Extraordinary feats of time travel are a nightly practice among astronomers, because the light from distant objects, such as galaxies, often takes years hundreds of thousands, millions, or even billions of years to travel from its origin in deep space to our eyes on earth. Thus we see most celestial objects not as they are today, but as they were in deep ages past, sometimes even before the genesis of the world from which we observe them. As an undergraduate astronomy major, I discovered that this power to see unimaginably distant places and their pasts offered certain scientific benefits and evoked feelings of sheer awe. At the same time, however, I realized that this inability to see the present state of distant cosmic systems was also a limitation, and that learning about the universe outside our solar system has been and remains a challenging enterprise. This is true not simply because of the vast distances involved, but because significant changes in a star, galaxy, or nebula often take place over millions or billions of years — timescales far beyond the scope of a single human observer's lifetime. For this reason, most European and American astronomers up until the mid-nineteenth century referred to the stars as "fixed" and unchanging; as such, the stars were largely ignored, and astronomy was defined as the study of planets. Nonetheless, in the eighteenth and nineteenth centuries, thinkers from a variety of walks of life began to construct and react to theories of dynamic, long-term cosmological change. It is around this remarkable story of the development of evolutionary cosmology — and the moral stakes that accompanied these often dangerous and radical ideas — that my collection of eighteenth- and nineteenth-century books and manuscripts has taken orbit.

As a graduate student in the history of science, the first books arrived under the guise of my dissertation. With a chapter focused on the naturalized English astronomer William Herschel (1738-1822), I decided it wouldn't be too decadent to purchase a few edited volumes containing key primary sources, including his scientific papers and the memoirs and correspondence of his sister and life-long astronomical partner, Caroline Herschel. The scientific papers revealed in detail the sheer scope of his observations — he discovered thousands of new stars and nebulae — and the fascinating methodological innovations that Herschel pieced together to tackle the challenges to empiricism posed by unobservable places, times, and processes. Herschel realized, for instance, that the methods of the natural historian of plants or animals could solve problems that contemporary astronomical methods could not address. While the astronomer could never in the traditional fashion observe the appearance and development of a star or cluster of stars from start to finish, by placing similar celestial objects next to one another in his mind's eye, he could — like a natural historian of plants or animals — arrange stars and nebular clusters of stars in order of development. It is for this reason that we still today refer to the "birth," "life," and "death" of stars and other cosmic objects.

One of the unexpected thrills of historical research is the detective work involved. Did the connection between natural history and astronomy extend beyond Herschel? I began to collect primary and secondary sources in earnest, and discovered, with delight, that Herschel was far from the only figure of the eighteenth and nineteenth centuries to see an
intimate connection between the two fields. I acquired a modern edited volume of the philosopher Immanuel Kant's *Universal Natural History and Theory of the Heavens* (1755), in which, as a young professor of physics, he articulated his own natural historical approach to dynamic cosmology. Though Kant’s theory was published decades before Herschel’s cosmological papers, the former’s ideas were virtually unknown thanks to his publisher’s poor luck or bad business practices: the establishment went bust before his treatise could be distributed. (Kant went on to do pretty well for himself in philosophy anyway.) Kant’s astronomical ideas did gain wider recognition in 1791, when an abridged version of his natural history of the heavens was bound together with Herschel’s papers on the same subject and reprinted in German. The same year, Erasmus Darwin (grandfather of Charles) published *The Botanic Garden*, an epic poem of nature written for a popular audience, which embraced Herschel’s natural historical approach to cosmology and connected it with the transformationist development of life on earth. Through the mechanisms of natural history, Darwin’s book made explicit a connection between the heavens and earth that had already been implied by the narrative structure of other popular natural histories of the period. Oliver Goldsmith’s *A History of the Earth and Animated Nature* (1774) was one of the most popular of these volumes; though ostensibly focused on botany, it nonetheless opened with an overview of astronomical cosmology.

Another critical connection was becoming apparent to me: in the early nineteenth century, cosmology — particularly dynamic cosmological theories — was an increasingly popular topic for books written for a broad, non-specialist audience, a type of publishing in which natural history had long proven successful. Readers wanted a "story" of the universe, and dynamic, evolutionary cosmological theories provided precisely that narrative arc, not only in the birth, life, and death of stars, but in the genesis of entire systems and the life that emerged from them. This synergy took on one of its most consequential forms in the most influential work of popular cosmology of the nineteenth century: Robert Chambers’ *Vestiges of the Natural History of Creation* (1844), which I acquired in an edited volume. The *Vestiges*, originally published anonymously, invoked the work of William Herschel and his son John (also an astronomer) to describe the evolution of the world out of primordial nebular fire mists. The then-anonymous author connected this dynamic theory of nebular development to a version of the Lamarckian transformation of species, all under the umbrella of a cosmic law of evolution directing the organization of matter from the nebular fires into plants, animals, and people. The book caused a sensation across Europe and America, creating a firestorm of excitement and dissent. The idea of a cosmos-wide law of evolution later sped the acceptance of the ideas of Charles Darwin, and the cosmic evolutionism of Herbert Spencer and Charles Darwin’s son, the astronomer George Howard Darwin.

Indeed, the moral stakes associated with dynamic cosmological theories were high. Most eighteenth- and early nineteenth-century people believed that deity had richly stocked other planets with inhabitants (why create a planet if not for a purpose, the contemporary reasoning went). Now, with Herschel’s discovery of thousands of new stars and nebular star clusters, cosmic census numbers were rising sharply. With millions of inhabited worlds in the mix, did it make sense to believe in a personal god? Many deists pointed to the stars as they answered "no," though most Christians of the period chose to see the celestial landscape and its inhabitants as a lesson in Christian humility: mankind was but one world among millions, yes, but the Creator was a being of infinite ability and attention. The connection between natural history and cosmology — especially as embodied by the cosmic evolutionism of the *Vestiges* — presented further threats, however, by reframing the once-sacred creation of life and mankind as part of a wider cosmic process, obeying natural laws, and not necessarily
connected to the detailed presiding care of a Creator. Several primary and secondary sources in my collection explore the ideas swirling around extraterrestrial life, including Michael Crowe's *The Extraterrestrial Life Debate* and Matthew Goodman's *The Sun and the Moon*. The latter details the wave of excitement that hit newspapers throughout the world when in 1835 a journalist at the *New York Sun* decided to have a little fun, announcing in an extremely detailed set of articles John Herschel's telescopic discovery of "man bats" and other exotic flora and fauna on the moon's surface.

Man bats aside, the moral threat posed by the cosmos and its inhabitants remained present throughout the nineteenth-century. Some, like John Herschel's friend William Whewell, chose to address this threat by arguing against the very idea of life on other planets in his book *Of the Plurality of Worlds* (1853). Others embraced the idea of millions of inhabited planets, even going so far as to make the idea central to their theological views. Perhaps nowhere was this more true than in the case of the Church of Jesus Christ of Latter Day Saints (also known as the Mormons), who also integrated dynamic cosmology into their worldview. By the time church founder Joseph Smith died in 1844, he had integrated the idea of inhabited worlds with the concept of a dynamic cosmos by framing the natural progressive evolution of cosmic systems as a type of natural moral progress that also guided the development of human societies and spiritual attainment. Human spirits, he declared, were capable of progressing to godhood, whereupon they would receive their own "star" or planetary system (the world "star" at the time was ambiguous and could refer to a number of different types of celestial objects). This explained the purpose of all those other inhabited worlds, and fit within the cosmic evolutionism of the period. Several books in my possession shed light on the development of religious cosmology in this context, including a collection of early cosmological primary source texts written by church founder and natural philosopher Orson Pratt, and specialist secondary sources including Colleen McDannell and Bernhard Lang's *Heaven: A History*, John Brooke's *The Refiner's Fire*, Craig Hazen's *The Village Enlightenment in America*, and *Wrestling the Angel: The Foundations of Mormon Thought: Cosmos, God, Humanity*, by Terryl Givens.

Curating this unique research collection has brought together sources rarely placed in conversation with one another, including primary and secondary sources on eighteenth- and nineteenth-century texts on cosmology, natural history, extraterrestrial life, the popular press, and religious beliefs. I recognize, however, that my collection will always be incomplete and biased by the historical contingencies through which manuscript material passes: from the relative durability of certain types of texts (ephemera like astronomical lecture announcements, for example, were far less likely to survive than officious texts by famous names) as well as my own assumptions and theories and those of my secondary sources. I hope nonetheless that the primary sources I collect in original manuscript or book form can someday either augment, or form the nucleus for, a collections strength at a research university. In the future, I hope to deepen the collection's manuscript base, particularly with items whose acquisition is affordable, but whose intellectual value in the context of the study of eighteenth and nineteenth-century astronomy and cosmology is meaningful.
Bibliography

Primary Sources


A small set of original manuscript letters by the British Astronomer Royal, Sir George Biddell Airy (1801-1892), concerning observations of the Annular Nebula and Lord Rosse's great nebulae-seeking telescope, the “Leviathan” of Parsontown. “My experience at Parsonstown was not so extensive as you might suppose. The climate is detestable! But possibly it was more varied in kind than you would expect. There are yet to be made trial-attempts for the perfectionating [sic] of the instrument...” He expresses distrust of American observations.


One of the most important cosmological texts of the nineteenth century. By connecting the dynamic cosmological ideas of William Herschel and Pierre Simon Laplace to a version of Jean Baptiste Lamarck's theory of species transformation, Vestiges excited fevered public discussion concerning the truth of its scientific claims and the moral consequences of the same ... not to mention speculation as to the identity of its anonymous author. Detractors rejected its cosmic evolutionism and drew a careful line between ‘good’ natural history and dangerous, materialistic French natural history. William Herschel's son John declared the Vestiges shallow and rife with errors. “Why people should read such books,” he wrote the geologist Adam Sedgwick, “when they have Lyell, Sedgwick, and the Prophets is more than I can conceive, but the ‘great fact’ that grows upon one in this age is the appetite for the trashy.” His friend Sedgwick, meanwhile, declared the book “a map of rank materialism foul & fetid,” its popular style revealing it to be “from a woman’s pen ... clever but very shallow.” (Here Sedgwick was being circumspect; elsewhere he declared the book a “rank pill of asafetida and arsenic, covered with gold leaf.”) In short, bad French materialism was linked to sloppy popular cosmology – made further suspect thanks to its popularity among female readers – and the ‘evolutionary’ universe it tended to embrace.


Concepts from organic evolution and astronomy continued to mutually co-evolve throughout the nineteenth century, even as astronomy, geology, and evolutionary biology developed increasingly separate professional identities. George Howard

Darwin (1845-1912), son of Charles Darwin, became Plumian Professor of Astronomy at Oxford. Among other astronomical pursuits, he worked to find ‘evolutionary’ mechanisms shared by the development of solar systems in the heavens, and systems of life on earth, as in The Tides and Kindred Phenomena in the Solar System.


August Heinrich Christian Gelpke (1769-1842) was a German astronomer and scientific popularizer. His popular science works, including Allgemein physikalische Betrachtungen über das Weltgebäud, brought the latest cosmological theories of Herschel and others to a wide German readership.


Goldsmith's principle life accomplishments outside his literary output were – in chronological order – bringing up the bottom of his class at Trinity College Dublin, being publicly admonished for an attempted riot, bartering his way through Europe with a flute, and living an entirely dissolute lifestyle in London. The high cost of dissolution required him to maintain a frenetic literary output, which included the popular A History of the Earth and Animated Nature. Goldsmith believed that natural history’s true interest and value lay in the fact that the imagination allowed man to move beyond dry individual facts into an examination of nature’s relations and causes – that is to say, to investigate natural change over time. This was precisely the potential that Herschel identified when he justified his natural historical approach to cosmology on the basis of the idea that viewing the heavens as “a luxuriant garden,” allowed the astronomer to “extend the range of our experience to an immense duration.”


Both awareness and reception of cosmological ideas was conditioned to an extent by geography. Just as Kant's cosmological ideas gained traction in German-speaking lands in the early 1800s (after their republication bound to copies of Herschel's cosmological papers), the cosmological ideas of the Swiss mathematician J.H. Lambert were best known in French-speaking Europe. The French astronomer Antoine Darquier published Lambert's cosmological theory in French in 1801, with only a passing note of Herschel's "curious" observations.

Though over eighty years old, this book, written by William Herschel's granddaughter, Constance, is an invaluable resource containing excerpts from family manuscripts now lost.


In this manuscript letter John Herschel offers a few notes on a lecture on earthquakes, illustrating the daily proximity of his work in natural historical subjects to his astronomical labors.


See essay for further discussion.

Herschel, Sir W.J. Archive of Sir W.J. Herschel, Director, Royal Botanical Garden.

This small collection of manuscript items from the library of John Herschel's son William J. Herschel includes seeds collected by his father while conducting astronomical observations of nebulae and stars at the Cape of Good Hope in the 1840s. Like John's work in geology, his frequent engagement with botany is a tangible example of the physical proximity of observations of the heavens to observations of life and the earth.


See essay for discussion.


As it had others, including the far more eminent Immanuel Kant, William Herschel's publications inspired the French natural philosopher and author Claude François Le Joyand to attempt to establish his own intellectual priority. In this text, probably printed in an edition of approximately 250 (over 180 of which he dropped off for academicians at Paris' illustrious academies), Le Joyand argued that he had published a method for gauging the distance to the stars long before Herschel's method for the same appeared in his cosmological papers.


Astronomy textbooks provide a window into the way in which cosmological theories and their moral implications were interpreted and presented for a sector of society considered particularly morally and intellectually sensitive: children, from primary school through university. This university textbook presented Herschel's cosmological theories as unbridled speculation — a cautionary tale — but found his observational labors admirable. This copy is unique in that it contains marginalia from 1848, made by the Yale student who used it for his astronomy class. While the professor is not named, the student did provide several doodles of his likeness.

Pratt, Orson. *Wonders of the Universe: or, a Compilation of the Astronomical Writings of Orson Pratt*, embracing lectures on astronomy delivered in 1871 at the University of Deseret. Salt Lake City: Nels B. Lundwall, 1937.

Covering Pratt's astronomical writings and lectures between 1871 and 1879, these primary source texts reveal the close relationship between materialism, cosmology, and inhabited worlds in the Mormon theological sphere.

Sabine, Edward. Autograph Letter. Late 1840s.

The British astronomer Edward Sabine (1778-1883) expresses approval of John Herschel's review of Alexander von Humboldt's *Cosmos*.


This primary source text includes comprehensive attendance lists for all the Royal Astronomical Society's nineteenth-century club dinners, allowing me to get a sense for which astronomers were regularly in social contact with one another.


See essay for discussion.

**Secondary Sources**

Most of the secondary sources that follow are discussed, or their relevant subject matter is referred to, in my essay. I have included a few notes with regard to those whose significance may be unclear.


Crosland details the social world and scientific interests of the astronomer Pierre Simon Laplace's intellectual society at Arcueil, which brought Alexander von
Humboldt, the author of *Cosmos*, into direct contact with Laplace's own cosmological theories.


In Holmes' terrifically evocative book, William Herschel's cosmological work is placed within the context of eighteenth- and early nineteenth-century scientific wonders.


Unusually, this copy includes an insert with a full list of buyers for each Herschel manuscript lot, which has allowed me to track down the whereabouts of several manuscripts valuable to research.


A wonderfully detailed look at William Herschel in the scientific world of late eighteenth-century Bath, this delightful small book includes an examination of Herschel's intellectual pursuits while a member of the Bath Philosophical Society.
The Eighteenth Century: Theory and Interpretation fosters theoretical and interpretive research on all aspects of Western culture from 1660 to 1830. The editors take special interest in essays that apply innovative contemporary methodologies to the study of eighteenth-century literature, history, science, fine arts, and popular culture. Previously a triannual, in 2010 ECTI debuted as a quarterly journal. Full-text content is available at this website through Project Muse. Current subscribers should select the Login tab in the top right and enter their login information. Select the Online Access link from the right menu bar to access content.