

The Stars of *Hamlet*

Shakespeare's astronomical inspiration? | By Donald W. Olson, Marilyn S. Olson, and Russell L. Doescher

WILLIAM SHAKESPEARE'S celebrated play *Hamlet* is the one in which "time is out of joint" and "something is rotten in the state of Denmark." The story's preoccupation with things going wrong is also true of the times in which Shakespeare wrote it — the darkening last days of Queen Elizabeth I's reign at the turn of the 17th century. Although many commentators have discussed themes that enhance the dark tone of the play, it is not surprising that in such a rich work there is yet another image to consider, one of interest to astronomers and relevant to the play's feeling of apprehension.

The play begins after midnight on a bitter cold night. The soldiers standing guard on the ramparts of Elsinore Castle in Denmark explain to the scholar Horatio the circumstances under which they have seen a ghost on two previous nights. Just before the ghost of Hamlet's father reappears, one of the soldiers is describing the time when the spirit is accustomed to walk:

Bernardo: Last night of all,
When yond same star that's westward from the pole
Had made his course to illumine that part of heaven
Where now it burns, Marcellus and myself,
The bell then beating one, — [*Enter ghost*]

The rest of the scene reminds us that in Shakespeare's plays it was usual for dramatic human events to be paralleled by heavenly portents. Horatio asserts that the death of Julius Caesar was presaged by "stars with trains of fire," "disasters in the sun," and the Moon "sick almost to doomsday with eclipse." Within this context, and with an author attentive to nature, could this reference to a star west of the pole have meant more to Shakespeare and his audience than it does to us? Did this star have a basis in reality? And why did Shakespeare choose to begin the play with this celestial reference?

The bell tolling 1 a.m. sets the time of night, but to determine which stars lie "westward from the pole" we also need to know the time of year. Fortunately, the text of the play provides sufficient clues. The soldier Francisco complains that this night is



"bitter cold," and Hamlet agrees on the next night that the "air bites shrewdly; it is very cold," suggesting a date in late fall or winter. The guard Marcellus, shortly after encountering the ghost, comments that when "that season comes, Wherein our Savior's birth is celebrated . . . then, they say no spirit can walk abroad." For this reason we can conclude that act 1 does *not* take place during the season of Advent, which begins on the Sunday closest to November 30th and ends Christmas Day.

Furthermore, Hamlet tells us that the death of his father occurred approximately two months before the beginning of the play, and the ghost reveals that he was murdered while taking an afternoon nap in the open air ("sleeping within my orchard"). The death of Hamlet's father

therefore appears to have taken place near the end of summer, perhaps in September, when the afternoons still could be warm enough for sleeping outside. The opening scene of the play would fall two months later on a cold night in November. On this point we agree with such disparate commentators as Max Moltke (1871) and Steve Sohmer (1996), who conclude that act 1 of *Hamlet* is set in November.

Stellar Candidates

For an observer in northern Europe at 1 a.m. in November, is there an obvious choice for a bright star "westward from the pole"?

Technically speaking, of course, every star in the sky is located to the *south* of the north celestial pole. However, we can assume that the phrase "westward from the pole" describes a position with nearly the same altitude as the north celestial pole but with an azimuth toward the west. An observer facing north could reasonably describe a star in this location as being on the "west" side (or "to the left") of the pole.

When we attempt to identify Hamlet's star in an honors astronomy course at Southwest Texas State University, the students use planetarium software to find the dates (in the Julian calendar still used in England during Shakespeare's lifetime) when various prominent northern stars were "westward from the pole" at 1 a.m.

Several classic editions of *Hamlet* have stated that the star in

Above: William Shakespeare (1564–1616) completed the text of *Hamlet* in 1599–1601. **Right:** In November 1572 a brilliant new star suddenly appeared in Cassiopeia. This engraving from Camille Flammarion's *Astronomie Populaire* (1880) depicts Tycho Brahe's first sighting of the star on November 11th. The supernova blazed near the familiar *M* asterism of Cassiopeia, high above Polaris in the evening sky depicted here. By 1 a.m. the diurnal rotation of the heavens carried Cassiopeia and the new star to a position "westward from the pole." All illustrations provided by the authors.

the opening scene is probably a member of Ursa Major, on the grounds that Elizabethans used the Big Dipper asterism to tell time. Shakespeare indeed does have the characters in *Henry IV, Part I* (act 2, scene 1) deduce the hour of the night from the position of Ursa Major. But this constellation cannot match the season in act 1 of *Hamlet*, since our calculations show that Elizabethan observers would have seen the Pointer Stars “westward from the pole” at 1 a.m. only in the second half of April.

Shakespeare was also certainly aware of the bowl stars of the Little Dipper, Beta and Gamma Ursae Minoris, because he refers to them as the “guards of the ever fixed pole” in *Othello* (act 2, scene 1). However, these stars fail to satisfy the description in *Hamlet* because they fell west of the pole at 1 a.m. in the first week of July.

We can likewise rule out Vega and Deneb, the bright stars forming the northern side of the Summer Triangle, because they were “westward from the pole” at 1 a.m. near the end of July and the end of August, respectively.

A well-known modern edition of *Hamlet* (Arden Shakespeare series, 1997) suggests that Capella may be the star in act 1. Capella passed west of the celestial pole at 1 a.m. in the second week of January, when the nights are indeed “bitter cold” and Advent has ended. However, we reject this identification because it would require the murder of Hamlet’s father two months earlier to fall in November, which seems too late in the year to be sleeping outdoors in Denmark.

So far as we know, no previous authors have mentioned the stars of Cassiopeia as candidates, but they deserve consideration because they lie so close to the pole. Indeed, our computer calculations for Shakespeare’s lifetime show that this constellation did stand “westward from the pole” at 1 a.m. in the first half of November. Cassiopeia is a perfect fit to the position, time of night, and season specified in *Hamlet*. One problem remains — though the shape of Cassiopeia is familiar and striking, no single star is especially prominent; none is even 1st magnitude.

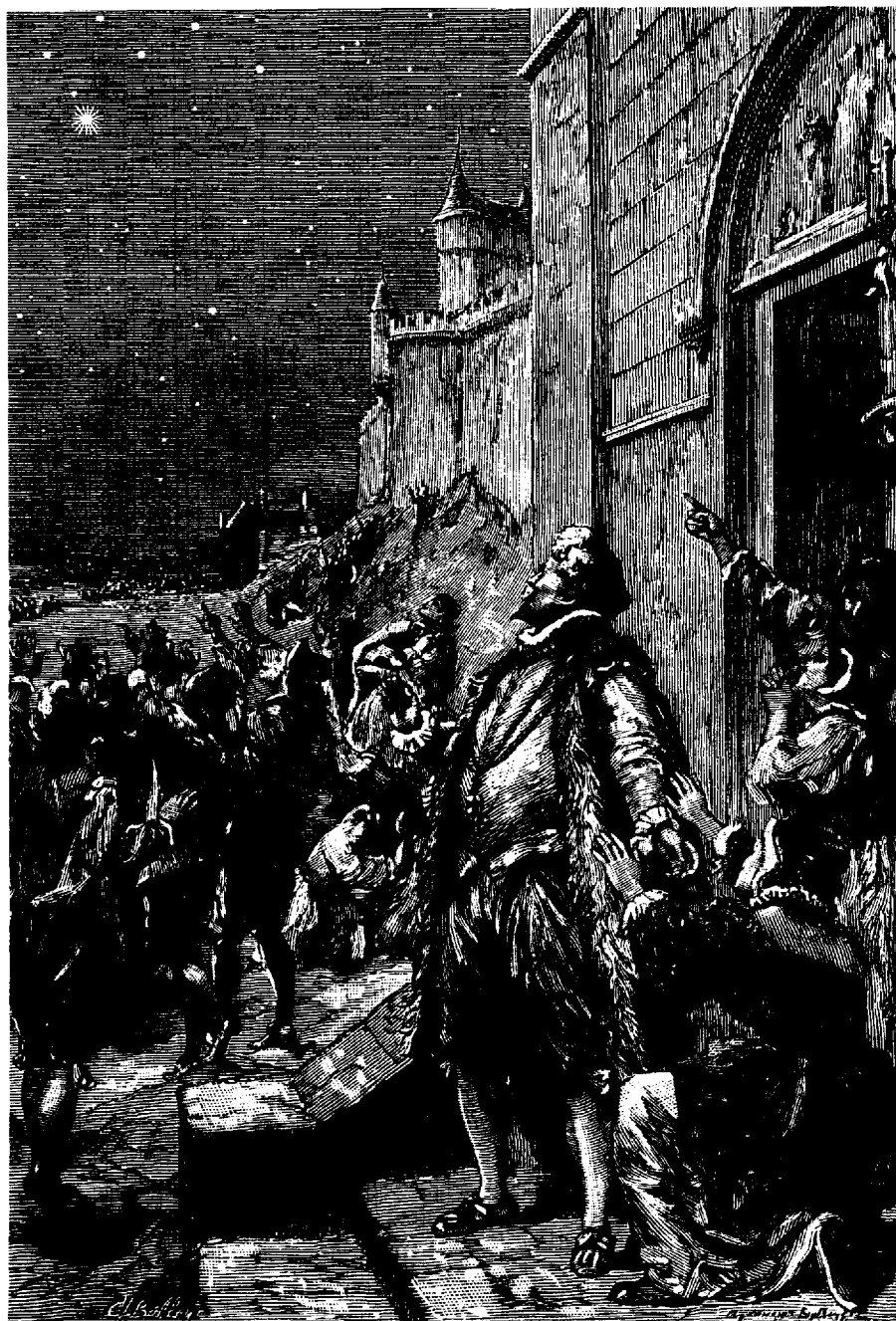
The New Star of 1572

But a remarkable star once did shine in Cassiopeia — the supernova of 1572. Moreover, this brilliant star suddenly appeared in November, precisely the month during which its position would have matched Bernardo’s description. Modern astronomers refer to this object as Tycho’s supernova, after the Danish astronomer who made the most detailed study of its properties. Amazed naked-eye observers of the time called it the “new star.”

We can only imagine that Shakespeare, who was eight years old, would never forget when he first saw the new star. However, Tycho Brahe (1546–1601), a contemporary of William Shakespeare (1564–1616), was 26 when the new star appeared, and we have detailed information about his reaction. The event helped inspire Tycho to devote his life to the serious study of astronomy.

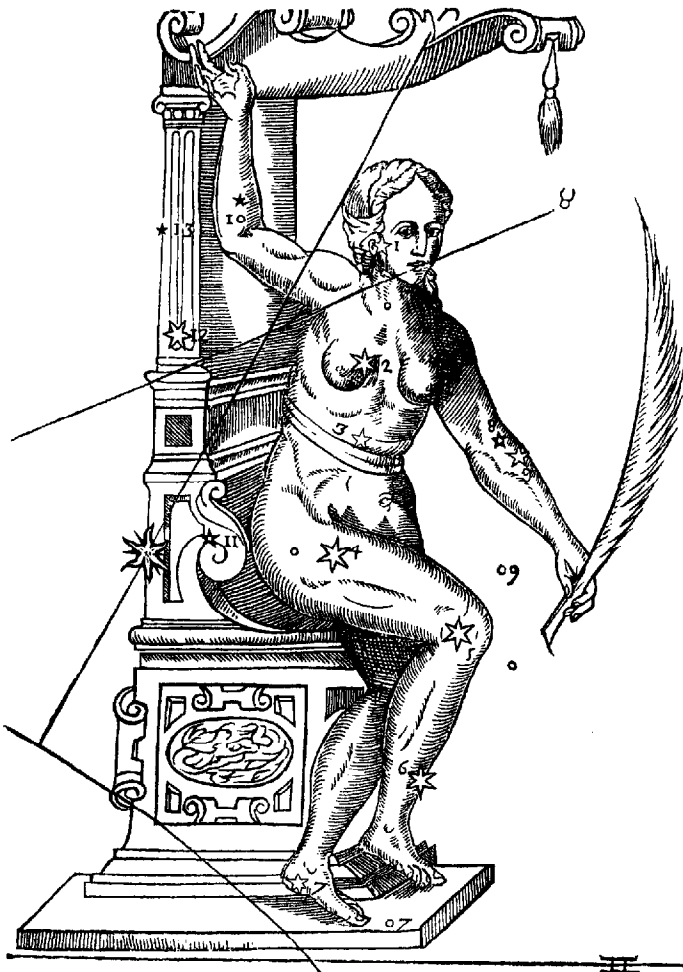
The supernova was first seen at Wittenberg on November 6, 1572, and then at five other locations in Europe before Tycho independently discovered it. Tycho published a short book about the new star (*De nova stella*, 1573) and later a detailed compilation of all known observations, including this vivid account of his own original sighting (translated by the authors from Tycho’s *Astronomiae instauratae progymnasmata*, 1602):

I first observed it on the 11th day of November [1572], because for many days preceding this the sky above our horizon was not at all clear. . . . During a walk on the evening of the above-mentioned day, I was contemplating the heavens, because the clearer air seemed to promise that astronomical observations could con-



tinue after dinner. I suddenly and unexpectedly beheld near the zenith an unaccustomed star with a bright radiant light. Astounded, as though thunderstruck by this astonishing sight, I stood still and for some time gazed with my eyes fixed intently upon this star. It was near the stars which have been assigned since antiquity to the asterism of Cassiopeia. I was convinced that no star like this had ever before shone forth in this location. . . . At this incredible sight I hesitated, and I was not ashamed to doubt that I could trust my own eyes. . . . As it happened at that time some country people were passing by, so I asked whether any of them perceived this star in the high heavens. They cried out that they clearly saw this enormous star. . . .

At the beginning, its apparent magnitude exceeded all of the fixed stars, including those of the first magnitude, and even the Dog Star itself and the brightest star in Lyra. Indeed, the new star appeared brighter than Jupiter at the acronical time [opposition], when closest to the Earth. It rivaled the brilliant aspect of Venus when nearest to the Earth. During November the new star was so bright that, when the air was clear, many people with sharp vision were able to see it in the daytime, even at midday.



This illustration published by Thomas Digges (*Alae seu scalae mathematicae*, 1573) depicts the supernova of 1572 at the back of Cassiopeia's chair. The supernova's right ascension was almost exactly 0 hours, placing it very near the equinoctial colure (the diagonal line marked with the symbol for Aries). The equinoctial colure is the great circle that passes through the north celestial pole and the vernal equinox, or the first point in Aries.

To be visible in the daytime and to rival Venus, the new star must have had an apparent visual magnitude of -4 or even brighter. As readers can verify with planetarium software, the supernova was a circumpolar object for observers in northern Europe and shared the sky in the early morning hours with Venus, which was magnitude -4.6 in November 1572.

To the Elizabethan observer the new star was not only a memorable sight but an event with disturbing religious and philosophical implications. In the two millenniums since Aristotle the fixed stars had been regarded as unchanging celestial symbols of security and order, with transitory phenomena such as comets and meteors assigned to the "elemental" regions below the Moon. The unprecedented new star shook people's confidence. Existing state papers show that Lord Burghley, adviser to Queen Elizabeth, consulted the astronomer Thomas Digges for his judgment about its nature and influence. The English historian Raphael Holinshed in his *Chronicles* (1587) shows this mixture of scientific interest and concern in his entry for 1572:

A STRANGE STAR APPEARED

The eighteenth of November in the morning was seene a star northward verie bright and cleere, in the constellation of Cassiopeia, at the backe of hir chaire. . . . This starre in bignes at the first appering seemed bigger than Jupiter, and not much lesse than Venus when she seemeth greatest. Also the said starre never changing his place, was caried about with the dailie motion of heaven, as all fixed starres commonlie are . . . it was found to have beene in place celestiall far above the moone, otherwise than ever anie comet hath beene seene, or naturallie can apeere. Therefore it is supposed that the signification therof is directed purposelie and speciallie to some matter, not naturall, but celestiall, or rather supercelestiall, so strange, as from the beginning of the world never was the like.

Holinshed not only summarizes popular reaction but also provides a connection to Shakespeare, who repeatedly went to the *Chronicles* as a source for some of his best-known plays. Thus his boyhood memory of the new star could have been reinforced at the time he was writing *Hamlet*.

Another vivid English account occurs in the *Annales* compiled by the popular historian William Camden, himself an eyewitness to the new star of 1572:

A NEW STAR

I know not whether it bee worth the labour to mention that which all Historiographers of our time have recorded, *to wit*, that in the moneth of November, a new Starre, or if you will, a *Phaenomenon*, was seene in the Constellation of *Cassiopeia*, which (as I my selfe observed) in brightnesse excelled *Jupiter* in the *Perigee* or nearest point of the *Eccentric*, and *Epicycle*: and in the same place it continued full sixteene moneths, being carried about with the daily motion of the heaven.

Thomas Digsey, and *John Dey*, Gentlemen, and Mathematicians amongst us, have learnedly proved by *Parallactic* Doctrine, that it was in the celestiall, not in the Elementary Region.

The two scientists mentioned by Camden were the most prominent astronomers in Elizabethan England, Thomas Digges (1546–95) and John Dee (1527–1608), whose observations appeared prominently in Tycho's final volume on the new star.

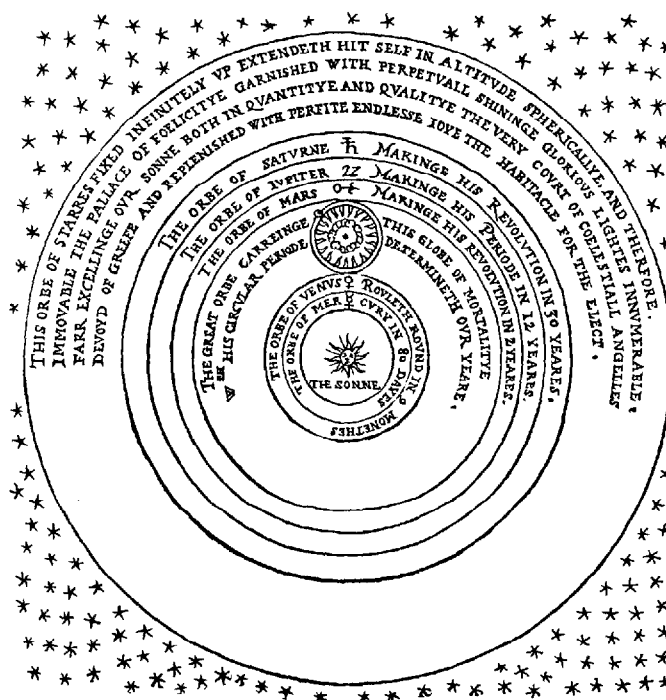
While the supernova was still visible in the northern sky, Digges published *Wings or Ladders of Mathematics* (*Alae seu scalae mathematicae*, 1573), which promised "to investigate the distance, im-

mense magnitude, and position of this extraordinary star." Dee also wrote several works devoted to the new star, including a mathematical text (*Parallaticae commentationis praxeosque*, 1573) showing how parallax measurements in theory could be used to calculate its distance from the Earth. In practice, pretelescopic instruments were unable to measure an accurate parallax for a star. (The first reliable calculations of stellar distances by this method did not occur until 1838–40.) But Tycho, Digges, and Dee were successful in establishing that the new star had a very small parallax and therefore must lie much farther away than the Moon. The popular accounts of Holinshed and Camden show that this significant result became common knowledge.

Tycho, Digges, and Shakespeare

The supernova faded below naked-eye visibility after 16 months, but the discussion of its meaning, along with that of a bright comet seen in 1577, continued for decades. Similarly, Shakespeare's involvement with Elizabethan astronomy was not confined to this childhood incident. In fact, in a lifetime that has left remarkably few clues, several point to a relation with those scientists most closely associated with the study of the new star.

Shakespeare uses the very Danish names Rosencrantz and Guildenstern in the play for two of Hamlet's old Wittenberg friends who have been turned into spies by his wicked uncle. As previously noted by Owen Gingerich (*S&T*: May 1981, page 395), the family names "Rosenkrans" and "Guldenstern" appear in the famous portrait showing Tycho surrounded by the coats-of-arms of his ancestors. This picture was published in the 1596 and 1601 editions of Tycho's astronomical letters. We can be



Shakespeare's cosmos: This diagram of the universe according to the Copernican heliocentric system appeared as part of Thomas Digges's "A Perfit Description of the Caelestiall Orbes," in the popular book *Prognostication Everlasting*, available in seven editions between 1576 and 1605. Digges and Shakespeare lived in the same area of London and the two likely crossed paths.

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certain that copies of this engraving were available in astronomical circles in London in the 1590s, for in a letter to English scholar Thomas Savile on December 1, 1590, Tycho writes:

Respectfully greet on my behalf the most noble and most eminent master John Dee. . . . Also do not leave ungreeted the most noble and equally most erudite mathematician Thomas Digges, whom I also sincerely praise and wish well.

He adds in a postscript:

I have included four copies of my portrait, recently engraved in copper at Amsterdam.

Gingerich concluded that “the coincidence with the names Rosencrantz and Guildenstern” is “so striking that we may be reasonably sure that Tycho’s portrait was one of the sources for *Hamlet’s* cast of characters.” The scholars Leslie Hotson, A. J. Meadows, and Peter Usher have pointed out that Shakespeare lived near Digges in London and assume, as does Gingerich, that he may have seen Digges’s copy. Hotson, in fact, devotes three chapters of a Shakespeare biography to tracing connections between the playwright and the Digges family. Shakespeare’s imagination may well have associated the English astronomers, the new star, the Danish astronomer, and the Danish Hamlet.

Moreover, if Shakespeare had looked up Denmark in the most famous pictorial atlas of the period, he would have seen Tycho’s castle observatory immediately adjacent to the castle at Elsinore that he eventually chose for his Danish setting.

Astronomical Imagery in *Hamlet*

The use of a contemporary reference to astronomy in *Hamlet* reinforces some well-established themes within the play. Several examples suggest that the connections among Denmark, stars, and the time being “out of joint” were of importance to Shakespeare. He seems to be playing etymologically, in his accustomed manner, with the names of the now-false friends “Guldenstern” (golden star) and “Rosencrantz” (rose garland or wreath). Generally speaking, the stars and garlands in the play — beginning with the memorable star west of the pole — are associated with blight or change. Ophelia, for example, is given a “crants” for her burial, not her wedding.

One striking example in *Hamlet’s* act 1, scene 5, shows Shakespeare describing a disturbed state of mind with imagery borrowed directly from astronomy:

Ghost: I could a tale unfold whose lightest word
Would harrow up thy soul, freeze thy young blood,
Make thy two eyes like stars start from their spheres. . . .

The idea of a star leaping out of its sphere is markedly odd. Whether the “new star” of 1572 had done it or not, however, was a matter of spirited debate. John Dee attempted to explain why the supernova suddenly appeared, for example, by proposing that the star had left its accustomed sphere and dropped directly toward the Earth. Dee elaborated this theory in a manuscript with a Latin title that we translate as: “On the astonishing star, in the asterism of Cassiopeia, which descended from the heavens as far down as to the orb of Venus: and again drew back perpendicularly into the secret places of the heavens, after the sixteenth month of its appearance” (1573). The explanation that the star had started from its sphere was taken up in Camden’s *Annales*, which noted that Digges and Dee were of the “opinion that it vanished by little and little in ascending.”

In a more encompassing example from act 2, scene 2, when Rosencrantz and Guildenstern first greet Hamlet, he analyzes his melancholy with another famous astronomical reference:

I have of late, — but wherefore I know not, — lost all my mirth . . . and indeed . . . this goodly frame, the earth seems to me a sterile promontory; this most excellent canopy, the air, look you, this brave o’erhanging firmament, this majestic roof fretted with golden fire, why, it appears no other thing to me but a foul and pestilent congregation of vapours.

This speech ties the stars to Hamlet’s sadness, doing so by echoing, while reversing, the boyish optimism and delight of the following passage by Digges:

Heerein can wee never sufficiently admire thys wonderfull & incomprehensible huge frame of goddes woork proponed to our senses, seinge fyrst thys baul of ye earth wherein we move . . . we may easily consider what litle portion of gods frame, our Elementare corruptible worlde is, but never sufficiently be able to admire the immensity of the Rest. Especially of that fixed Orbe garnished with lightes innumerable and reachinge up in Sphaericall altitude without ende. (From “A

The names “Rosenkrans” and “Guldenstern” appear on the left arch and column in a famous portrait of Tycho Brahe (1546–1601). The Dutch artist Jacob de Gheyn engraved the likeness in 1590, and similar designs appeared as frontispieces to the 1596 and 1601 editions of Tycho’s collected astronomical letters.





A lavishly illustrated *Atlas of the Principal Cities of the World*, published in 1588, included this engraving of the strait known as the Sound of Denmark. Tycho Brahe's castle observatory Uraniborg (Uraniburgum in the Latin spelling) stands in the center of the island of Hven (Hvena). Only a short distance away, dominating the left foreground of this view, is the castle at Elsinore (Helsingenor), chosen by Shakespeare for the setting of *Hamlet*.

Perfit Description of the Caelestiall Orbes," added as an appendix to *Prognostication Everlasting*, 1576.)

Digges employed similar language regarding the "pallace of foelicitye . . . garnished with perpetuall shininge glorious lightes innumerable" in the legend on an engraved plate that accompanied the essay. Shakespeare would very likely have been aware of Digges's text and the diagram of the planetary orbs and the firmament of stars, even if he had not seen it at Digges's home, since the *Prognostication Everlasting* went through at least seven editions between 1576 and 1605, becoming "one of the most widely read and popular books of the period," according to Francis R. Johnson (*Huntington Library Bulletin*, 1934, page 71).

A Shakespearean Memory

Should you be out on a clear November night and happen to notice Cassiopeia just "westward of the pole" after midnight, take a moment and imagine what it must have been like four centuries ago as a "new" star appeared there. The connections between William Shakespeare's *Hamlet* and the astronomers Thomas Digges and Tycho Brahe, the leading European authorities on the new star, make the *Hamlet*-supernova association more plausible. The spectacular stellar event in 1572 may have been the inspiration for the celestial portent in the opening scene of the most famous play ever written.

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