet is referring to the theory that planetary

12 Holden, *Herschel*, pp. 69–70. Herschel assumed this bright point on the moon to be the light from an erupting lunar volcano.

13 Fitzwilliam Museum, Cambridge, Perceval Collection, H131, 17th June 1787.

14 Matthews and Everest, *Poems*, II. 625; William Herschel, 'Observations of a Comet', *Philosophical Transactions of the Royal Society*, CII (1812), p. 134.

and stellar bodies are formed by aggregations of dust which gather in space and are drawn inwards upon themselves by their own gravity and compressed by the action of their own increasing mass to form solid bodies. Hence, the 'storm clouds' are said to 'roll/And move and grow as with an inward wind' (217–8).

The strong emphasis on the whiteness of the moon's appearance and light in the following lines suggests that there is no atmosphere on its surface:

> . . . white (219)
> Its countenance, like the whiteness of bright snow,
> Its plumes are as feathers of sunny frost,
> Its limbs gleam white, through the wind-flowing folds
> Of its white robe, woof of etherial pearl.
> Its hair is white, - the brightness of white light
> Scattered in strings . . .

As Matthews and Everest note, Shelley's repeated emphasis upon the whiteness of the light tends to suggest that there is no atmosphere on the moon to create any prismatic effect, and thus pure white is the only possible colour for any reflected light. They cite Herschel's use of the term 'curtain of light' in his 1812 paper on comets, but go no further. However, examination of Lind's correspondence on similar subjects now forms yet closer links between Herschel's thought and the subsequent knowledge exhibited by Shelley. Another source for this descriptive imagery of nebulous clouds and atmospheres may be traced to two of the astronomer's papers hitherto uncited by commentators.

In 1791, Herschel had presented a paper to the Royal Society entitled *On Nebulous Stars*.[15] This paper included accounts of his observations over a number of years, and used descriptive language having much in common with that which Shelley would later use. In October 1784 he had seen; 'A star . . . surrounded by a milky nebulousity or chevelure'. Again, in January 1785 he noted; 'A bright star with a considerable milky chevelure.' Herschel then observed in November 1790 that; 'there can be no doubt of the evident connection between the [milky] atmosphere and the star.' This description of nebular objects as having a hair-like appearance, and the use of the word 'atmosphere' to describe nebulous pools of light (and not used in the sense of a gaseous atmosphere like the Earth's) bears striking similarities to Shelley's imagery of heavenly bodies having 'wind flowing folds' of nebulous light. Herschel mused upon the nature of this shining nebulous fluid around certain stars; '. . . what a field of novelty is here opened to our conceptions! A shining fluid of brightness sufficient to reach us from the remote regions of a star',

15 *Philosophical Transactions*, LXXXI (1791), 71–88. A second paper in 1795 (*Phil. Trans.*, LXXXV, 46 *et seq.*) had outlined his theories on the nature of various types of luminous and transparent gases and fluids which formed in space, often as nebular 'atmospheres' around stars, and whose formation bore some resemblance to the way clouds formed in the Earth's atmosphere.

and posed the question; 'Can we compare it to the coruscations of the electrical fluid in the *Aurora Borealis*?' Again, Herschel's coruscations of luminous fluid may be argued to be analogous to the white hair of Shelley's moon, 'Scattered in strings'.

In Act IV, Shelley had also made use of his knowledge of other contemporary scientific beliefs about the moon and its properties:

> . . . yet its two eyes are heavens (225)
> Of liquid darkness, which the Deity
> Within seems pouring, as a storm is poured
> From jagged clouds, out of their arrowy lashes,
> Tempering the cold and radiant air around
> With fire that is not brightness . . .

Since Grabo, these lines (and particularly the last one) have widely been glossed as referring to Sir Humphrey Davy's work on infra-red radiation.[16] Matthews and Everest go into some further detail, noting that Davy's work was itself based upon Herschel's experiments with 'dark heat rays'. They also raise the point that Shelley's words carry more of a suggestion of ultra-violet (rather than infra-red) light.[17] This link to Herschel and to ultra-violet light may here again be further underlined via Lind.

In 1802, Lind had been discussing Herschel's experiments with Patrick Wilson (1743–1811), Professor of Astronomy at Glasgow University. In one letter, Wilson writes of how their 'excellent friend' Dr Herschel's last paper on the construction of the heavens contained matter very interesting to astronomers:

> . . . namely, the effect of the sun's emanations in changing the colour of paper or vellum moistened with the nitrate of silver from white to gray-brown and nearly black . . . It is remarkable that the less refrangible rays of the solar spectrum have very little effect in changing the colours – and that the blue and violet change it powerfully – but still exceedingly more remarkably that beyond the violet rays, and in the invisible boundary, there acts something which powerfully also operates in changing the colours. It is not improbable that the sun's emanations may be more compounded than hitherto had been imagined, and that the principle upon which such effects depend may be quite a different form of Heat or Light . . . [and might be] revealed to us by the refraction of the prism.[18]

Such a reading arising from this 'ultra-violet' (the term had not yet been coined) interpretation might then alter our overall perspective of the underlying picture being portrayed in lines 206–235. Though the imagery is complex and even slightly confused, perhaps a fanciful explanation is being offered for the fact that

16 King-Hele, *Shelley: His Thought and Work*, p. 189.

17 Matthews and Everest, *Poems*, II. 626.

18 Birmingham Central Library, James Watt Papers, W/1, 25 December 1802.

the reflected light we get from the moon has no heat. In such a case, Shelley would now be suggesting that the sun's rays in the visible spectrum (the white light) is reflected to earth from the moon, having been 'scattered in strings' (225) by the lunar surface, and somehow denuded of the invisible rays beyond the spectrum, which are retained around the body of the moon. This, in turn, might then prompt a re-reading of lines 214–218, which could now represent an explanation of the illusory apparent atmosphere, or 'the dusk aery veil' (212) that may sometimes be seen around the moon (often referred to as a 'ring around the moon'). In this case, the azure and gold clouds (214) would be rendered a poetic reference to ultra-violet and infra-red light respectively.[19]

Act IV of *Prometheus Unbound* then continues with a passage that continues to intrigue Shelley scholars:

> A sphere, which is as many thousand spheres, (238)
> Solid as crystal, yet through all its mass
> Flow, as through empty space, music and light;
> Ten thousand orbs involving and involved
> Purple and azure, white and green and golden,
> Sphere within sphere, and every space between
> Peopled with unimaginable shapes
> Such as ghosts dream dwell in the lampless deep
> Yet each intertranspicious, and they whirl
> Over each other with a thousand motions
> Upon a thousand sightless axles spinning

The complex imagery of the 'multitudinous Orb' (253) has been variously interpreted in many different ways, with suggested sources ranging from the biblical 'wheels within wheels' of *Ezekiel* I: 16 & 28, and Milton's *Paradise Lost* v.620–4, to the concentric crystalline spheres of the Aristotelian cosmos. Possible interpretations of its meaning have included a conflation of different theories of matter, ranging from the whorls of atoms (*laminae*) imagined by Lucretius, through the worlds-within-worlds of the seventeenth-century monad

19 It may also be the case that Percy Shelley's knowledge of Herschel and Davy's work on radiation from beyond the visible spectrum may have influenced a passage in his wife's novel Frankenstein.
In its early chapters, the description of Victor Frankenstein's education has been widely noted to reflect aspects of Percy Shelley's, to the extent that the character Dr Waldman is often thought to resemble James Lind. In this passage, Waldman lectures to his students upon the advances of science achieved by its 'modern masters':

> They penetrate into the recesses of nature, and shew how she works in her hiding places . . . They have acquired new and almost unlimited powers; they can command the thunders of heaven, mimic the earthquake, and even mock the invisible world with its own shadows.
>
> Mary Shelley, *Frankenstein*, 3 vols., (London: Lackington, Hughes, Harding, Mavor & Jones, 1818), I. ii.

This last phrase (which has hitherto defied any glossing), with its references to the 'invisible world', and 'shadows' of it that have been detected by scientists, might now be regarded as a reference to infra-red or ultra-violet rays.

theory of Leibniz, to Davy's contemporary theory (from his *Elements of Chemical Philosophy*) of the motions of particles around each other and around their own axes in a sort of microcosm of the Newtonian mechanistic universe.[20] But if we now follow the argument in favour of Herschel's influence further, new and more specific sources arise.

In considering the source of the luminousity of nebular stars (see discussion on *Prometheus Unbound* IV.219–25 above), Herschel noted that the existence of the 'shining fluid' did not seem to be so essentially connected to the stars around which it appeared to be gathered that it might also not exist without them. Indeed, there seemed to be clouds of nebulous matter in space with no stars at their centre. This led Herschel to the conclusion that the fluid itself was luminous, which in turn suggested further possibilities:

> . . . the separate existence of the luminous matter, or its independence from a central star, is fully proved . . . We may also judge, very confidently, that the light of this shining fluid is no kind of reflection from a star in the centre . . . If, therefore, this matter is self-luminous, it seems more fit to produce a star by its condensation than to depend on the star for its existence.[21]

Herschel went on to propose that the presence of this shining fluid might be evidence that 'the light that is perpetually emitted from millions of suns' might itself be a means of the propagation of matter throughout the universe:

> . . . notwithstanding the unconceivable subtilty of the particles of light, when the number of emitting bodies is almost infinitely great, and the time of the continual emission indefinitely long, the quantity of emitted particles may well become adequate to the constitution of a shining fluid, or luminous matter.[22]

This theory was quite in keeping with the Newtonian view of light as a stream of particles, but quite revolutionary in its conception of light as a conduit for the cyclic formation, breakdown, emission, and reformation of stars (and by implication, their associated planetary systems) throughout the universe. Perhaps because he was a pure observational astronomer and not a physicist, Herschel seemed reluctant to appear 'presumptuous' in proposing such theories, adding rather defensively; 'I hope it will not be found that in what has been said I have not launched out into hypothetical reasonings' and noted that it would be impossible to prove whether or not is theory might be true.

However, Herschel's subsequent descriptions of his idea of the 'complicated and mysterious' cycle of nebular stellar formation might now also provide us with another source of imagery for the 'multitudinous orb' in *Prometheus Unbound* IV.238 *et seq.* The structure and process described in this following

20 Matthews and Everest, *Poems*, II. 627; Thomas A. Reisner, 'Some Models for Shelley's "Multitudinous Orb"', *Keats Shelley Journal*, XXIII (1974), 52–9; Jerrold E. Hogle, *Shelley's Process* (New York: Oxford University Press, 1988), p. 199 *et seq.*

21 Herschel, "On Nebulous Stars", *Phil. Trans.*, LXXXI (1791), pp. 71–88.

22 Ibid.

passage from Herschel's 1811 paper bears notable similarities to Shelley's idea of 'sphere within sphere', as they 'whirl over each other with a thousand motions', all spinning upon 'sightless axles':

> Are not these faint nebulous branches [of shining fluid] joining to a nucleus upon an immense scale, somewhat like what the zodiacal light is to our sun in miniature? Does not the chevelure denote that perhaps some of the nebulous matter still remaining in the branches, before it subsides into the nucleus, begins to take a spherical form . . . in a concentric arrangement? And . . . will not the matter of these branches in their gradual fall towards the nucleus . . . produce a kind of vortex or rotary motion?[23]

If this is the case, the description of the orb is no mere microcosmic contrast of atomic matter with the huge Sun–Earth–Moon scale of the universe, but an expression of Shelley's poetic vision of a huge cosmic life cycle encapsulating the organic process of formation of all things from the greatest stars to the smallest particles of matter. Thus each atom, each particle of substance, the earth itself, and every star, is a microcosm of the entire universe.

Indeed, Herschel's catalogues of observed astronomical phenomena may now provide us with a specific model for the 'multitudinous Orb'. An object in the vicinity of the constellation Taurus was observed by Herschel on 13 November 1790 that particularly attracted his interest:

> A most singular phaenomenon! A star of about the 8th magnitude, with a faint luminous atmosphere, of a circular form, and of about 3' [minutes of arc] in diameter. The star is perfectly in the center, and the atmosphere is so diluted, faint, and equal throughout, that there can be no surmise of its consisting of stars; nor can there be a doubt of the evident connection between the atmosphere and the star.[24]

Due to its appearance, this object was categorised by Herschel, along with several other similar objects in a paper of 1791, as a 'planetary nebula'.[25]

Such an object, described by Lind, and later viewed through 'the enchanter's glass' of a telescope by Shelley himself, may have fed the poet's imagination enough for the later construction of his poetic model. Shelley's poetry has long been admired for its unique use of astronomical imagery, combined with a characteristic sense of cosmic positionality. His poetic point of view is situated in space itself, as opposed to the more traditional earthbound viewpoint of poets who describe the stars as points on a two-dimensional canvas of the night sky. We might now acknowledge Herschel's contribution to Shelley's vision, both specifically through the points raised above, and more generally through

23 *Phil. Trans.*, CI (1811), pp. 269–336, Section 26. Though published in 1811, Herschel would have been researching and writing this paper throughout Shelley's time at Eton.

24 Michael A. Hoskin, *William Herschel and the Construction of the Heavens* (London: Oldbourne, 1963), p. 124.

25 Hoskin, *Herschel*, pp. 118–129 (including illustrations facing pages 128 and 129). Citing Herschel's paper 'On Nebulous Stars, so properly called', *Phil. Trans. RS*, LXXXI (1791), 71–88. The object observed on 13 November 1790 was assigned the 'Herschel number' H. iv. 69. It is now known to astronomers by its New General Catalogue number NGC 1514. A recent photograph of it is available online at: www.seds.org/~spider/ngc/ngc.html

his addition of a 'third dimension' to early nineteenth century perceptions of space.

Moreover, whilst Shelley's use of astronomical imagery as a metaphor for radical political ideas has long been widely acknowledged, Lind and Herschel might now be proposed as probable influencing factors in this area, too. Continuing research indicates that the rapidly advancing science of astronomy was strongly associated with revolutionary politics amongst Lind and his circle during the late eighteenth century. In a letter to Lind dated 7 October 1791, the Scottish natural philosopher John Anderson (1726–96) wrote: 'I am still of the opinion that I have seen the two most wonderful things that have ever been seen in this Planet: the French Revolution and Dr Herschell's telescope.'[26]

Royal Grammar School, Eskdale Terrace, Newcastle upon Tyne NE2 4DX, England

26 University of British Columbia, Woodward Biomedical Library, Ms. WZ260.C668.