

VIRGINIA WOOLF AND  
THE DISCOURSE OF  
SCIENCE

*The Aesthetics of Astronomy*

HOLLY HENRY



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## *Stars and nebulae in popular culture*

Splashed across the front page of the *New York Times*, a resplendent, multi-colored photograph reveals two galaxies colliding in the depths of space, 63 million light-years from earth. The spectacular image of the explosive collision between the Antennae galaxies was captured by the Hubble Space Telescope, and appeared in multiple newspapers and on magazine covers. The cover of *Newsweek*, for instance, sported a dramatic image of the cosmic crack-up. Headlined “Galaxies: How the Universe Began – How it might End,” the magazine featured a report on galaxies as colossal whirls of stars and solar systems racing through space at tremendous speeds.<sup>1</sup> Hubble’s lens has glimpsed not only how stars are born, but also how worlds die out, and the massive collision between the Antennae galaxies suggests what the future ultimately holds for human existence. Astronomers now say the Milky Way is likely to find its demise in a similar galactic conflagration. According to the *New York Times*, “The Milky Way and Andromeda are approaching each other with a speed of 300,000 miles an hour.”<sup>2</sup> But given the vast distances between the galaxies no such collision, the news report assures, will occur for another five billion years, and by then earth will have been consumed in an enormous expansion of our dying sun. As the Hubble Space Telescope continues to relay never before seen cosmic events into the popular purview, the images beamed back from space have captivated public attention.

Similarly, nearly a century ago, as a new generation of telescopes began producing stunning photographs of extra-galactic phenomena, a popular fascination with astronomy emerged in the US and in Britain. On an October night in 1923, Edwin Hubble, working with the new 100-inch reflecting telescope at Mount Wilson Observatory, photographed the spiral nebula Andromeda. One particular photograph taken that evening would lead to a monumental discovery. By calculating the distance to a variable star identified on the photographic plate, Hubble determined that the Andromeda nebula appeared to be located nearly a million light-years

beyond our galaxy.<sup>3</sup> Prior to this, astronomers rigorously debated whether the Milky Way marked the extent of the entire universe.

The suggestion that the universe extended beyond our galaxy had been put forward as early as 1785, when British astronomer William Herschel contended that nebulous astronomical objects were “distant stellar systems.”<sup>4</sup> Later in the 1840s William Parsons, known as Lord Rosse, working with a 72-inch reflecting telescope, found that what were known as nebulae often had a spiral structure (Ronald Brashear and Daniel Lewis, *Star Struck* 159). Lord Rosse was able “to distinguish individual stars in some of the larger ones [which] helped strengthen the belief that spirals were galaxies (sometimes called ‘island universes’) like our own Milky Way” (*Star Struck* 159). However, when in 1918, Harlow Shapley measured the Milky Way at three-hundred thousand light-years across, he consequently “doubted that the spiral nebulae were distant galaxies as they could hardly be so far away as to be outside [our own] galaxy” (*Star Struck* 161).

The debate was settled in January 1925 with an official announcement of Hubble’s findings at a joint meeting of the American Astronomical Society and the American Association for the Advancement of Science held in Washington, DC.<sup>5</sup> Two months earlier, in November 1924, the *New York Times* ran a short article headlined: “Finds Spiral Nebulae Are Stellar Systems. Doctor Hubbell [sic] confirms view that they are ‘Island Universes’ similar to our own.”<sup>6</sup> Hubble’s confirmation of the existence of extragalactic nebula or galaxies external to the Milky Way, was said to have “expanded one hundred fold the known volume of the material universe.”<sup>7</sup> Before the end of the decade, Hubble and his assistant Milton Humason would announce yet another earth-shaking find. The universe, they reported, was expanding at an incredible rate. Light emitting from the faintest galaxies indicated they were receding from the Milky Way at speeds upwards of 12,000 miles per second (Edwin Hubble, *The Realm of the Nebulae* 119).<sup>8</sup> Galaxies located further away, Hubble’s velocity/distance relation indicated, were receding at even greater speeds.

Disclosure of Hubble’s findings sparked widespread popular interest in emerging telescopic technologies and cosmology in both the US and in Britain. Public fascination with the new discoveries in astronomy changed Mount Wilson Observatory, where Hubble conducted his research, “from a quiet enclave of astronomers into a bustling tourist attraction” (Gale Christianson, *Edwin Hubble* 212). By the early 1930s, the observatory opened for public viewing of stars and nebulae, and became a mecca for celebrities and public audiences alike drawing by the mid-thirties as many as 4,000 visitors on a holiday weekend (Christianson 213). Offering

accommodations in cabin-like bungalows for \$1.50 per night, the observatory provided opportunities for gazing at the stars through the 60-inch telescope and occasionally the large 100-inch Hooker telescope (Christianson 212). Tours of a small museum hung with photographs of stars and nebulae whirling millions of light-years from earth, as well as lectures on astronomy, were also available while the observatory's recently installed swimming pool provided an added attraction (Christianson 212).

Launched by his discoveries into the Hollywood set, Hubble was sought out by renowned scientists, actors, and literati alike. Hollywood celebrity Anita Loos, author of the novel that became the Broadway smash *Gentlemen Prefer Blondes*, screen and stage star Helen Hayes, British novelist Aldous Huxley, British actor George Arliss, as well as Albert Einstein himself ranked among Mount Wilson's more visible guests (Christianson 212). Each made the journey seeking the chance to peer through the observatory's powerful telescopes. "We were intrigued," Hayes later noted, "by the fact that a tiny bit of glass, which could fit into the socket of one man's eye, could swell out to embrace the whole universe. It seemed to put us in hailing distance of all eternity" (quoted in Christianson 259).

#### VIRGINIA WOOLF AND THE NEW VISTAS OF SPACE

What has not been recognized is the powerful shaping effect advances in astronomy in the early decades of the twentieth century had on Britain's literary artists and intellectuals. Nor has the scientific and personal collaboration between scientists in the US and in Britain been explored explicitly in relation to the British fascination with astronomy in the 1920s and 1930s. Virginia Woolf, in particular, was deeply curious about the sciences, especially astronomy. Her fiction and essays reveal that she read best-selling, non-technical science texts covering cosmology, relativity, and the new physics. Developments in astronomy and cosmology were reported in daily newspapers, as well as the eclectic weekly literary reviews in which Woolf published her short fiction and essays. As Gillian Beer notes, "Virginia Woolf, like most educated people of the 1920s, was well aware of Einstein as an intellectual presence."<sup>9</sup> Not only would she have read about galaxies whirling in the abysses of space, the nearly unimaginable size of the star Betelgeuse, and Clyde Tombaugh's discovery of a new planet, Pluto,<sup>10</sup> but she also knew, and in some cases socialized with, some of Britain's most prominent mathematicians and science writers.

Through her association with Ottoline Morrell at both Garsington Manor and in London, Woolf became part of a network of intellectuals

many of whom published multiple non-technical science books on advances in mathematics, the new physics and in cosmology.<sup>11</sup> There she had opportunity to discuss science and mathematics with Cambridge mathematicians Bertrand Russell and Alfred North Whitehead. Leonard Woolf's description of the Garsington gatherings suggests that astronomy and cosmology may have been typical topics of discussion:

The zenith of the Garsington week-end in late spring and early summer was Sunday afternoon. . . . [T]here was always a galaxy of male stars, from ancient red giants like [W.B.] Yeats to new white dwarfs from Balliol and New College. . . . The Oxford generations of the nineteen tens and nineteen twenties produced a remarkable constellation of stars of the first magnitude and I much enjoyed seeing them twinkle in the Garsington garden. (*Beginning Again* 202–3)

Two scientists who played a significant role in heightening Britain's popular interest in astronomy and cosmology were British mathematician and cosmologist James Jeans and Cambridge astrophysicist Arthur Eddington. Woolf clearly had read their popular science books and, as Gillian Beer suggests, may have known their work through their BBC wireless broadcasts.<sup>12</sup> Thus, Woolf's literary and polemical writing represents a significant site for discovering the interconnections between British literary artists and the scientists who were their colleagues and associates.

While Woolf's personal and intense fascination with cosmology will unfold in the chapters that follow, this chapter explores the pervasive public preoccupation with astronomy that Britain experienced in the 1920s and 1930s, as well as how this interest was generated. Chapter One examines the cultural impact of Hubble and Einstein's reconfiguration of modern cosmological models of the universe, and reconstructs in part the popular milieu within which Woolf was formulating her global aesthetics. The chapter in addition explores the social and literary networks through which Woolf found opportunity for exchange with renowned scientists and popular science writers of her day.

#### THE ATHENAEUM: WOOLF'S LITERARY CONNECTION TO THE SCIENCES

Popular audiences in Britain were amazed at the new vistas of intergalactic space captured by improved telescopic technologies. Photographs of spiral nebulae and distant stars, published largely in non-technical astronomy texts, and to a limited extent in the daily press, brought into the public purview spectacular images of intergalactic space. Topics related to



cosmology and the physical sciences became inextricably interwoven into public discourse. Daily newspapers such as *The Times* [London] and the *London Illustrated News*, as well as review journals including the *English Review*, *London Mercury*, and the *Review of Reviews*,<sup>13</sup> eagerly engaged the public with articles on cosmology, relativity, and the new physics. Such literary journals enjoyed a wide circulation in the early decades of our century largely, as Adrian Smith has noted, because “[t]he cinema was in its infancy and the wireless still a decade away. Television was the stuff of science fiction . . . Thus the only competition was the daily press” (*The New Statesman* 49–50). Readers found in these publications essays on physics, cosmology, and the atom as readily as articles on homemaking. A January 1929 issue of the *Hibbert Journal*, for instance, featured essays on “The Human Value of the New Astronomy” and “Relativity in Prayer” alongside an essay titled “Homemaking as a Key Industry.”

One journal in particular dedicated to bringing both the arts and the sciences to its readers was the eclectic British weekly the *Athenaeum*. From its earliest inception in 1828, the *Athenaeum* had been devoted to providing a forum for intellectual interchange between artists, scientists, economists, and politicians. In its second issue, the journal announced its subjects: “literature, art, and science.”<sup>14</sup> By the 1910s, the *Athenaeum* ran regular sections on book reviews, entertainment reviews, music and drama, poetry, and recently released gramophone recordings. While the science content had been somewhat reduced, the journal continued to publish articles and essays on advances in technology and the sciences. In 1923 the *Athenaeum* was subsumed into the *Nation & Athenaeum*, under John Maynard Keynes, and maintained a reputation throughout the decade as “one of the foremost weeklies in the country.”<sup>15</sup>

Some of Virginia Woolf’s best and earliest short fiction, essays, and literary reviews received top billing in the *Athenaeum*, and its later configuration the *Nation & Athenaeum*. “Solid Objects” and “Kew Gardens” were first published in the *Athenaeum*, while her treatise on a modern prose poetics, “Mr. Bennett and Mrs. Brown,” appeared in the *Nation & Athenaeum*.<sup>16</sup> In fact, prior to 1925, Woolf published largely in these journals or anonymously in the *Times Literary Supplement* (Hermione Lee, *Virginia Woolf* 559). Her husband, Leonard, also made significant editorial contributions to the *Nation & Athenaeum* while serving as literary editor from 1923 through 1931.

The *Athenaeum* quickly developed as a vital part of the intellectual life of Virginia and Leonard Woolf and their colleagues. As Michael Whitworth

points out, “Intersecting with the Garsington circle was one which formed around the literary weekly the *Athenaeum* under the editorship of John Middleton Murry between 1919 and 1921.”<sup>17</sup> Indeed, Woolf wrote in March 1919 to her sister Vanessa Bell: “Our amusement now is Murry and the *Athenaeum*. . . . It is rather fun about the *Athenaeum*, as every one is to write what they like . . .” (L2: 341). Many within the Woolfs’ circle published book reviews, original literary work, and essays in the publication. These included Woolf’s brother-in-law Clive Bell, art critic and friend Roger Fry, T.S. Eliot, Aldous Huxley, E.M. Forster, Bertrand Russell, Lytton and James Strachey, and Katherine Mansfield. The later *Nation & Athenaeum* became so central to the Woolfs’ social circle that Vanessa complained to Roger Fry in December 1923: “Talked a great deal about the *Nation*. It seems to me like a drug. Everyone reads it and discusses it in and out and theres always a lot of gossip about each article or review – one is quite out of it if one hasnt seen it for some weeks as I generally havent” (quoted in Lee, *Virginia Woolf* 447). Woolf biographer Hermione Lee has also noted the importance of the journal to the Woolfs: “With Leonard at the *Nation* and Virginia as his frequent contributor, and with the [Hogarth] Press expanding at the same time, the Woolfs settled, as a couple, into the centre of the London literary network. Virginia’s relationships were greatly entangled in this . . .” (*Virginia Woolf* 447).

Both the *Athenaeum*, and the *Nation & Athenaeum*, developed as crucial sites for Virginia Woolf’s access to science writers, and for her reading of popular science. “Literary journals and publishing houses,” Whitworth comments, “create imaginary communities, geographically disparate, but possessing some degree of cultural or ideological agreement.”<sup>18</sup> The *Athenaeum* brought Virginia and Leonard, if only by virtue of their association with the publication, into conversation with several prominent popular science writers. In fact, “a number of the most respected scientists of the times were contributors during the later years of the magazine.”<sup>19</sup> In addition, Leonard Woolf, as literary editor of the *Nation & Athenaeum*, reviewed popular science texts by scientists and science writers including Bertrand Russell, J.B.S. Haldane, Gerald Heard, and James Jeans.<sup>20</sup>

Often the Woolfs’ articles and essays and those of their colleagues, published in the *Athenaeum*, appeared on pages adjacent to non-technical essays on advances in the sciences. This stark juxtaposition of scientific exposition and the literary essay was standard fare. For instance, an essay titled “Matisse and Picasso” by Clive Bell was published back-to-back with a review of books on Einstein’s theory of gravitation.<sup>21</sup> One of Roger Fry’s

essays, “Art and Science,” appeared next to an article on Einsteinian relativity titled “The Equivalence Principle.”<sup>22</sup> Notice of Ernest Rutherford’s lecture on “Atomic Projectiles and their Collisions with Light Atoms” appeared in a June 1919 issue, while an announcement for T.S. Eliot’s talk on “Poetry” for the Arts League appeared in an October issue that same year. Although Jeans and Eddington, two of the nation’s most celebrated popularizers of astronomy, did not publish in the journal, their books and public lectures were regularly reviewed by *Athenaeum* writers. For instance, their public debate on the viability of Einsteinian relativity held at the Royal Society in 1920 was recreated for public audiences through *Athenaeum* coverage.

Particularly from 1919 through the early 1920s, astronomy and the new physics were featured topics in the *Athenaeum*. At that time, John William Navin Sullivan, a mathematician, science writer, and assistant editor for the journal, published numerous essays on astronomical experiments, Einstein’s general relativity theory, and on cosmology. In 1919 alone, J.W.N. Sullivan featured articles on the importance of the British Eclipse Expeditions of that year, the magnitude and apparent brightness of stars, the relation of the sciences to art and literature, as well as on the “island-universe” debate regarding the question of whether the Milky Way was only one of innumerable galaxies. In an essay titled “Stellar Universes,” Sullivan concluded, “It is difficult to avoid the hypothesis that the spiral nebulae are separate universes, ‘island universes[,]’ . . . existing at distances unimaginably greater than the dimensions of our own lens-shaped system and Milky Way.”<sup>23</sup> This he wrote six years prior to the announcement of Hubble’s discovery that the Andromeda nebula was indeed an entire galaxy located outside the Milky Way.

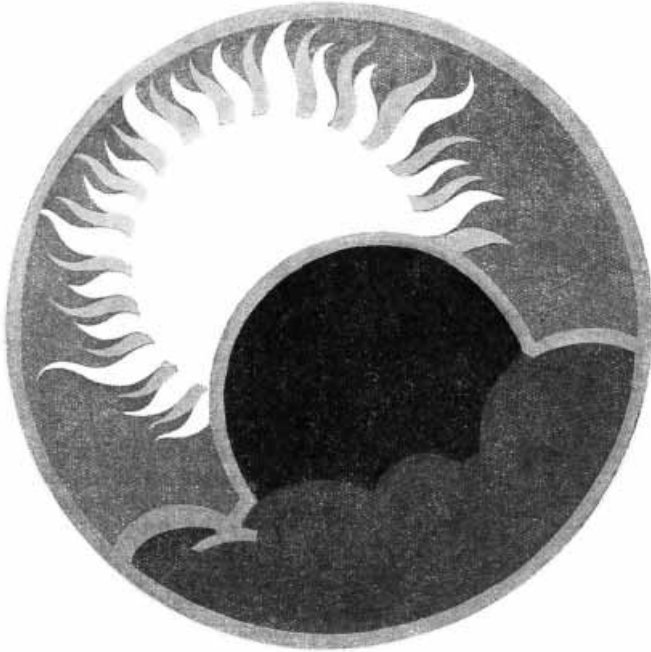
In a recent reassessment of Sullivan’s work, Michael Whitworth credits Sullivan with having “pioneered the craft of scientific journalism.”<sup>24</sup> Sullivan became acquainted with Ottoline Morrell’s circle, including Aldous Huxley, in the summer of 1918 when he moved next door to Garsington Manor to work as a conscientious objector.<sup>25</sup> Convinced of the importance of astronomical discoveries for literature, Sullivan criticized modernist fiction writers for their inability to adopt a “cosmic” perspective and to address the issues of an age in which humans were grappling with their position “amid the great spaces of astronomy.”<sup>26</sup> Popular science books would become “serious rivals of modern novels and poetry,” argued Sullivan, because “[t]hey are more dramatic, they open up larger vistas, they are as well written, and they are cheaper.”<sup>27</sup> Sullivan’s assessment, as this study will show, was not that far from the truth.

STANDING ON THAT "GLOBE OF GLASS":  
RELATIVITY AND ECLIPSE MANIA<sup>28</sup>

In June of 1927, when a total solar eclipse was to be visible in England, the event was so widely celebrated by the British public that special overnight train and bus services from London to Yorkshire, Lancashire and other locations within the belt of totality were provided (Lee 508; *L3*: 377). It was the first, and probably only, time that most living in England would have the opportunity to witness a total eclipse of the sun. Virginia Woolf and Vita Sackville-West were among those fascinated millions armed with smoked glass who flocked to the path of totality in hopes of glimpsing the event.<sup>29</sup>

In the weeks leading up to the eclipse, as science writer Sylva Norman noted, "the word 'eclipse' was the Hail and Farewell of every conversation."<sup>30</sup> Days just prior to the eclipse, *The Times* [London] ran multiple articles on predicted weather conditions, designated scientific observing posts, special train schedules, tips for safe observation, as well as detailed maps of motor routes to areas of totality. Celebrations on the eve of the eclipse were widespread. At Richmond, located very near the central line of totality, a week-long list of entertainment was planned to include "a lecture; a dance in the castle grounds... competitions; whist drives... [and] a cricket match."<sup>31</sup> In London, "there was the Crystal Palace, with room on its terraces for thousands of people."<sup>32</sup> For those traveling to England's western coast, *The Times* reported: "Southport will carry out its elaborate arrangements for entertaining the visitors during the small hours. Cinemas, cafes, and dancing places will be open besides the sands."<sup>33</sup> From Blackpool, the Bickerstaffe steamer was "to leave the pier for a cruise into the centre of the belt of totality."<sup>34</sup> One Yorkshire community held an "Eclipse Dance" scheduled to conclude with the eclipse itself.

Advertisements and editorial cartoons that appeared in daily newspapers and weekly publications demonstrate the extent to which this particular eclipse was celebrated. Distributors of Barclay's Lager, for instance, cashed in on the intense popular interest with a full-page advertisement which read: "Light or Dark? For those who dwell outside the area of teetotality there is no drink to eclipse Barclay's Lager" (Figure 1.1). The Barclay's advertisement appeared in a June 1927 issue of *Punch*, which published several editorial cartoons that month parodying the public fascination with the eclipse.<sup>35</sup> One cartoon, lampooning the public appetite for details related to the eclipse, depicted a gentleman dropping in on an "eminent official" at the Royal Astronomical Society to say, "Excuse me, Sir, but I thought

**LIGHT or DARK ?**

*For those who dwell outside the area of teetotality there is no drink to eclipse Barclay's Lager. There's Barclay's Light and Barclay's Dark — and between the two there's a mutual arrangement always to satisfy the mood of the moment. Call for Barclay's — the British Lager, and the best that's brewed.*

# **BARCLAY'S LAGER**

*Light or Dark . . . The Drink for every kind of Thirst*

Figure 1.1 **Barclay's lager capitalizes on eclipse.** Barclay's lager cashed in on the widespread public interest in the June 1927 eclipse. This full-page advertisement appeared in the 29 June issue of *Punch*.



Caller (to eminent official of Astronomical Society). "EXCUSE ME, SIR, BUT I THOUGHT IT MIGHT BE OF INTEREST TO YOU TO KNOW THAT THERE WILL PROBABLY BE AN ECLIPSE OF THE SUN ON THE TWENTY-NINTH OF THIS MONTH."

Figure 1.2 **Punch cartoon on the 1927 solar eclipse.** A *Punch* editorial cartoon (15 June) parodies the widespread public interest in, and knowledge about, the total solar eclipse to be visible in England. Courtesy of *Punch* Cartoon Library and Archive.

it might be of interest to you to know that there will probably be an eclipse of the sun on the twenty-ninth of this month" (Figure 1.2). In another, titled "The Eclipse," a woman, who stands looking skyward through her piece of smoked glass, reprimands her unruly son, "If you don't behave yourself, Osbert, I shan't bring you next time" (Figure 1.3). The cartoon's humor lies in the fact that it was widely known this was the first total solar eclipse to be visible in England for more than 200 years. As Woolf herself had noted, another would not be seen in Britain's skies until 1999 (*D3*: 144; also 142, n. 16).<sup>36</sup>



**THE ECLIPSE.**

**"IF YOU DON'T BEHAVE YOURSELF, OSBERT, I SHAN'T BRING  
YOU NEXT TIME."**

Figure 1.3 **"The Eclipse."** This *Punch* cartoon (29 June issue) suggests the degree of public fascination with events related to astronomy. A mother, who observes the total solar eclipse through smoked glass warns her unruly son, "If you don't behave yourself, Osbert, I shan't bring you next time." The humor of the cartoon's caption inheres in the fact that there would not be another total solar eclipse visible in England until 1999. Obviously many in Britain were aware of the scientific details regarding the eclipse. Courtesy of *Punch* Cartoon Library and Archive.

In those early morning hours of 27 June, under the eerie and haunting sky of the eclipse, Woolf witnessed a dramatic 24 seconds when darkness swept over Bardon Fell and the Yorkshire Dales. The skies, Woolf noted, “became darker and darker as at the beginning of a violent storm; the light sank & sank . . . when suddenly the light went out. We had fallen. It [the earth] was extinct. There was no colour. The earth was dead” (*D3*: 143). Deeply moved by the experience despite the cloud cover that prohibited her seeing a fully blackened sun, Woolf recorded details of the event in her diary (*D3*: 142–4), and later reworked that account for her essay “The Sun and the Fish,” and her novel *The Waves* (237).

From her vantage point, the cloud cover that morning was considerable. “We began to get anxious,” wrote Woolf; “We saw rays coming through the bottom of the clouds. Then, for a moment we saw the sun, sweeping – it seemed to be sailing at a great pace & clear in a gap; we had out our smoked glasses; we saw it crescent, burning red; next moment it had sailed fast into the cloud again; only the red streamers came from it; then only a golden haze . . .” (*D3*: 143). Woolf clearly knew the science of the event she was observing. She noted the crescent sun partly obscured by the moon. Those “red streamers” she glimpsed were most likely coronal streamers or solar prominences. One of the poignant aspects of this particular eclipse was the sheer element of chance, due to the unsettled weather, in seeing the eclipsed sun during the 23 or 24 seconds of totality. “The moments were passing,” wrote Woolf, “We thought we were cheated . . . Nothing could be seen through the cloud. The 24 seconds were passing” (*D3*: 143). Nor was she alone in reporting the strange light produced by both the eclipse and cloud cover. Special correspondents for *The Times* at Giggleswick, Southport, West Hartlepool, and Swanage, and on board an Imperial Airways plane chartered by the news firm, also offered detailed reports on the strangeness of the pale eclipsed light. *The Times* correspondent at West Hartlepool, where totality was obscured by clouds, commented on the silence of the crowds as they stood in the moon’s shadow: “As there was no spectacle to watch in the sky, the darkness was all the more impressive. There was a strange eerie stillness in nature and in the vast gathering of men. No sound was heard but the breaking of the small waves on the sands.”<sup>37</sup>

Standing in the pale light, Woolf mused how the world seemed on the verge of extinction. She understood the very real possibility that life on our planet might easily be extinguished. The “darkness” was like “a sudden plunge, when one did not expect it” and had evoked for her a sense of humans “at the mercy of the sky” in an ancient struggle for survival (*D3*: 144). In “The Sun and the Fish,” Woolf reflected on her sense, as the



light turned achromatic, of earth's fragility. She envisioned the earth as a dessicated "frail shell" or as a "globe of glass":

The shadow growing darker and darker over the moor was like the heeling over of a boat, which, instead of righting itself at the critical moment, turns a little further and then a little further on its side; and suddenly capsizes. . . . It [the earth] hung beneath us, like a cage, like a hoop, like a globe of glass. It might be blown out; it might be stove in. (*CE4*: 181)

Upon the sun's reappearance, she recalled in her diary, it was "with a great sense of relief. It was like recovery. We had been much worse than we had expected. We had seen the world dead" (*D3*: 144).

Interestingly, Woolf's diary entry on the eclipse, dated 30 June, is remarkably similar to Sylva Norman's published account that appeared in the 9 July issue of the *Nation & Athenaeum*. Both women noted similar motifs and images, namely, the sense of the earth withering under the strange silver light of an eclipsed sun, and a feeling of connection with humanity's primitive past. Norman compared the "credulous savage [who] beats drums to scare off the devourer of the sun" to the revelers at a local "Eclipse Dance" who "use[d] drums and saxophones to herald [the eclipse's] approach and celebrate its swallowing."<sup>38</sup> Woolf too had noted, "I thought how we were like very old people, in the birth of the world – druids on Stonehenge" (*D3*: 143). Likewise in "The Sun and the Fish" Woolf observed: "We were very, very old; we were men and women of the primeval world come to salute the dawn" (*CE 4*: 180). Jane Goldman, in *The Feminist Aesthetics of Virginia Woolf*, comments that it is the "sense of shared experience which comes across most powerfully in Woolf's description" of the eclipse (29).<sup>39</sup> Indeed, Woolf noted, "Never was there a stranger purpose than that which brought [so many millions] together that June night . . ." (*CE 4*: 179). The solar eclipse catalyzed for Woolf a vision of earth as a fragile oasis of life for all humankind.

At least four widely-publicized events related to astronomy and cosmology, in the early decades of the twentieth century, had a significant impact on popular culture in Britain and the US. Besides Hubble's determination that entire galaxies existed beyond the Milky Way and that the universe is expanding, two other events related to astronomy attracted public attention: the return of Halley's comet in 1910, and the British Eclipse Expeditions of 1919 which demonstrated the viability of significant tenets of Einstein's General Theory of Relativity.

In the summer of 1910, Halley's comet once again approached the sun in its roughly 75-year cycle, and this time the earth was to pass through

the comet's tail.<sup>40</sup> "Two years earlier, astronomers had detected cyanogen gas, a known poison, in the tail of comet Morehouse"; consequently, public concern mounted regarding the possibility of world-wide poisoning as earth traversed Halley's tail (Christianson 61). "Comet pills," intended to counter the effects of the comet's potentially poisonous gases, found a viable market.<sup>41</sup> In the US, claims of the possibility of a collision with the comet fueled apprehension regarding Halley. One American science writer warned of the effects of such a cataclysmic event:

[T]he year 1910, with its return of Halley's comet, is by some looked upon with fear and dread. . . . What will happen if the astronomers have made a slight mistake in their calculations and the comet should come into collision with the earth? With the earth traveling in space at the great speed of 18 1/2 miles per second, and the comet in the opposite direction with a velocity even greater, such a head-on collision would be appalling; the earth might possibly be blown to pieces!<sup>42</sup>

It was speculated further that Halley might "strike Earth somewhere between Boston and Boise, knocking the planet into the depths of outer darkness and dooming every creature on its surface" (Christianson 61). In addition to concerns regarding a planetary collision, there were warnings that hydrogen in the comet tail could ignite the earth's atmosphere: "Some sealed their windows against the predicted fallout while others," suggestive of the tragic events surrounding the cult deaths associated with the March 1997 passing of Comet Hale-Bopp, "saved the comet the trouble by committing suicide" (Christianson 61).<sup>43</sup>

England, too, experienced a pervasive public anxiety over Halley's return. One British postcard depicted a fireball streaking across the sky. A face painted on the fireball included fangs and claws, which grasped human victims as it swooped over a crowd.<sup>44</sup> Actually, the possibility of a comet colliding with earth, and the terrifying consequences of such an event, had been looming in the British imagination as early as 1897 with the publication of H.G. Wells's short story "The Star." In Wells's tale, an asteroid slams into Neptune and accumulates into a flaming mass that hurtles toward earth. Like Halley's comet, the asteroid garners international attention and is featured in newspaper headlines in London and other capital cities. "[N]ewspaper readers of two hemispheres were made aware for the first time of the real importance of this unusual apparition in the heavens. 'A Planetary Collision,' one London paper headed the news..." (H.G. Wells, "The Star" 681).<sup>45</sup> With uncanny accuracy, Wells's story not only anticipated a decade earlier the kind of comet panic experienced over Halley in Europe and the US, but also speculated on the widespread

natural disasters that would result from the impact or even near-miss of a passing asteroid. In “The Star,” a “master mathematician,” a kind of Einstein-like figure at whom many initially scoff, predicts global warming (caused by an increase in earth’s temperature as the “blazing mass” neared earth) as well as “[e]arthquakes, volcanic outbreaks, cyclones, sea waves, [and] floods” (“The Star” 686).<sup>46</sup> However, just as “the star” approaches, the moon passes between the asteroid and earth, forcing the asteroid to veer into the sun.

The plot of “The Star” was later reworked by Wells for his novel *In the Days of the Comet* (1906). In the novel version, the earth’s passage through a comet’s gaseous green tail has a mesmerizing effect and causes humans to desist from aggression and war. Wells’s story and his subsequent novel share extremely similar details with an earlier novel by the French astronomer and popularizer of astronomy N. Camille Flammarion. In the English translation titled *Omega: The Last days of the World* (1894), Flammarion envisioned a comet of greenish hue striking the Earth centuries in the future. Public panic ensues when it is learned that the comet is comprised of carbonic-oxide gas, and concerns are raised regarding “whether the mixture of this noxious gas with the atmosphere would poison the entire population of the globe” (*Omega* 22–3). In Flammarion’s version an “illustrious astronomer,” like the unnamed “master mathematician” of Wells’s short story, describes how the moment of impact will produce simultaneously “an earthquake . . . a volcanic eruption, [and] a cyclone” (*Omega* 49, 48–9). However, in Flammarion’s tale there is no rescue for humanity. While the comet, on impact with earth, causes limited devastation, humanity eventually faces extinction millions of years later. Yet the closing lines of the novel reassured readers that in the vast expanse of the universe, life abounded on distant planets circling far-flung stars: “infinite space remained, peopled with worlds, and stars, and souls, and suns; and time went on forever” (*Omega* 287).

If Halley’s comet raised public awareness regarding earth’s vulnerability in the depths of space, Einstein’s “general theory of relativity demolished the conventional sense of stability of the entire material universe.”<sup>47</sup> Einsteinian relativity had largely reconfigured nineteenth-century conceptions of space and time. The theory’s dynamical model for space and time provided the basis for entirely new models of the universe, both then and now. Whereas Newtonian physics defined gravitation as an actual force of attraction, Einstein contended that astronomical objects instead moved in relation to the contours of space itself. According to his then highly controversial and contested theory, planets orbited the sun because the fabric of space surrounding the sun was warped or curved by the sun’s mass, and that even star light, as a result of the sun’s mass, would be deflected by such curvature.

While completing his general theory of relativity, Einstein had hoped to find means of testing the theory, which predicted that light would be deflected by the gravitational field of astronomical objects. “Einstein wrote to George Ellery Hale, the leading American solar astronomer, in 1913 asking him whether, in his experience, someone could detect the offset location of a star that happened to be just to the side of the Sun during normal daylight hours. Hale responded that this could not be done with instruments available at the time and that one would have to wait for a solar eclipse to view a star next to the Sun” (*Star Struck* 52).

Six years later, Arthur Eddington, and Charles Rundle Davidson of the Royal Observatory at Greenwich, led the British Eclipse Expeditions to determine the viability of Einstein’s claims of the curvature of space, and whether star light passing near the sun would be deflected to the degree Einstein had calculated. In preparation for the total solar eclipse in May of 1919, Eddington and Davidson traveled to Africa and Brazil, respectively, to telescopically photograph the Hyades stellar group in order to confirm Einstein’s calculations for the deflection of light by the sun’s gravitational field. These stars, whose light normally is occluded by the sun’s brilliance, would be visible during the eclipse and their apparent distance from the sun’s limb could be calculated. Despite unfavorable weather conditions, at least for Eddington, both British astronomers nevertheless obtained photographic evidence that confirmed displacement of the Hyades stellar group to the degree Einstein had predicted.<sup>48</sup>

Their findings, announced in November 1919 at a joint meeting of the Royal Astronomical Society and the Royal Society in London, made headlines across Europe and the US. Light appeared to have mass; space could bend. Observational confirmation of these tenets of relativity suggested that Einstein’s general relativity provided a more viable and accurate model for understanding the dynamics of space. Eddington’s apt analogy of the physicist’s predicament prior to Einstein’s theories points up the significance of the expeditions:

In default of a better framework, [a Newtonian model of the universe] was still used, but definitions were strained to purposes for which they were never intended. We were in the position of a librarian whose books were still being arranged according to a subject scheme drawn up a hundred years ago, trying to find the right place for books on Hollywood, the Air Force, and detective novels.<sup>49</sup>

Thus Einstein was launched into the public limelight. “The speed with which his fame spread across the world, down through the intellectual layers to the man in the street,” according to Ronald Clark, “created a startling phenomenon . . .” (*Einstein: The Life and Times* 246). Prior to the

Eclipse Expeditions, Einstein had not been taken entirely seriously, even by many physicists. But once the results of the Eclipse Expeditions reached the pages of *The Times* [London] and the *New York Times*, he had attained celebrity status. Following the Expedition reports in *The Times*, “the paper carried something concerning Einstein and his celebrated theory . . . more or less daily for the rest of the year.”<sup>50</sup> The media attention was so intense that Einstein “complained to Max Born that he felt like a man plagued by the Midas touch – only, instead of turning into gold, everything he touched turned into newsprint!” (David Cassidy, *Einstein and Our World* 64). In London, relativity limericks and cartoons appeared in local papers, and one apparently could purchase relativity pottery.<sup>51</sup> One British cartoon featured a detective nabbing a bank robber with “a flashlight whose light rays turned corners”; the cartoon was captioned, “Elementary, my dear Einstein” (Clark 248). Even London’s Palladium music hall attempted to book Einstein for a “three-week ‘performance’” (Clark 248).<sup>52</sup>

By 1929, Einstein’s work had been so widely absorbed into popular culture in Britain and in the US that upon publishing a short paper in a German publication, Einstein received an odd letter from Eddington, stating: “You may be amused to hear that one of our great department stores in London (Selfridges) has posted on its window your paper (the six pages pasted up side by side) so that passers-by can read it all through. Large crowds gather around to read it!”<sup>53</sup> The following year, in an incident at Manhattan’s Museum of Natural History, guards had to dispel a “near riot” when more than 4,000 people rushed to see a film that explained relativity (Denis Brian, *Einstein: A Life* 191).

Part of Einstein’s popularity was born of sheer confusion. Attempting to cater to the pervasive demand for articles on relativity, newspapers were willing to pay high fees for concise, non-technical expositions (Clark 238). However, not all explications were equally rigorous or elucidating. For instance, Alexander Moszkowski, a writer in Berlin who published in 1921 his interviews with Einstein, recalled that European news coverage of the Eclipse Expeditions included “full-page beautifully coloured pictures intended to give the reader an idea of the paths pursued by the rays for the stars during the total eclipse of the sun” (*Einstein, the Searcher* 14–15).<sup>54</sup> Despite the newspapers’ “large illustrations,” which Moszkowski noted, “must certainly have cost the authors and publishers much effort and money,” the illustrations were often inaccurate (*Einstein, the Searcher* 14). “These afforded Einstein much amusement, namely, *e contrario*, for from the physical point of view these pages contained utter nonsense. They showed the exact opposite of the actual course of the rays . . .” (*Einstein, the Searcher* 15).

Likewise, in 1920, *The Times* [London] offered in an issue of its educational supplement a three-page spread on relativity, one article of which was written by Dr. Herbert Wildon Carr. Carr had that year published a non-technical, book-length exposition on Einstein titled *The General Principle of Relativity*, which apparently revealed less about Einstein's theory than Carr's own limited understanding of the topic. J.W.N. Sullivan, a strong proponent of Einstein's controversial theories, wrote a rather scathing review of Carr's book:

We admit that the theory of Relativity is a mysterious subject; Professor Carr, to us, makes it more mysterious than ever. For instance, he introduces two trains, one travelling at sixty miles an hour and the other at thirty miles an hour. We knew that something complicated was coming, because we are always meeting these trains in expositions of Relativity. But never before have we encountered Professor Carr's remark about them: "According to the principle of Relativity, the velocity of each is identical, because in each train the observer is at rest."<sup>55</sup>

Noting Carr's absurd inference that "every velocity is equal to every other," Sullivan sympathized with more conservative British physicists who remained skeptical of relativity: "We can understand that Sir Oliver Lodge dislikes the theory."<sup>56</sup>

Whether as fallout from public confusion or the increase in popular expositions on astronomy and relativity, terms like "gravitational fields," "space-time," and "light-years" fell into common parlance. "Women lost sight of domestic worries and discussed co-ordinate systems, the principle of simultaneity, and negatively charged electrons," wrote Moszkowski regarding the public response to Einstein (*Einstein, the Searcher* 14). By popular estimation the universe was reeling. Virginia Woolf had commented that the year 1910 marked an irreversible change in the way humans negotiated their world. In the essay "Character in Fiction" she noted the profound inability of conventional literary forms to articulate the world revealed presumably by the new physics and the new astronomical vistas of space. "Thus it is that we hear all round us, in poems and novels and biographies, even in newspapers articles and essays, the sound of breaking and falling, crashing and destruction. It is the prevailing sound of the Georgian age..." (*E3*: 433-4).<sup>57</sup> Mark Hussey notes that while Woolf intended to comment on "shifts in European aesthetic practices," the early decades of the twentieth century witnessed "profound changes in scientific conceptions of the universe."<sup>58</sup> Yet it seems likely that Woolf also meant to suggest the ways in which the new vistas of space were shaping modernist literature. Leonard Woolf observed of the same time period those advances

in science and technology that had reconfigured the popular perception of the human place in the universe: “[I]t was exciting to be alive in London in 1911 and . . . there was reason for exhilaration. The revolution of the motor car and the aeroplane had begun; Freud and Rutherford and Einstein were at work beginning to revolutionize our knowledge of our own minds and of the universe” (*Beginning Again* 37).

CAMBRIDGE PUBLISHES SCIENCE FOR GENERAL AUDIENCES

Rapid developments in cosmology and astronomy in turn sparked a tremendous market for popular expositions on relativity, the new physics, and astronomy. Science writer F.S. Marvin observed, “Recent speculations on the nature of the stars have aroused so much interest that books on the subject have been selling like novels, and people have been arguing more about fundamental questions than they have ever done since Darwin.”<sup>59</sup> By the mid-1920s, Cambridge University Press realized the potential market for affordable non-technical expositions on astronomy and cosmology. S.C. Roberts, secretary of the Press, recalled the point at which he stumbled upon the idea “that cosmogony might contain the potentialities of best-selling beyond the dreams of academic avarice” (“A Memoir,” *Sir James Jeans*, ix). Roberts had been reading the conclusion to *Astronomy and Cosmogony* (1928), a highly respected technical text by James Jeans. The final chapter described the saga of humanity’s nascent position in an ancient and vast universe, and read as dramatically as any novel or play: “Man may have appeared on the scene rather late in the history of the universe,” warned Jeans; “possibly the main drama of the universe is over, and our lot is merely to watch the unwanted ends of lighted candles [the stars] burning themselves out on an empty stage” (*Astronomy and Cosmogony* 421).<sup>60</sup>

Jeans’s writing appealed to a wide range of audiences in that the kinds of inquiry even his textbooks pursued had been formerly left largely to poets and philosophers. At the close of *Astronomy and Cosmogony*, Jeans had queried:

What is the relation of life to that universe, of which, if we are right, it can occupy only so small a corner? What, if any, is our relation to the remote nebulae, for surely there must be some more direct contact than that light can travel between them and us in a hundred million years? Do their colossal uncomprehending masses come nearer to representing the main ultimate reality of the universe, or do we? . . . Or is our importance measured solely by the fraction of space and time we occupy – space infinitely less than a speck of dust in a vast city, and time less than one tick of a clock which has endured for ages and will tick on for ages yet to come?(422)

Jeans emphasized the fact that humans have existed for only a fraction of the time the universe has endured. Jeans's popular books on astronomy, in particular, invited the reading public to likewise contemplate the new vistas of space and their meaning for humankind.

Anticipating the exploding market for popular accounts of advances in astronomy, Roberts proposed that Jeans, who initially had published largely technical texts, write a popular exposition on astronomy. Jeans replied that although Cambridge had a reputation as "the finest mathematical printers in the world," he was convinced the Press "couldn't sell a popular book" ("A Memoir," *Sir James Jeans* x). He couldn't have been more wrong. In September of 1929, Jeans published through Cambridge *The Universe Around Us* and consequently was catapulted into the public eye. "The first edition . . . was sold out during October. By the end of 1929, 11,300 copies had been sold" ("A Memoir," *Sir James Jeans* x). A year later, the *Evening Standard* [London] reported that the book had sold more than 40,000 copies in English, and that the publication was to be translated into seven additional languages.<sup>61</sup> Traditionally devoted to publishing only scholarly texts, Cambridge University Press saw the opportunity for cashing in on popular science, and emerged as the "Press that made science a best seller."<sup>62</sup>

By the time Jeans had prepared a sequel, *The Mysterious Universe* (1930), *The Times* was asking to publish advance copy of the final chapter.<sup>63</sup> To say the book sold well would be an understatement. According to Roberts, "For the next few weeks our chief concern was to keep *The Mysterious Universe* in stock" ("A Memoir," *Sir James Jeans* xi). Selling 1,000 copies a day in the first month, *The Mysterious Universe* was also later translated into at least thirteen languages including Czech, Bengali, and Burmese (E.A. Milne, *Sir James Jeans* 77). In his history of the Cambridge University Press, Roberts recalled, "Undoubtedly the largest measure of purely popular fame came to the Press as a result of its publication of the reflections of mathematicians and philosophers on the ultimate problems of the universe."<sup>64</sup> The Press had published popular science books prior to this. Alfred North Whitehead's *The Concept of Nature* (1920) as well as his *Science and the Modern World* (1926) had been successful expositions on investigations into the nature of material phenomena and on the new physics, and Arthur Eddington's *The Nature of the Physical World* (1928), according to Michael Whitworth, "lifted popular-science publishing to new heights."<sup>65</sup> Yet none of these texts reached the initial sales volume of Jeans's non-technical publications. Jeans made a significant contribution to the popularization of, in particular, astronomy. Even the daily newspapers repeatedly commented on his rapid rise to fame. Headlines in the *Sunday Express* [London] in March 1931 read: