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Arabic Reports about Supernovae 1604 and 1572 in *Rawḥ al-Rūḥ* by ᶜĪsā b. Luṭf Allāh from Yemen

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Abstract

We present Arabic texts about supernovae SN 1572 and SN 1604. The short observational reports were found in the Yemeni history book entitled *Rawḥ al-Rūḥ* written by ᶜĪsā b. Luṭf Allāh b. al-Muṭahhar. The text about SN 1604 specifies the location of a new star at the beginning of the zodiacal sign of Sagittarius, consistent with SN 1604 in the constellation of Ophiuchus. It was observed in fall A.D. 1604 for some 40 days (probably limited by its heliacal setting after around A.D. 1604 22 November). The object is called a *najm* (star) of the *nayāzik* (transient celestial objects), from which we can conclude that it was a tailless and/or stationary new star (rather than, e.g., a comet). It was specified to be as (large/bright as) Jupiter, consistent with the supernova in A.D. 1604 October and November The text confirms other reports about SN 1604. Furthermore, a short text reports a new star (*najm*) in the north-east, larger than Venus, observed in the year A.H. 980 (A.D. 1572 May to 1573 May), connected to the death of a leader on A.D. 1572 9 ± 2 November; this could well be SN 1572, otherwise observed to be as bright as Venus since A.D. 1572 6 November. These new findings may

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indicate that more Yemeni reports about Galactic supernovae can be uncovered. The description of the new star of A.D. 1604 as *najm* (star) of the *nayāzik* (transient celestial objects) and of the comet of A.D. 1577 as "a star [*najm*] … of the *nayāzik*, with a tail … with a visible movement" shows that the author distinguished between cometary and star-like transient celestial objects.

Keywords
Comet 1577, supernova 1572, supernova 1604, *Rawḥ; al-Rūḥ*, ʿĪsā; b. Luṭf Allāh

Introduction

With the observation of the New Stars (now known as supernovae (SNe)) of 1572 and 1604 by, e.g., Tycho Brahe and Johannes Kepler, respectively, it became clear that such transient celestial phenomena are located not only supra-lunar but even far beyond the solar system.[1] SNe were also observed by Far and Near East Asian astronomers throughout the previous centuries, but they did not yet write explicitly that they took place outside the solar system.[2]

Any historic observation of a supernova (SN) is important for our understanding of SNe: Historic observations can in principle deliver the exact date of the explosion (hence, the age of the SN remnant and, if existing, the neutron star), the position of the SN, which is needed to identify the remnant, brightness, colour, and evolution, which can yield the SN type. Such historic observations have been used very successfully for SNe 1006 (from Arabia, Eastern Asia, and Europe), 1054 (from Eastern Asia and Arabia), 1181 (only from Eastern Asia), and SNe 1572 and 1604 (from Eastern Asia and Europe), plus a few more SNe from the first millennium A.D.[3] For example, the SN remnant of SN 1006 was identified by combining the positional information from observers from Arabia, China, and St Gallen,[4] especially ʿAlī ibn Riḍwān, a scholar, who lived from A.D. 988 or 998 until 1061 in Cairo, Egypt.[5]

Scholars writing in Arabic considered transient celestial events like comets as being located in the Earth atmosphere like meteors – following Aristotle, who considered true stars to be eternal and constant. There are several Arabic reports about SN 1006,[6] but only one Arabic report about SN 1054: Ibn Abī Uṣaybiʿa (historian who lived A.D. 1194 or 1203–1270 in Damascus, Syria) quoting Ibn Buṭlān (a physician, who lived A.D. 1038–1075 in Baghdad, Iraq) wrote about the *kawkab atharī* meaning something like a *star leaving traces* or *spectacle star* (describing the very bright SN 1054);[7] *kawkab* can mean *star* or *celestial object* in a general sense including *planet* (*najm* can only mean *star*); for *comet*, Arabic authors also used the term literally translated from the Greek *cometes*, i.e., star with a lock of hair (*al-dhu'āba*).[8]

The word *nayzak* (of Persian origin) is often translated with *comet*. Also, the words used in European texts translated with *comet* mean in a more general sense a *transient luminous celestial object* (e.g. the chronicles of Liege, Lobbes, Venice, and Metz use *cometes* for the new star in A.D. 1006[9]); such a transient object can be either a stationary tailless *new star* (often scintillating with bright rays) or a moving *comet* (mostly with

tail). The Chinese knew to differentiate two classes of *new stars* (so-called Guest Stars), namely, with tail (*xingbo, boxing*, or *huixing*) and without tail (*kexing* or *zhoubo*), and often report in addition whether the transient object is moving relative to the stars indicating a *comet* in modern terminology.[10] The *nayzak* (new star) of 1006 was long regarded as a comet instead of an SN.[11] See Kunitzsch[12] for a review on the Arabic words used for stars and transient celestial objects.

The SN of 1604 (SN 1604 or Kepler's SN) was observed since A.D. 1604 9 October for about 1 year by European, Chinese, and Korean astronomers; both Johannes Kepler and David Fabricius obtained sufficient positional accuracy so that the supernova remnant (SNR) could be identified[13] yielding a distance of roughly 3 kpc;[14] despite many points in the light curve, it is still not settled whether SN 1604 was a core-collapse or thermonuclear SN[15] so that any additional information on, e.g., the light curve may be useful.

The SN of 1572 (SN 1572 or Tycho's SN) was observed since A.D. 1572 6 November for more than 1 year by European, Chinese, and Korean astronomers;[16] Tycho Brahe obtained sufficient positional accuracy so that the SNR could be identified yielding a distance of roughly 2 kpc;[17] a light echo spectrum confirmed that it was a type Ia thermonuclear explosion.[18]

We present Arabic texts on SNe 1604 and 1572 from Yemen, the first Arabic reports found on these two recent SNe, with our English translations. Then, we discuss the information regarding the dating of the *new star* of 1604 and other details like its location in the sky, stationarity, taillessness, light curve, and duration of visibility. After discussing the text and information for SN 1572, we close with a short summary.

The Arabic text on a new star in A.D. 1604 in *Rawḥ al-Rūḥ*

Given the recently found report about SN 1006 in the Yemeni history by al-Yamānī,[19] we have searched for more SN reports in Yemeni literature.

We found brief reports about what we today call the SNe of A.D. 1572 and 1604 in the Arabic book entitled *Rawḥ al-Rūḥ*, which means something like *The Spirit of the Soul* or *Refreshment of the Soul*. It was written by ʿĪsā b. Luṭf Allāh b. al-Muṭahhar (short: ʿĪsā b. Luṭf Allāh, sometimes called Ibn al-Muṭahhar), who died in A.H. 1048 (A.D. 1638/1639). This historic work reports the history of Yemen from A.D. 1494 to 1620 (A.H. 900–1029).

We have consulted two manuscripts: (a) MS Berlin 9743 (MS number 9743 in Ahlwardt's catalogue[20]), which we received in electronic form from the Staatsbibliothek Berlin, Germany (name of copyist and date of copy are not mentioned), and (b) a photocopy of an MS consulted by W. Rada at the city library of Ṣanʿāʾ, Yemen, consisting of two volumes – the first volume was written or copied on a Friday morning the 28th of the month of Shawwāl (year not specified), and in the second volume it is specified that it was finished by the original author ʿĪsā b. Luṭf Allāh on the 20th of Ramaḍān in the year A.H. 1048 (A.D. 1639 January); in MS Ṣanʿāʾ, it is mentioned that the text was written (or copied) in the town of Zabīd, Yemen – the town and its university were an intellectual centre of Yemen in the ninth through twelfth centuries A.D., located about 1° south-west of Ṣanʿāʾ. Both MSs are probably from the eleventh-century A.H. (seventeenth-century A.D.), MS 9743 was dated "around 1100h = A.D. 1688" in Ahlwardt.[21] As far as the new

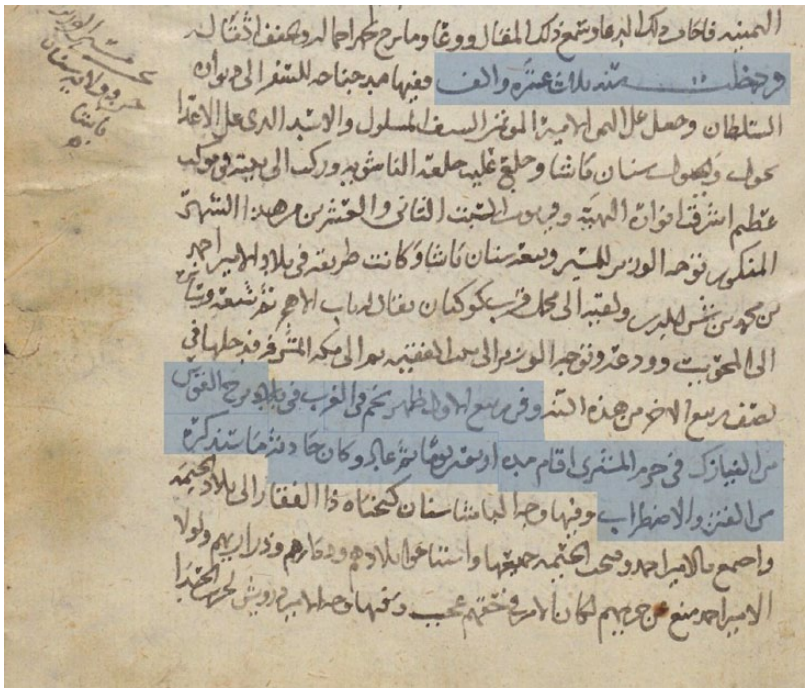

Figure 1. We show the Arabic text from *Rawḥ al-Rūḥ* by ʿĪsā b. Luṭf Allāh (MS Berlin 9743, page 177) with a short report about SN 1604. The relevant text is indicated by colour and starts in the second line from the top, where the year 1013h (hijra) is mentioned corresponding to A.D. 1604/1605. After some text about unrelated issues, the text in the third to fifth line from the bottom reports about the new star (SN 1604). A transcription of the Arabic, our translation to English, and more details are given in the text. The words on the top left margin are not related to the new star.

star is concerned, the two MSs are identical; there are small differences in other places, see below. An edition of this work exists, but was not available to us.[22]

We present here the Arabic text of the relevant sentence about the transient celestial object of A.D. 1604 from MS Berlin, page 177, lines 9–11 (see Figure 1):

> [year A.H. 1013]
>
> *... wa-fī rabīʿ al-awwal ẓahara najm fī al-gharb fī* [here the word *bilād*, "land," was erroneously written and crossed out] *burj al -qaws min al-nayāzik fī jirm al-mushtarī aqāma muddat arbaʿīnyawman thumma ghāba wa-kāna ḥādithuhu mā sanadhkuruhu min al-fitan wa-l-iḍṭirāb …*

Our English translation of the report and its context are as follows (our additions in square brackets, an addition from MS Ṣanʿāʾ in round brackets; the Arabic text above is given for the central paragraph about the transient object):

(Then the year [A.H.] 1013 entered and in that year … on Saturday, 22nd of the previously mentioned month … Then, the minister travelled to Bait al-Faqīh, then to Mekka al-Musharrafa which he entered in the middle of Rabīᶜ al-Ākhir [Rabīᶜ II] of this year.)

And in the month of Rabīᶜ al-Awwal [Rabīᶜ I] a star [*najm*] of the *nayāzik* appeared in the West [*fī al-gharb*] in ["*land*" crossed out] (the beginning of) the zodiacal sign [*burj*] Sagittarius, as large as Jupiter [literally: *in the body/appearance of Jupiter*]. It remained for 40 days and then disappeared. And what happened with it [or: what was caused by it] was what we shall mention of conflicts and tumult …

The object is specified as a *najm of the nayāzik*; the latter is the Arabic plural of *nayzak*, a word of Persian origin (plural *nayāzik*), which is often translated as *comet*, but means in a more general sense *transient celestial object*, in modern terminology including comets, novae, and SNe (see above). It was used also for SN 1006 by other Arabic authors.[23] The description as *nayzak* (*transient celestial object*) is further specified as *najm of the nayāzik*, i.e., like a star, namely noticed to be tailless and/or stationary: a *stellar* transient celestial object. We interpret the rare wording *in the body/appearance of Jupiter* to mean something like *similar to Jupiter*, e.g., as large or bright as Jupiter.

We will now discuss the additional information contained in this short text, also in order to identify the new star. The texts about the new star of A.D. 1572 and the comet of A.D. 1577 are discussed further below.

The dating of the observation in A.D. 1604

The report for A.H. 1013 contains the wording *on Saturday, 22nd of the previously mentioned month*, meaning the month, whose events were previously narrated, from the context clearly the first month of the year, Muḥarram 1013 (*Then the year 1013 entered …*); we can use this to check for internal consistency (and, hence, dating credibility). We should keep in mind that the Islamic year has 12 lunar months, a day (as well as a date and a weekday) run from evening to evening, and any conversion from the Islamic to the Julian or Gregorian calendar has an uncertainty of some 2 days due to (a) the uncertain start of the Hijra era on the evening of either A.D. 622 15 or 16 July; (b) the fact that it is often not known a posteriori when in history a month and, hence, a year had an extra day (355 days instead of 354 days), which was needed, because the synodic month is 29.53 days, i.e., slightly different from an average month length of 29.5 days; and (c) some uncertainty in crescent sighting due to, e.g., weather and landscape.[24]

When our author specifies a date as *Saturday, 22nd of this month* [Muḥarram], he considers this day, date, and weekday to run from evening to evening. According to the calculated Islamic calendar, the 22nd day of the month of Muḥarram in the year A.H. 1013 was running from the evening of A.D. 1604 19 June (Saturday) to the evening of 20 June (Sunday) in the Gregorian calendar, with an uncertainty of 2 days. Hence, a date given as *Saturday, 22nd of this month* [Muḥarram 1013] can be considered correct: then, the month of Muḥarram started one day earlier (compared to the *calculated* Islamic calendar).

The date of first appearance of the new star is then given as *In the month of Rabīᶜ I* in the year A.H. 1013. In the calculated Islamic calendar, the given month of Rabīᶜ I in A.H. 1013 ran from A.D. 1604 28 July to 26 August[25] (with an uncertainty of again 2 days). This would certainly be too early for SN 1604, which was discovered by two Italian observers on A.D. 1604 9 October, one day later in China, and definitely not one or more days earlier, as many astronomers did observe the relevant area in the sky the days before 9 October because of a close planetary conjunction.[26] For a sighting from Yemen some 2 months earlier than all others, one would need to assume some kind of a precursor explosion 2 months before the final SN, for which there is otherwise no evidence.

However, there are two different months, whose names appear twice in the series of Arabic month names, namely, not only Rabīᶜ I and Rabīᶜ II but also Jumādā I and Jumādā II. While the month of Rabīᶜ I in A.H. 1013 was too early, Jumādā I ran from A.D. 1604 25 September to 24 October[27] (uncertainty being 2 days; the conjunction between moon and sun was on 23 September at around noon time UT, so that the crescent was first visible on 24 or 25 September in the evening, weather permitting; on 24 September, the moon was already 10° above the horizon at Ṣanᶜāᵓ, i.e., possibly detectable). The month Jumādā I indeed includes exactly the period of first observations of SN 1604 in Europe and Asia.

We suggest that the original report and observation was done in Jumādā I, but that either during the (possibly oral) transmission of the report or due to a memory mistake by the observer or author, the month erroneously changed from Jumādā I to Rabīᶜ I, the only other Arabic month name which appears twice. Alternatively, it could also be a scribal error of a copyist.

Hence, it is quite likely that the report cited above is about SN 1604. There are no other transient celestial objects like comets known for the relevant period, A.D. 1604 and 1605.[28]

In the text for A.H. 1013 (given above in English), an unrelated event from the (middle of the) month Rabīᶜ II is indeed mentioned immediately before the short text about SN 1604; if this Yemeni chronicle narrates the events in chronologic order, this may be seen as further evidence for our suggestion (month change for the SN report).

To test the reliability and dating accuracy of the author and/or his informants, we can investigate a few other, well datable, astronomical events mentioned within a few years before and after A.D. 1604 (page numbers for MS Berlin 9743, variants and additions from MS Ṣanᶜāᵓ in round brackets):

(a) Page 170, lines 13 and 14:

wa-fī l-muḥarram minhā inkhasafa [sic] al-qamar khusūfan kullīyan wa-dhālika fī burj al-dalw.

Our English translation:

During the month of Muḥarram of this year [A.H. 1007], a total lunar occultation occurred in the zodiacal sign of Aquarius.

Indeed, there was a lunar eclipse on A.D. 1598 16 August (in Muḥarram of A.H. 1007) in Aquarius visible from Ṣanᶜāᵓ.

(b) Page 177, lines 2 and 3:

wa-fīhā iftaraqa (MS Ṣanᶜāᵓ has iqtarana) al-thaqīlān zuḥal wa-l-mirrīkh fī burj al-qaws.

Our English translation:

In this year the two heavy ones, Saturn and Mars, separated (had a conjunction) in the zodiacal sign of Sagittarius.

This is the last event listed for A.H. 1011, which ended on A.D. 1603 10 June (within 2 days). While MS Ṣanᶜāᵓ has *iqtarana* for *had a conjunction* here, MS Berlin has *iftaraqa* for *separated*, two almost similarly written Arabic words with opposite meaning. Jupiter and Saturn were close to each other towards the end of A.H. 1011 so that the reading *iqtarana* (MS Ṣanᶜāᵓ) for *had a conjunction* is astronomically correct. The two planets were located slightly east of the eastern edge of the constellation of Sagittarius, i.e., consistent with *the zodiacal sign of Sagittarius* given. It may be possible that the author or observer had mistaken Jupiter for Mars.

(c) Page 183, lines 1 and 2:

wa-fī ākhir shaᶜbān fī hādhihi l-sana iqtarana al-mushtarī wa-l-mirrīkh wa-ṣārā ka-l-najm al-wāḥid.

Our English translation:

At the end of the month of Shaᶜbān of this year [A.H. 1015], a planetary conjunction occurred between Jupiter and Mars (in the zodiacal sign of Aquarius) such that (Mars had eclipsed Jupiter and) they were seen as one star [*najm*].

Indeed, there was a very close conjunction between Jupiter and Mars in that month: The month of Shaᶜbān of A.H. 1015 corresponds to A.D. 1606 December and would end on about 30 December; the closest conjunction took place on 14 December so that there is an offset here by some 2 weeks.

(d) Page 187, lines 4 to 3 from bottom:

wa-fī al-niṣf min rabīᶜ al-ākhir waqaᶜa fī l-qamar khusūfᶜ amma jirmahu wa-adhhaba rasmahu wa-dhālika fī burj al-jady.

Our English translation:

In the middle of Rabīᶜ II [in the year A.H. 1018], there happened a lunar occultation that covered the whole body of the moon such that it disappeared from sight, it was in the zodiacal sign of Capricorn.

Indeed, this lunar eclipse took place on A.D. 1609 16 July (the middle of the month of Rabīᶜ II of A.H. 1018; of course, lunar occultations always happen in the middle of a lunar month) at the border of Capricorn and Sagittarius as seen from Ṣanᶜāᵓ.

There are no further datable astronomical events listed in *Rawḥ al-Rūḥ* between A.D. 1598 and 1609. In sum, the author appears to be quite credible for astronomical events and dates, although not perfectly correct. Our author may have been an eyewitness himself, or the astronomical events may have been reported to him (directly?) by another person, whom he quotes (in some parts slightly incorrect compared to our reconstruction). We will publish the other astronomical observations in *Rawḥ al-Rūḥ* later.

Identification with SN 1604

There are several more details, which show that the new star reported here is most certainly to be identified with SN 1604.

Location/direction

The location of the new star is given as appeared in the west in (the beginning of) the zodiacal sign Sagittarius.

Indeed, SN 1604 is close to the border of (our) constellations of Sagittarius and Ophiuchus. Kepler and Fabricius measured the position of this new star with respect to stars in Sagittarius, Ophiuchus, and others.[29] Kepler entitled his work about this new star as *De Stella Nova in Pede Serpentarii*, i.e., at the *foot of the serpent holder*, today known as Ophiuchus, i.e., near the end of Ophiuchus, close to the beginning of Sagittarius. SN 1604 was indeed visible in the *west* (in the evening) in the fall of A.D. 1604.

Stationarity/taillessness

The Arabic word *nayzak* is often used for what we today call *comet*, sometimes for a *new star*, in general for *transient celestial object*. Here, neither motion relative to stars nor any tail is reported; indeed, the object is called a *najm of the nayāzik*, i.e., a *star-like* transient celestial object: non-extended and stationary (co-moving with the fixed stars), i.e., nova or SN (like the *nayzak* of A.D. 1006, SN 1006). The wording *najm of the nayāzik* shows that our author is leaving the Aristotelian paradigm that a transient object (*nayzak*) would be sub-lunar. The word *remained* (or: *was there*, Arabic: *aqāma*) in the wording *It remained for 40 days* may neither refer to stationarity nor constant brightness, but just to the fact that it was observable for 40 days; stationarity (*najm of the nayāzik*) and brightness (*like Jupiter*) were given elsewhere.

Brightness/size/colour

The wording *in the body/appearance of Jupiter* probably just means something like *as large as Jupiter* or *as bright as Jupiter* or just *like Jupiter*. (While SN 1604 and Jupiter were in relatively close conjunction in October 1604, there was no occultation.) A brightness like Jupiter is very similar to other accounts: *As bright as Jupiter* (9–15 October) from Europe or *as large as Jupiter* (17–25 October and 7–13 November) from Korea.[30] A brightness like Jupiter in October 1604 corresponds to an apparent magnitude about −1.6 m (or −1.6 mag).

While the last observations from Europe in A.D. 1604 were dated *17 October* and *end of October* (both: *much brighter than Jupiter*), Korean observers continued their monitoring until 26 November; the peak was reached 28–31 October according to the Korean accounts (*as bright as Venus, rays lustrous*).[31]

If the new star reported in Yemen indeed was SN 1604, then it is quite plausible that it was compared to Jupiter, not only because it was as bright (or large) as Jupiter (in October/November A.D. 1604) but also because it was located very close to Jupiter, within a few degrees. In October 1604, also the planets Saturn and Mars were located within a few degrees around SN 1604, a close conjunction with all three planets in retrograde motion; in October and November, SN 1604 was located between Jupiter and Saturn, but closer to Jupiter in October and closer to Saturn in November. That SN 1604 was compared to Jupiter, but not to the other planets, gives quite a precise brightness information, maybe within a factor of 2 like Jupiter (about −1.6 mag), and indeed brighter than both Saturn and Mars, both around 1 mag at that time. That the Yemeni observer(s) did not compare the new star to Venus (as the Korean astronomer(s) did during the peak) may be due to the fact that the Yemeni observer(s) either did not observe SN 1604 late October and early November and/or because Venus was not visible in the evening; the Korean astronomers could compare it with Venus as experienced professional court astronomers comparing the SN to the typical or maximal brightness of Venus or with its actual brightness (visible in the morning in the east in October at −4 mag).

Korean observers compared SN 1604 also with Jupiter before and after the peak brightness: "slightly smaller than Jupiter" 15–16 October and 14 November and "as large as Jupiter" 17–25 October and 7–13 November, and then with Mars in the second half of November; the Korean astronomers observed SN 1604 until 26 November at heliacal setting before conjunction with the Sun and then again since heliacal rising on A.D. 1604 26 December.[32] As mentioned above, European observers compared SN 1604 to Jupiter already for 9–15 October; the Korean reports have to be regarded as more homogeneous and possibly as more precise and accurate.

If we assume the known light curve of SN 1604[33] and if the wording *as large as Jupiter* in the Yemeni report can be interpreted as meaning within, say, 1 mag as bright as Jupiter, then this observation can be dated to some time from 1604 9–25 October and 7–19 November, when European and Korean observers compared it to Jupiter (Korea, 16–19 November: *smaller than Jupiter*).

Visibility period/light curve

The star is said to have been visible *for 40 days and then disappeared*. Whether the wording *then disappeared* refers to before or after conjunction with the Sun (December 1604) is not specified. Eastern Asian and European observers could observe the star for several months after conjunction with the Sun.[34] It is first given that the object was visible *for 40 days*, and then it is added that it *then disappeared*. It is not specified whether it *disappeared* suddenly or whether it faded within a period of, say, a few days; the use of the word *then* may indicate that the period of fading was not included in the 40 days. Hence, the object was probably roughly constant for some 40 days and then afterwards *disappeared* or faded away, at least it started to change its brightness faster than before.

A period of roughly constant brightness (around the peak) and then the fading is consistent with an SN light curve.

If the Yemeni observers knew the atmospheric extinction effect at low altitude, then the reported transition from an apparently roughly constant brightness to the disappearance or fading would not be due to extinction at low altitude. It is well possible that its heliacal setting has been observed in Yemen in the second half of November 1604. The Yemeni observer was probably searching for the new lunar crescent on A.D. 1604 22 November at the western horizon in order to know the date of the start of a new month (conjunction of moon and sun on 21 November at around 7:30 h UT): At sunset on 22 November, the crescent was 16° above horizon at Ṣanᶜāᵓ, i.e., well visible – weather permitting, and the crescent was in close conjunction with both SN 1604 and Saturn that evening. It is quite likely that the Yemeni observer(s) noticed SN 1604 that evening, and it may have appeared to become fainter since then or as compared to October. If the Yemeni observer did observe SN 1604 on around 22 November, then it was at low altitude at about 2 mag. As mentioned before, the wording *and then disappeared* could also refer to a time after conjunction with the Sun.

The given period of 40 days since their first observation should lie between about A.D. 1604 9 October (first observation by Italian observers) and 26 November (heliacal setting), a period of 49 days; Korean observers observed it from 13 October to 26 November (45 days), Europeans since 9 October, but not in November. If the wording *It remained for 40 days and then disappeared* is meant to indicate some 40 days of roughly constant brightness, then we can limit the Yemeni observations to the period from about 9 October to 16 November (39 days), when SN 1604 was compared to Jupiter (and not to any other star or planet) by European and Korean observers (including the phrase *smaller than Jupiter*), i.e., very roughly, maybe within 1 mag, like Jupiter – and definitely brighter than Mars and Saturn and fainter than Venus. The specified visibility period of 40 days gives additional confidence in the identification of this new star as SN 1604.

The new star in A.H. 980 (A.D. 1572/1573)

On page 139 of *Rawḥ al-Rūḥ* by ᶜĪsā b. Luṭf Allāh, we found the following text, see Figure 2 (square brackets are our additions), from MS Berlin:

[year A.H.] *980.*

Wa-dakhalat sanat thamānīn wa-tisᶜimiᵓa wa-fīhā ẓahara najm min majrā banāt naᶜsh al-ṣughrā mimmā yalī al-mashriq akbar min al- zuhara, wa-taḥaddatha al-nās anna dhālika li-mawt al-Muṭahhar ibn al-imām wa-anna ẓuhūr mithlihi lā yakūn illā li-mawt malik min al-mulūk al-jisām aw raᵓīs ᶜaẓīm fī dhālika al-iqlīm.

We translate it into English as follows:

Then began the year 980h [14 May 1572 to 2 May 1573 A.D. ± 2 days]. In it, a star [*najm*] larger than Venus appeared in the path [*majrā*] of Ursa Minor [*Banāt Naᶜsh al-Ṣughrā*] towards the East. People said that this would indicate the death of al-Muṭahhar, the son of the Imam, and that the appearance of such [objects] only happens in order to indicate the death of some mighty king or a great leader in that region.

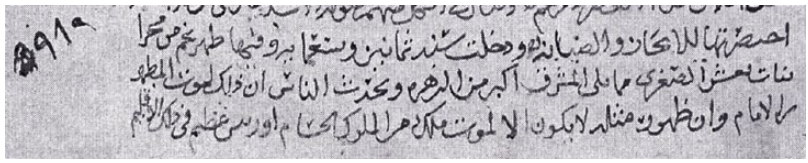

Figure 2. We show the Arabic text from *Rawḥ al-Rūḥ* by ᶜĪsā b. Luṭf Allāh (MS Berlin 9743, page 139) with a short report about SN 1572. The relevant text is found in the last three lines of that page, as shown here. At the left margin in the text, the year 980h (hijra) is given in Arabic numerals, corresponding to A.D. 1572/1573. A transcription of the Arabic, our translation to English, and more details are given in the text.

Dating

ᶜĪsā b. Luṭf Allāh here gives only the year of the appearance of the new star: 980h started on A.D. 1572 14 May (±2 days).[35] Indeed, SN 1572 was otherwise observed since A.D. 1572 6 November[36] and then with interruptions due to conjunction with the Sun for more than 1 year. At the left margin of MS Berlin, we can also read the number *980* written in Arabic numerals, i.e., year 980h.

The short text cited above mentions the death of *al-Muṭahhar, the son of the Imam (al-Muṭahhar ibn al-imām)*. The mentioned *Imam* is the Shi'ite Zaydī Imam and leader al-Mutawakkil, who died in March 1555 A.D. His eldest son took up the leadership, called *al-Muṭahhar, the son of the Imam.* This person is the grandfather of the author of our MS: ᶜĪsā b. Luṭf Allāh b. al-Muṭahhar, meaning *ᶜĪsā son* (or: *descendant*) *of Luṭf Allāh son* (or: *descendant*) *of al-Muṭahhar*, a rare name. It is also known that the mentioned grandfather of our author died of a sudden and unexplainable death on A.H. 980 Rajab 3 (A.D. 1572 9 ± 2 November).[37] It is therefore quite likely that the new star reported here – interpreted to have caused or announced the death of *al-Muṭahhar, the son of the Imam* – was seen on or shortly before 9 November: Even if the particle *li* would not indicate a temporal priority of the star, but would just mean *belongs to*, and if the prophecy was constructed after the death, it worked only if the new star was seen *before* the death, as it was very bright and seen by many people. This dating is then well consistent with SN 1572, which appeared on A.D. 1572 6 November.[38]

Other datable astronomical entries just before and after A.D. 1572 are correctly dated to within 1 month or better, quoting from MS Berlin:

(i) Page 127, lines 10 and 11:

waqaᶜa fī l-shams kusūf ᶜaẓīm ṭalaᶜat min jihat al-SHARQ munkasifa.

Our English translation:

the sun was eclipsed greatly, it rose eclipsed from the east,

given for 29 Rabīᶜ II 976h, i.e., A.D. 1568 21 October (±2); a solar eclipse starting below the horizon with more than 50 percent obscuration, as seen from Yemen, happened in the early morning of A.D. 1568 21 September (see eclipse.gsfc.nasa.gov); if 29 Rabīᶜ I 976h

is meant here, i.e., 1 month earlier, due to, e.g., a memory or scribal error, then the date corresponds to A.D. 1568 21 September (±2), the date of the eclipse; it is worth mentioning that the *29th* of the lunar month is given here (29 Rabīᶜ II or I), i.e., new moon, the correct phase for a total solar eclipse.

(ii) Page 144, lines 7 and 8:

wa-fī shaᶜbān min hādhihi l-sana al-madhkūra inkhasafa al-qamar khusūfan ghashā ṣafḥatahu jamīᶜahā wa-dhālika fī burj al-ḥūt.

Our English translation:

The moon was occulted by an occultation, which obscured all of its disc, in the zodiacal sign of Pisces (MS Ṣanᶜāᵓ has "Gemini"),

given for Shaᶜbān 981h, i.e. A.D. 1573 26 November to 24 December (±2); totality in Yemen is correct for A.D. 1573 8 December in the constellation Gemini (see eclipse.gsfc.nasa.gov).

(iii) Page 146, lines 14 and 15:

wa-dakhalat sanat khams wa-thamānīn wa-tisᶜimiᵓa fa-fī shaᶜbān minhā ẓahara najm fī al-gharb min al-nayāzik bi-dhanab wa-aqāma ayyāman yasīra yasīru sayran ẓāhiran.

Our English translation:

The year 985h entered, and during the month of Shaᶜbān [A.D. 1577 Oct 14 to Nov 11 (+/- 2)], there appeared a star [*najm*] in the west, [one] of the *nayāzik*, with a tail. It stayed for a few days, moving with a visible movement.

This is Tycho's comet of A.D. 1577 (seen otherwise since 1577 November[39]); it is reported and dated correctly to A.H. 985 Shaᶜbān, i.e., A.D. 1577 October/November.

Location

The wording *in the path (or course) of Banāt Naᶜsh al-Ṣughrā* (Ursa Minor) *towards the east* can be considered correct: SN 1572 was located in Cassiopeia,[40] and indeed at a similar altitude as UMi, namely, far north as seen from as far south as Yemen. It was seen first (*appeared*) in the east in the early evenings in November 1572. While SN 1572 at a declination of 62° north was circumpolar for observers in Europe, China, and Korea, it did set for observers in Yemen, e.g., Ṣanᶜāᵓ being at a latitude of 15° north.

Size or brightness

The new star was given to be "larger than Venus." From 6 November 1572 on for about 2 weeks, Venus and SN 1572 were visible at the same time about 1 hour before sunrise

from Yemen, strongly separated (Venus rising in the east, SN 1572 setting in the west), both at a brightness of about −4 mag. SN 1572 could have been truly brighter than Venus, or it appeared brighter due to less extinction. However, the observations could have been restricted to evenings (*appeared ... towards the east*), because experienced naked-eye observers can compare objects to Venus, even if the latter is not visible at the very same time. Jupiter was well visible with SN 1572 at a brightness of −2 mag; from the fact that the new star was not compared to Jupiter, but Venus, we can conclude that the new star was much brighter than Jupiter, which is consistent only with SN 1572. Since the given size or brightness (*larger than Venus*, about −4 mag) is correct, according to other observations for November 1572 (e.g. in Korea, it was reported as "larger than Venus" since A.D. 1572 6 November);[41] it is quite likely that SN 1572 was observed in Yemen in November 1572; already in December 1572, SN 1572 was compared to Jupiter by Tycho Brahe.[42] There was no comet visible at around that time.[43]

Discussion

The word *najm* is used here for the new star; neither a tail nor any motion relative to other stars is mentioned so that we can consider it as star-like and not being a comet.

Since ᶜĪsā b. Luṭf Allāh, the author of *Rawḍ al-Rūḥ*, died in A.D. 1638/1639, he may have been an eyewitness of SN 1572, but possibly too young to have measured and/or remembered details. The connection of the new star with the death of his grandfather was probably an important narrative in his family, so that ᶜĪsā b. Luṭf Allāh knew about the new star. He also may have copied this text from another report (possibly shortened or otherwise modified); he could report observations of his teacher(s) or other contemporaries. Since he was the grandson of the leader (who died A.D. 1572), he was well informed about politics and other events in Yemen.

Summary

We presented Arabic reports from *Rawḍ al-Rūḥ* by ᶜĪsā b. Luṭf Allāh about observations of new stars in A.D. 1572/1573 and 1604, which can be identified with SNe 1572 and 1604.

For the new star in A.D. 1604, location (in the west in the zodiacal sign of Sagittarius, consistent with the constellation Ophiuchus), reported stationarity and/or taillessness as star-like transient celestial object (*najm of the nayāzik*), brightness roughly like Jupiter for a period of some 40 days, and then disappearance are all well consistent with SN 1604. If our conjecture (month change) is accepted, i.e., Jumādā I instead of Rabīᶜ I, then the brightness reported to be *as large as Jupiter* (−1.6 mag) would provide an additional constraint for the light curve; also, if the Yemeni observer indeed has observed the heliacal setting of SN 1604 around 22 November, this could provide a new data point or limit for the light curve;[44] one may also find additional and more precise measurements from Yemen and elsewhere in Arabia to study the brightness evolution of SN 1604 together with Korean and European observations to constrain the SN type.[45]

The Arabic observations of SNe 1572 and 1604 confirm reports from East Asia and Europe. It may well be possible to find more Arabic, and in particular Yemeni reports on

historic SNe, in particular maybe also about SN 1181, or more details about SNe 1572 and 1604, possibly even about those SNe which formed the Vela Jr and Cas A SNRs, which may otherwise have remained unobserved.[46] Due to the very southern location of the former (−46° declination), it may have been missed by all or most European and Eastern Asian observers, but could have been observed in Yemen. Since Yemeni observers have observed the SNe in 1006[47] and 1604, some others may have noticed new bright stars in the time in between.

Rawḍ al-Rūḍ is a credible source for astronomical events in the late sixteenth and early seventeenth centuries A.D. Its author, ᶜĪsā b. Luṭf Allāh, may possibly have been an eyewitness for the last decades. The timing of astronomical observations, however, is sometimes off by up to 2–4 weeks. Yemeni scholars have maintained a high level in astronomy to at least the early seventeenth-century A.D.

In previous centuries, Arabic scholars used wordings like *kawkab atharī* for SNe 1054 and the word *nayzak* in a more general sense for a *transient celestial object* (*comet* or *meteor* or *new star*), e.g., for SN 1006.

Tycho Brahe noticed the difference between two kinds of transient objects in the course of his measurements of SN 1572 and the comet of 1577; he used the term *nova* for tailless stationary transient celestial objects[48] (now, we distinguish between *nova* and *SN*). In the chronicle *Rawḍ al-Rūḍ* by ᶜĪsā b. Luṭf Allāh from Yemen, the difference is noticed at around the same time: the new star of A.D. 1604 is called a *najm of the nayāzik*, i.e., a star-like transient celestial object, and the new star of A.D. 1572 was called a *najm*, i.e., a star. We also saw that ᶜĪsā b. Luṭf Allāh called the comet of A.D. 1577 a *star with a tail* and [*one*] *of the nayāzik* and mentioned that it was moving; hence, he could clearly distinguish between moving new stars with tail (comets) and non-moving tailless new stars (novae/SNe).

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