Hamlet and Infinite Universe

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Shakespeare (1564-1616) lived at a time of great ferment in the world. Both the Renaissance and the Reformation were well under way, transforming the intellectual landscape of Europe and inviting new discoveries and original thought. His productive career spanned the critical period between publication of *De revolutionibus* by Copernicus (1473-1543), whose model of the universe placed the Sun at the center instead of the Earth, and the telescopic observations of Galileo (1564-1642), which supported that model. References to astronomy in Shakespeare's works afford an appreciation of how such a thinker viewed that transformation in world view. I argue that as early as 1601 Shakespeare anticipated the new universal order and humankind's position in it. In my reading, Shakespeare's *Hamlet* contains an allegorical description of the competition between two cosmological models: the infinite Sun-centered universe of Thomas Digges (c.1546-1595) of England, and a hybrid Earth-centered model of Tycho Brahe (1546-1601) of Denmark.

The old geocentric model of the universe had been perfected by the Greco-Roman astronomer Ptolemy (Claudius Ptolemaeus, *circa* 140 A.D.) in his *Almagest*, and was still accepted in Shakespeare's day. It seemed to be most reasonable since all celestial motion appeared, from Earth, to be centered on the Earth. Moreover, the model complemented Elizabethan society, for both were hierarchical; as Shakespeare's character Ulysses says in *Troilus and Cressida*: "The Heavens themselves, the Planets, and this

centre [meaning Earth] /Observe degree, priority, and place." Unfortunately, there remained the vexing problem of retrograde motion.
Retrograde motion is the occasional reversal in the apparent direction of motion of the planets Mars, Jupiter, and Saturn relative to the sphere of the stars. It occurs whenever these planets lie in a direction opposite to that of the Sun. Such perversity was puzzling, for it contradicted the perfect simplicity of the geocentric model.

The Polish astronomer Copernicus solved the problem of retrograde motion in principle by proposing that the Sun was at the center of the universe, and the Earth and the other five known planets revolved around it. The Earth was the center only of the Moon's orbit and was otherwise not special. However this model required that the Earth be in motion. The idea of a rotating and revolving Earth was counterintuitive to most people and contrary to established religious and scientific doctrine, and so enjoyed little immediate success.

In 1541, shortly before the death of Copernicus, Georg Joachim (known as Rheticus) completed his studies under Copernicus and brought back to the university in Wittenberg, Germany, the essence of the new model. By 1551, Copernicanism had started to take root in England, too. Digges, a scientist and military scholar, was an early English champion of Copernicus's model. He published his own model of the universe, *A perfit description of the caelestiall orbes*, in 1576.
All models prior to that of Digges were contained in a spherical shell of stars beyond which lay Paradise and the realm of the Prime Mover. In his mind's eye, Digges saw an infinite universe of stars each like the Sun. His revolutionary leap shattered the appearance of an outermost sphere of stars and replaced it by space of limitless extent filled with stars. Although an early speculation by the philosopher and theologian Nicholas of Cusa had reserved the term "infinite" for the Deity, Digges was the first Renaissance writer to advance the idea of a physically infinite universe. Eight years after Digges' proposal, the Italian philosopher Giordano Bruno published similar ideas; for this and other impieties Bruno was burned at the stake in 1600.

Although Tycho Brahe was a student at Wittenberg for a short time, his model was still geocentric, since he made both the Sun and the Moon revolve around the Earth. Tychonic geocentricism differed from Ptolemy's in that Tycho allowed the other planets to circle the Sun. In that respect, Tycho advanced a sort of hybrid geocentric model, but the details were never worked out and the model therefore never explained retrograde motion.

An account of Tycho's hybrid model appeared in 1588 in his book, *Recent Appearances in the Celestial World*, which was published in a limited edition

and which he sent to select friends and colleagues. In 1590 the English scholar Thomas Savile received a letter from Tycho asking to be remembered to Digges. Tycho was then living on the island of Ven in the Oresund Sound, where he was constructing his observatory, Uraniborg. At the same time the King of Denmark was building HelsingÃ¸r Castle a short distance away. In his letter, Tycho suggested that some excellent English poets might compose witty epigrams in praise of him and his work. He also sent four copies of a portrait of himself that showed him standing under a stone arch featuring the family shields of his great-great-grandparents Sophie Gyldenstierne and Erik Rosenkrantz.
Shakespeare knew the Digges family and had probably seen Tycho's letter and portrait, choosing the names for the characters Rosencrantz and Guildenstern in *Hamlet* this way. Rosencrantz and Guildenstern personify Tychonic geocentricism, I argue, while the false king Claudius is named for Claudius Ptolemy. *Hamlet* personifies the infinite universe of Digges' model. "Elsinore" in *Hamlet* is named for the King of Denmark's HelsingÃ¸r, while the castle platform in the play is like an observatory which affords an unobstructed view of the sky. Shakespeare pinpoints Tycho's island of Ven when he has Hamlet speak the line: "I am but mad north-north-west. When the wind is southerly, I know a hawk from a handsaw." Thus madness is associated with Elsinore, where Claudius resides and which lies almost exactly north-north-west of Ven, while Wittenberg lies in a southerly direction from Ven. It is from Wittenberg that appearances are correctly interpreted. When Claudius asks the Prince why he is still so dejected at the death of his father, Hamlet puns, "I am too much in the sun," thus associating himself with the reference point for planetary alignments. The royal couple express their desire that Hamlet not return to Wittenberg by saying that such a course "is most retrograde to our desire." Here they refer to Hamlet's retrograde—;or contrary—;motion to the seat of Copernican cosmology. The astronomical meaning of "retrograde" dates to Chaucer in the 14th century, while the senses of "moving backward" or "returning upon a previous course" were in use at least by about 1530 and 1564, respectively. But here the term "retrograde" follows hard upon the term "opposition," which is the very time when planets undergo retrograde motion, leaving the astronomical metaphor in no doubt. "Why should we in our peevish opposition / Take it to heart?" says Claudius. "Fie, 'tis a fault to heaven." To geocentrists, retrograde motion was indeed a "fault to nature" or a "fault to heaven," for clearly Nature is going against common sense here. Conjunction is the remaining alignment, and Claudius completes the metaphor when he says of his new wife: "She is so conjunctive to my life and soul, / That as the star moves not but in his sphere, / I could not but by her."

Rosencrantz and Guildenstern are contemporaries of Hamlet just as Tycho and Digges were contemporaries. (Shakespeare's unfavorable portrayal of

these two courtiers as "adders fanged" could signify his opinion both of Tycho's cosmology as well as of his vanity.) Claudius summons the two courtiers to help him since a new geocentric model should be helpful to the old. No sooner have they arrived than they enter into an argument with Hamlet, whereupon Hamlet makes his eloquent Diggesian statement: "I could be bounded in a nutshell and count myself a king / of infinite space . . ." The "nutshell" could refer both to the shell of fixed stars supposedly encasing all of creation in all previous models, or to the portrait of Tycho, his image bounded by an arch of stone.

Eventually Claudius dispatches Hamlet to England with the two courtiers as guards, urging in a letter "the present death of Hamlet. Do it, England . . ." But Shakespeare remains true to the ancient Danish legend, as told in the 12th century by Saxo Grammaticus. The two Danish courtiers are killed instead, because Hamlet has altered the content of the letter they carry.

Hamlet accomplishes first the deaths of Rosencrantz and Guildenstern, and then of Claudius. To recognize the fact that Digges' model is a corollary of the Copernican, Shakespeare in the waning moments of the play departs from the Danish legend and brings in Fortinbras fresh from conquest in Poland. Fortinbras salutes the English ambassador, and so unifies the models whose originators hailed from Poland and England.

The quest for truth and exposure of falsity is a theme that runs through Shakespeare's play. The castle platform is the interface between the castle interior and the sky, a contrast that parallels the contrast of reality and appearance, as when Hamlet says: "Seems, madam? Nay, it is. I know not seems." The passage from geocentricism to Digges' vision of an infinite universe is a passage from appearances to reality.

This reading suggests that Hamlet evinces a scientific cosmology no less magnificent than its literary and philosophical counterparts. While the last year of the 16th century saw the martyrdom of Giordano Bruno, the first year of the 17th century sees the Bard's magnificent poetic affirmation of the infinite universe of stars.

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