What does humanity owe the stars, those seemingly lifeless and immobile entities which congregate millions of miles from its home? Throughout history humanity has been fascinated by what lies beyond the realm of planet Earth and its immediate surroundings, and Edmond Halley was no exception. A renowned British astronomer from London itself, Halley made substantial advances in not only the popular field of astronomy but also in the closely associated disciplines of physics, mathematics, meteorology, navigation, and optics. A contemporary of Isaac Newton and John Flamsteed, the aura surrounding Edmond Halley’s name in the sphere of British astronomy will not waver in the near future.

Before one can fully appreciate the scientific contributions of Edmond Halley, it is beneficial to look briefly at the origins of the man behind such complex and valuable findings. He was born in October of 1656 in Haggerston, England to a merchant of soap and salt (Math and Mathematicians). These do not sound like the products of a wildly accomplished business venture. However, the population of the rural areas outside of London in the mid-seventeenth century apparently recognized the values of proper hygiene and delectable food, and the enterprise proved to be quite lucrative. Without the success of the soap and salt industry, some of Halley’s more remarkable achievements may never have been initiated, much less completed. His father funded a number of his trips to chart the southern hemisphere and continually provided Edmond with the
appropriate instruments crucial for adequate observation. While Halley lived with the soap seller in Haggerston, a major change in governmental structure was upon London. Halley was born into the state of the Commonwealth with Sir Oliver Cromwell serving as the Lord Protector (Cook 32). However, when Edmond was just four years of age, Charles II reclaimed the throne and reestablished the monarchy. Haggerston was close enough to London to witness this transition, and Halley was schooled at St. Paul’s, an educational facility in conjunction with the famous cathedral, until the Great Fire of London destroyed both in 1666 (Notable Mathematicians). He received further instruction at home before his enrollment in Queen’s College at Oxford at the young age of seventeen.

It was during the course of his studies at Oxford that Halley was first recognized as a rising star in the study of the heavens. In the time before Kepler, most people, including the brightest minds of the day, assumed that planetary orbits took virtually a circular form. Kepler discredited this by proving that planetary orbits were not circular but rather elliptical. However, he still could not escape the notion that the angular motion of a planet is of a uniform nature (Ball 164). One hundred years later, Halley was able to prove that the movement of the planet around the empty focus of the ellipse is not exactly uniform (164). From this seemingly uneventful proof, Halley’s reputation as a distinguished, youthful, and legitimate astronomer would only soar, both at home and abroad.

Halley’s rising status was certainly not hindered by his frequent associations and correspondence with the Astronomer Royal of the time, John Flamsteed. Some of Halley’s first recognized and professional observations were done with Flamsteed at the
Royal Observatory in Greenwich, including calculating the sun’s period of rotation to be between twenty-five and twenty-six days (Cook 58). Among his many goals to be achieved through observation, Halley’s strongest desires were aimed at accurately determining the position of the stars, work set in motion by the legendary Tycho Brahe of Denmark. As Flamsteed at Greenwich and another celebrated astronomer, Hevelius at the German town of Dantzig, were working on a celestial map of the northern hemisphere, Halley set out to determine astral positions of the previously unexplored southern hemisphere and left Oxford without attaining his degree (Ball 166). The observations necessary for an adequate construction of a map of the heavens until that time had been done almost exclusively in Europe, resulting in virtually no knowledge of the sky seen below the equator. At the young age of twenty, Halley set out to change the prevailing perspectives of the time by exploring previously uncharted skies. In 1676 he set sail on the vessel Unity, bound for the British-controlled island of St. Helena, a small mass of land off the western coast of Africa (Cook 61). He traveled with traders of the East India Company at the request of King Charles II. Among the gadgets in Halley’s repertoire of astronomical tools were a Towneley’s eye-piece micrometer, a mural quadrant, pendulum clocks, a sextant, and a telescope twenty-four feet long (59). Halley had heard reports of clear blue skies in the area of St. Helena, but he must have visited during the wrong season as his stay proved the opposite. Almost every day he had to deal with uncooperative weather, and the majority of his state-of-the-art devices were rendered useless. In response to the stubborn atmosphere, Halley had to implement a new tactic. He took the positions of two prominent stars from Tycho’s work and then took those assessments to be given. He then measured the angular distance of a third star
from the two given positions with his sextant and calculated the position of the third luminary from the two distances (70). He recorded all these distances in his *Catalogus stellarum Australium* and presented it to Charles II (78). Although most individuals familiar with astronomy were impressed by the work of Halley, some looked down upon his methods, especially assuming the positions of certain stars in Tycho’s work were given. His most unusual critic was Flamsteed, previously one of his greatest supporters, and this was the beginnings of a feud between them that lasted even beyond the grave. Nevertheless Edmund Halley was now one of the brightest stars among many.

After the success at St. Helena, Halley’s once budding career as an astronomer was in full bloom. In recognition of his achievements with the southern skies, Oxford granted him the Master of the Arts degree, an act most feel was directly triggered by the king himself. He was also elected a Fellow of the Royal Society, England’s most prestigious collection of those with an aptitude for the sciences (Ball 168). It was just at this time that the Royal Society was in need of the service of an individual with the experience Halley had. With his work at St. Helena, Halley had been one of the first to tackle so tremendous and time-consuming a project as a celestial map with telescopic sights (Cook 70). This work was just the preparation he needed for what was laying ahead. When Brahe was engaged in his observational work of the northern hemisphere, he did not use a telescope simply because one had not yet been invented. He worked instead with open sights, noting directions with the naked eye (89). Between the time of Brahe and that of Halley, Galileo invented the early telescope and left the discipline of astronomy with two procedures for detecting the position of the stars. The question then arises as to which is the more accurate method. Sir Robert S. Ball, writing in the early
twentieth century, seems to think the conclusion should be apparent, stating that “an observer would be as likely to make an error of a minute with the sighting apparatus in Tycho’s instrument, as he would be to make an error of a second with the modern telescope” (Ball 170). However, for Halley and his contemporaries working in the late seventeenth and early eighteenth centuries, the answer was not crystal clear. The newest member of the Royal Society, Edmond Halley, seemed just the right man to lift the fog.

Despite Galileo’s achievement of a precursor to the modern telescope, the art of heavenly observations with open sights did not die out immediately. One advocate of their use was the respected German astronomer Hevelius, who did his work out of an observatory in Dantzig. He endured much criticism for his employment of open sights in his observational techniques and responded by requesting that the Royal Society send someone to experiment with both methods (Cook 89). Newly returned from his telescope-oriented observations at St. Helena, Halley seemed the perfect fit for the task so he was off to Dantzig for several months, observing with both his own instruments and those of Hevelius. Sources give differing accounts of Halley’s reaction to his time spent in Germany with Hevelius. Alan Cook, a Master at Cambridge University and writing in the present day, claimed that Halley initially left Dantzig with the opinion that telescopic sights provided more accuracy, but he was simultaneously impressed with the degree of exactness that Hevelius could achieve with his use of bare sights (100). Cook writes of the later dwindling of Halley’s respect for Hevelius and his methods when Hevelius spoke falsely of Halley’s practices at St. Helena (103). Sir Robert S. Ball tells his audience that Halley was immediately convinced of the superiority of the telescope in determining the positions of the stars (Ball 170). Halley’s more likely response was
probably the one described by Cook. The telescope had always been available to use
during his lifetime, and he was probably unfamiliar with the exact intricacies of charting
with open sights. Whether or not there exists any truth behind the account of their later
quarrel, Halley likely recognized the great value in working alongside Hevelius and
discovering an alternate means of mapping the heavens.

In addition to his work with Hevelius, Halley collaborated with one of the most
recognizable names in the history of the development of science, Isaac Newton. In fact
Halley is responsible for the publication of Newton’s greatest work and his investigation
into gravitation, Principia. The basis for Principia was a problem that had bothered both
astronomers and the world of science for some time. Assume that planets move in
circular orbits around the sun and also that the square of their period is proportional to the
cube of their mean distance from the sun. Then it follows that the force acting on the
planet varies inversely as the square of its distance from the sun (174). However, the
planets move in elliptical orbits rather than circular paths and hence the previous
conclusion cannot be made immediately. This dilemma was such an area of interest
among scientists that Sir Christopher Wren was even willing to offer a monetary reward
for a solution (175). Halley knew just who to call upon for the answer. While at
Cambridge, Isaac Newton proved that planetary motion “could be completely accounted
for on the hypothesis of a force of attraction directed towards the sun, which varies
inversely as the square of the distance from that body” (175). Apparently Newton was a
humble man and did not desire the notoriety which would be a consequence of his
findings because he was reluctant to have his work published and distributed. Halley
kept pushing him to do so and eventually convinced Newton that his proofs were
instrumental to future investigations of the heavens and should therefore be known by at least the academic world. At the time the Royal Society was hurting with regard to funds so Halley was given direct responsibility, both in terms of implementation and costs, for the publication of *Principia* (176). As the science world praised Newton and his groundbreaking developments in the theory of planetary motion, few were aware of how vital Edmond Halley was to the process of *Principia*’s emergence. Very soon, though, he would begin work on certain entities for which he is still presently remembered.

Shortly after his return from St. Helena, Halley went on a tour of continental Europe, making stops in Paris to work with the French astronomer Cassini and Dantzig, where he did his aforementioned analysis of observational methods with Hevelius. It was in Paris that he began his observations of comets and their paths. Halley’s work in determining the orbit of a comet had its foundations in the research of Newton, who said that a comet’s course “could be completely accounted for as consequences of the attraction of the sun” (178). After a careful and thorough dissection of Newton’s work, Halley concluded that the orbit of a comet could be deduced from observations of its positions on three different dates. He eventually established paths for twenty-four comets by using his personal observations and historical records, and it was in this work that he made the discovery for which his name will be forever remembered. He noticed that the paths of three comets closely resembled each other and upon further analysis surmised that they were not three different orbits but rather three appearances by the same comet. Occurring in intervals of seventy-five or seventy-six years, the first observation was made in 1531, the second in 1607, and the third in 1682 (179). Before Halley’s work “a comet, if not regarded merely as a sign of divine displeasure, or as an omen of intending
disaster, had at least been regarded as a chance visitor to the solar system, arriving no one knew whence, and going no one knew whither” (179). In other words sightings of comets were considered rare circumstances. Now Halley was claiming quite the opposite and predicted a return of this comet in late 1758 (180). Halley was aware that his death would prevent him from seeing his calculation through to the end, but his patriotic fervor was at its greatest when he spoke of it: “If it should return, according to our predictions, about the year 1758, impartial posterity will not refuse to acknowledge that this was first discovered by an Englishman” (180). On Christmas Day of 1758, seventeen years after Halley’s death, the comet made a return trip past Earth just as he had predicted. For this reason the comet will forever share its name with Edmond Halley.

On top of all that he had achieved in the realm of astronomy up until this point, Halley added another success to his resume in the last stages of his life. In 1720 he succeeded Flamsteed as the Astronomer Royal and prepared for the move to Greenwich (183). When he arrived he found the observatory in disarray and virtually no equipment adequate enough for proper observation. He attempted to buy back Flamsteed’s instruments from his widow, but she held a grudge against Halley initiated by her late husband. He began to observe the moon and its motion with the objective of more accurately establishing longitudes at sea, but his death in 1742 prevented many substantial results.

Edmond Halley will be remembered for much more than his work in astronomy. He is considered the father of social statistics with his creation of mortality tables. He deduced the chance someone that was x years old would live for y more years, determined the expectation of life at a given age, and calculated the relative price of life
insurance (Cook 199). He is also considered the founder of geophysics, the physics of Earth. In the realm of meteorology, he studied solar heating to track the trade winds and monsoons, and he also is credited with concocting the first meteorological chart with actual data (Math and Mathematicians). He also developed the mathematical relationship between barometric pressure and heights above sea level, and he caused a ruckus in the church when he used math and science to discredit the biblical account of the age of Earth (Math and Mathematicians). All examples demonstrate that Edmond Halley infiltrated not only astronomy’s inner circles but also several other scientific disciplines.

Edmond Halley was no stranger to the sciences. Throughout his existence he developed and maintained a capacity for both learning and sharing all that the sciences had to offer. While he will be remembered first and foremost as an astronomer, Halley was able to impact the direction several disciplines were taking in the late seventeenth and early eighteenth centuries. While men like Newton and Kepler will continue to be mentioned in the classroom on a daily basis, only Halley will come back every seventy-five years.
Works Cited


