THE HELIACAL RISE OF SIRIUS-
OBSERVATIONS AND COMPUTATIONAL ALGORITHM

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ABSTRACT

In this article are given in full details 3 first-hand observations of the heliacal rise of Sirius at two locations with very different atmospheric extinctions (0.36 and 0.16).

Then a simple to use formula is derived in which the arcus visionis of Sirius is a linear function of the atmospheric extinction.

In the end there is a concise practical manual of how to determine the extinction at a given place and then the arcus visionis and the day of the heliacal rise of Sirius.
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The heliacal rise of the brightest star has fascinated human imagination since times immemorial. It was one of the most important celestial events in ancient Egypt and Babylonia. In Egypt it was Sothis-Isis, embodiment of gods and its heliacal rise was the herald of the new religious year. With the start of the Egyptian sacred year and civil year coinciding every 1460 years, the heliacal rise of Sirius is of utmost importance for Egyptian and world chronology and history. In Babylonia it is well attested in MUL.APIN- the first textbook in Astronomy in cuneiform. It was a prominent event also in the meteorological almanacs from the classical era.

In modern Bulgaria, the brotherhood of the Danovists view Sirius as the star of the Divine Wisdom and its heliacal rise as the beginning of the sacred year. Many of them observe it diligently and with mystical fervour every August on the mountain tops of Rila near the seven lakes. Until now, there are very few published observations of the heliacal rise of Sirius and there is virtually no algorithm that may make possible its prediction. This study serves mainly to this purpose.

Using 3 first-hand observations of the heliacal rise of Sirius at two locations with very different extinctions I derive here a simple to use formula in which the arcus visionis of Sirius is a linear function of the atmospheric extinction. The work here is a continuation of my article from 2001 published in JHA.

Much more detailed version may appear soon in ‘The Babylonian Sky Observer’ or elsewhere.

THE METHOD

In the basis of my formula for the computation of the heliacal rise of Sirius is the simple arcus visionis (AV) method. Though that this method is generally flawed, it gives excellent results for celestial objects brighter than -1.0 mag. because they rise heliacally very close to the horizon.

THE OBSERVATIONS

To construct my formula I use 3 personal first-hand sightings of the morning appearance of Sirius. I have observed with absolute certainty the heliacal rise of Sirius 3 times- once in Bulgaria and twice in Seattle. I have another observation in Bulgaria from 2004 which is useful but not so certain and I can use also for comparison observations made by Filip Filipov and other Danovists in Bulgaria in the Rila mountains.

There was a lucky circumstance which allowed for confident derivation of the formula. The atmospheric extinctions around Varna, Bulgaria and Seattle, USA are very different. In Bulgaria it is 0.36 (+-0.10) and in Seattle it is 0.16 (+-0.04). I measured the extinctions at the aforesaid places numerous times observing the altitude at which the stars rise in night.

THE 2003 SEATTLE SIGHTING

DIARY FOR AUGUST 18, 19, 2003, QUEEN ANNE, SEATTLE, USA. The vista point at 5th Ave. N and Lynn str., on Queen Anne hill, 122° 19’ West longitude, 47° 39’ North latitude.

August 18  Very clear night. 1:20 to 4:30 AM Aurora Borealis… At 5:35 AM Sirius twinkled once only at the absolute limit of my vision. The altitude of the Sun was -6° and Sirius: +1.4° Their azimuthal distance (dAZ) was: 54°. At 5:42 AM Sirius twinkled several times again at the absolute limit of my vision. Sun: -5°, Sirius: +2.4°.  dAZ: 54°. AV of Sirius for the day: 7.3°.

I cannot consider this day for the Morning First (MF = heliacal rise) of Sirius because it was on the absolute threshold of perception. However this is important observation since it gives assurance that it is possible to see the MF of Sirius with 7.3° AV if only the extinction was lower...

Observations like this, when I hardly see the star and only for parts of the second, I call ‘SPOT’ observations. They are very valuable inasmuch as they point to the lower limit of the AV of the star. If we have ‘spot’ observations of a star then we can easily find out the critical value of its arcus visionis. When the AV of a star reaches, on a particular day, a value greater than this ‘critical AV’ then the star heliacally rises. In contrast to this, most of the time we have no choice but to work with the observational arcus visionis, i.e. the value of the AV for the day when the star first appeared. Because the AV of the stars
change discreetly, i.e. jumping with a certain value every day, it is not possible to pinpoint the exact critical value for the AV. The daily jump in the AV depends on many factors and in most cases is between 0.1° and 1.0°. For Sirius it is around 0.8° to 1.0° for the temperate latitudes.

**August 19 MF** Clouds here and there with a lot of clear skies between them.  
4:56 AM start. At 5:27 saw Sirius with binoculars touching the crest of the mountains (0.75° altitude)  
5:28 Sirius twinkled 3 times (flashed and vanished) and disappeared. 5:29 to 5:35 Sirius flashed 5 times in one minute very powerful. 5:35 to 5:43 Sirius flashed once in a minute. 5:43: Sirius disappeared. Best was seen around 5:30. The whole time Sirius was observed on orange background of the sky. Sirius twinkled, flashed extremely strong light, every time with different colour, for parts of the second, like an explosion, and then disappeared only to come back again... It never had steady light, but its rise was spectacular! AV of Sirius for the day: 8.2°. Azimuthal distance with the Sun 55°. This is the day of the heliacal rise of Sirius. I continued to observe Sirius the next days too. Here is a table summarizing my observations.

**TABLE 1, THE HELIACAL RISE OF SIRIUS IN SEATTLE IN 2003**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>V</td>
<td>Time</td>
<td>Alt</td>
<td>Alt</td>
<td>Time</td>
<td>Alt</td>
<td>Alt</td>
<td>dTime</td>
<td>AV</td>
<td>Perception</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sun</td>
<td>Sirius</td>
<td></td>
<td>Sun</td>
<td>Sirius</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Spot</td>
<td>9:35</td>
<td>-6°</td>
<td>1.4°</td>
<td>5:42</td>
<td>-5.0°</td>
<td>2.4°</td>
<td>Parts of second</td>
<td>7.3°</td>
<td>1 spot</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>MF</td>
<td>5:28</td>
<td>-7.3°</td>
<td>0.9°</td>
<td>5:43</td>
<td>-5.0°</td>
<td>3.1°</td>
<td>15 min</td>
<td>8.2°</td>
<td>5 flash</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>5:28</td>
<td>-7.5°</td>
<td>1.5°</td>
<td>5:48</td>
<td>-4.5°</td>
<td>4.5°</td>
<td>20 min</td>
<td>9.0°</td>
<td>5 flash</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Steady</td>
<td>5:22</td>
<td>-8.6°</td>
<td>1.2°</td>
<td>5:50</td>
<td>-4.4°</td>
<td>5.3°</td>
<td>28 min</td>
<td>9.8°</td>
<td>7 steady</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>5:13?</td>
<td></td>
<td></td>
<td>5:53</td>
<td>-4.3°</td>
<td>6.8°</td>
<td>40 min</td>
<td>11.4°</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>5</td>
<td>-13°</td>
<td>0.85°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.7°</td>
<td>8</td>
<td></td>
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<tr>
<td>28</td>
<td></td>
<td>4:51</td>
<td>-14.7°</td>
<td>0.70°</td>
<td>6:07</td>
<td>-3.2°</td>
<td>11.3°</td>
<td>76 min</td>
<td>15.4°</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>4:48?</td>
<td></td>
<td></td>
<td>6:09</td>
<td>-3.2°</td>
<td>12°</td>
<td>81 min</td>
<td>16.2°</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

18 Aug: spot sighting i.e. Sirius seen only for parts of the second 19 Aug: Heliacal Rise of Sirius (Morning First) Sirius seen easily. 21 Aug: first day with steady light (from 5:28 to 5:34)

**Explanations to table 1**: In column 2: V: the visibility rated from 0 to 12. In column 3: Time>: time of first appearance of Sirius. In column 4: Alt Sun>: the altitude of the Sun when Sirius appeared. In column 5: Alt Sirius>: the altitude of Sirius when first appeared. In column 6: Time X: time of disappearance of Sirius. In column 7: Alt Sun X: the altitude of the Sun when Sirius disappeared. In column 8: Alt Sirius X: the altitude of Sirius when disappeared. In column 9: dTime: time length of observation of the star in minutes. In column 10: AV: the Arcus Visionis of Sirius for the day. In column 11: Perception: degree of clear perception of Sirius from 0 to 10. After Aug 27, on any clear day, Sirius usually was to appear with around 0.7 – 0.8° of altitude and disappear when the Sun has reached -3.2° altitude. The azimuthal distance Sun-Sirius these days was around 60°.

**THE 2005 SEATTLE SIGHTING**
DIARY FOR AUGUST 18, 19, 2005, QUEEN ANNE, SEATTLE, USA
The vista point at 5th Ave. N and Lynn str., on Queen Anne hill, 122° 19’ West longitude, 47° 39’ North latitude.

**August 18** Clear night with clouds up to 3° altitude.  5:37 AM Saw Sirius with binoculars above the clouds (2° altitude) 5:52 AM End of observation. Did not see Sirius with naked eye.

**August 19 MF** Clear. Thick fog up to 3° altitude. Very damp.  2:59 AM start. 5:27 saw Sirius with binoculars at 15 arcmin. over the crest of the mountains (1° altitude). 5:30 Sirius twinkled once and vanished on orange background. 5:34 Sirius twinkled weak 5 times in one minute. 5:36 to 5:37 Sirius flashed strong 3 times. 5:44 Sirius twinkled weak 5 times in one minute. 5:47: Sirius disappeared. Best was seen around
5:36. The whole time Sirius was observed on orange background of the sky. Sirius twinkled, appeared and then disappeared during the whole time. He never had steady light. Its light was weak, blunt. AV of Sirius for the day: 8.6°. Azimuthal distance with the Sun 55°. This is the day of the heliacal rise of Sirius in 2005.

**TABLE 2, THE HELIACAL RISE OF SIRIUS IN SEATTLE IN 2005**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>9</th>
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<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Vis</td>
<td>Time</td>
<td>Alt</td>
<td>Alt</td>
<td>Time</td>
<td>Alt</td>
<td>Alt</td>
<td>dTime</td>
<td>AV</td>
<td>Perception</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>MF</td>
<td>5</td>
<td>5:30</td>
<td>-7.0°</td>
<td>5:47</td>
<td>-4.5°</td>
<td>4.0°</td>
<td>17 min</td>
<td>8.6°</td>
<td>2 twinkle</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>5:26</td>
<td>-7.9°</td>
<td>1.5°</td>
<td>5:46</td>
<td>-4.9°</td>
<td>4.4°</td>
<td>20 min</td>
<td>9.0°</td>
<td>3 twinkle</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>3</td>
<td>5:24</td>
<td>-8.6°</td>
<td>1.2°</td>
<td>5:42</td>
<td>-5.7°</td>
<td>4.4°</td>
<td>18 min</td>
<td>10.1°</td>
<td>3 twinkle</td>
<td></td>
</tr>
</tbody>
</table>

**COMPARISON BETWEEN THE 2003 AND 2005 HELIACAL RISE OF SIRIUS IN SEATTLE**

In the course of the last 5 years of observations in Seattle, in the period 2001-2005 I have seen that one and the same star does appear on the same date, provided it is brighter than +1.5 mag. In comparison I have observed how stars around +3.0 mag. appeared, in 2005, 3 days later than they did in 2003. Even the heliacal sighting of the bright stars were very different in strength of perception and beauty, if you want, in 2003 and 2005. The year 2003 had a very dry and clear summer while the summer of 2005 was much more humid and cloudy. As a result the morning-first risings of the stars in 2005 were blurred and not so exiting and easily detected.

In 2003 I spot-saw Sirius on the 18th of August with 7.3° AV. On the same date in 2005 Sirius had an AV of 7.8° but I was able to see it only with binoculars! Although that Sirius rose on the same date both years, its ‘way’ of rising was quite different. In 2003 Sirius flashed a bright red color for part of the second, then disappeared, then came back after a minute flashing extremely powerful blue, stayed for few seconds and vanished and then came back powerful green-white… Nothing of the sort happened in 2005. Sirius rose blunt white-grey and on the border of perception. It was boring and disappointing. The difference is in the quality of the atmosphere. In 2003 the extinction was 0.16, but on 19th of August 2005 I measured the extinction to be 0.20. When I became aware of the strong difference in the perception of the risings of Sirius, I remembered the passage by Cicero in his ‘De divinatione’ where he narrates how the ancient Greeks conjectured about the quality of the air and consequently the quality of the harvest by the heliacal rise of Sirius! Now, I can make a table with my 3 observations of its heliacal rise … The data and diary of my observation in Bulgaria are published in JHA, May 2001.

**TABLE 3, THE HELIACAL RISE OF SIRIUS IN VARNA AND SEATTLE**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>7</th>
<th>8</th>
<th>9</th>
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<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place</td>
<td>Date</td>
<td>V</td>
<td>Ext.</td>
<td>dAZ</td>
<td>T</td>
<td>T</td>
<td>X</td>
<td>dT</td>
<td>Alt Sun</td>
<td>Alt Sirius</td>
<td>Alt Sun</td>
<td>Alt Sirius</td>
<td>Alt of Night-Rise</td>
<td>AV</td>
</tr>
<tr>
<td>Varna Bulgaria</td>
<td>2000 Aug 17</td>
<td>3</td>
<td>0.36</td>
<td>53°</td>
<td>4:32</td>
<td>30</td>
<td>4:44</td>
<td>30</td>
<td>12 min+</td>
<td>8.1°</td>
<td>2.7°</td>
<td>6.1°</td>
<td>4.7°</td>
<td>1.3°</td>
</tr>
<tr>
<td>Seattle USA</td>
<td>2003 Aug 19</td>
<td>5</td>
<td>0.16</td>
<td>55°</td>
<td>5:28</td>
<td>5:43</td>
<td>15 min</td>
<td>7.3°</td>
<td>0.9°</td>
<td>5.0°</td>
<td>3.1°</td>
<td>&lt;=0.7°</td>
<td>8.2°</td>
<td></td>
</tr>
<tr>
<td>Seattle USA</td>
<td>2005 Aug 19</td>
<td>5</td>
<td>0.20</td>
<td>55°</td>
<td>5:30</td>
<td>5:47</td>
<td>17 min</td>
<td>7.0°</td>
<td>1.5°</td>
<td>4.5°</td>
<td>4.0°</td>
<td>&lt;=0.7°</td>
<td>8.6°</td>
<td></td>
</tr>
</tbody>
</table>
Explanations to table 3:
In column 4: Ext: the extinction. In column 5: dAZ: the azimuthal difference between the Sun and Sirius

THE FORMULAE

We will write two formulae, one for the observational arcus visionis and another for the critical arcus visionis. The observational AV is the AV observed on the day of the heliacal rise of Sirius. The critical AV is not observed but rather inferred value. We can use spot observations or other ways to ascertain it. When the AV of Sirius on a certain day becomes greater than the critical value, the star becomes visible for the first time.

FORMULA WITH THE OBSERVATIONAL AV

If we build an equation with E (the extinction), using the observational AV’s at Seattle and Varna and solving for the AV, it will be: \[ \text{AV}^\circ = 6.12^\circ + E \times 13 \] (f 1)
This formula assumes linear dependency and an azimuthal distance between the Sun and Sirius of around 50° +/- 10°. Both assumptions I estimate do not take too much toll on the exactness.

FORMULA WITH THE CRITICAL AV

Now we can try to figure out the formula with the critical arcus visiones.
For Seattle, the spot AV of Sirius (from Aug 18) is 7.3° and the observational AV is 8.2°. We can safely assume a critical value of 7.8°.
For Varna I do not have spot observations for Sirius. From the observations of the Danovists, however, which result in 10° to 11° AV, I can assume that the critical AV for Varna should be somewhere around 10.4°.
The formula then, constructed with these critical AV’s, will be: \[ \text{AV}^\circ = 5.72^\circ + E \times 13 \] (f 2)

HOW TO COMPUTE THE HELIACAL RISE OF SIRIUS

A SHORT PRACTICAL GUIDE

This article would not be worth much without empowering the reader with enough practical knowledge in order to be able to predict the day of the heliacal rise of Sirius. Here are the necessary steps:

FINDING OUT THE ZENITH LIMITING MAGNITUDE

The zenith limiting magnitude is the magnitude of the faintest star that we can see in the zenith. We observe the area around the zenith looking for faint stars with a star-atlas or computer program at hand. If we can see stars of magnitude 4 we search for these that are 4.5 or 5 and so on. If we can see the Milky Way then the limiting magnitude is at least 5 and most probably 5.5 or even 6. In or close to urban centers the limiting magnitude is around 4.5 at best.

FINDING OUT THE ATMOSPHERIC EXTINCTION

The atmospheric extinction for a given place shows how many star-magnitudes are extinguished by one earth atmosphere. In the best case, in a dry mountain desert, the extinction will be around 0.10. In the worse case, around some sea coasts, it may reach 0.40 and even 0.50.
There are some scholars who like to think that they can compute the extinction from temperature, pressure, humidity et cetera. The truth is that the only way to know what is the extinction for a given geographical region is to measure it practically. To do this we must observe the rise or set of stars in deep nights with clear sky. We should do this several nights with stars of magnitude between +2 and 0.
First with the help of a computer program we note the time of the astronomical rise of the stars in question. Then we must go to a suitable place and have at least 20 minutes for our eyes to adjust to night vision. Then, knowing the place on the horizon where the star is supposed to show, we observe patiently until the star shows up. When we see the star for the first time we note the exact time and also the perception of the star, e.g. is it twinkling, flashing or is it steady in light et cetera. Then we must find out the altitude of the star when it became visible to the naked eye for the first time. This is the altitude of the ‘night rise’ of the star. Some call it ‘the extinction angle’ of the star. We can measure the altitude of the star with special instruments used by navigators (sextant), geologists (teodolit) or the military, that can measure altitude of objects and angles. Or we may use a computer program with which, knowing the time we could easily see the altitude of any star.
After we assess the altitude of the star at the moment when it first became visible we have to figure out through how many earth atmospheres (or airmasses) did the light of the star pass in order to reach our eyes. Here a small digression will be helpful. As we look to a star in the zenith, its light passes through 1 earth atmosphere. However, if we look at a star situated close to the horizon, its light has to pass through much thicker layer of air that is measured in numbers of earth atmospheres called also airmasses. The light of a star on the horizon for example passes through thickness of air equivalent to 38 atmospheres.

So, there is a certain number of airmasses corresponding to every possible altitude. At altitude of 90° (zenith) it is 1 airmass (atmosphere). At altitude of 0° (horizon) it is 38 airmasses. We consult table 4 to find out the number of the airmasses.

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Airmasses</th>
</tr>
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<tbody>
<tr>
<td>90°</td>
<td>1</td>
</tr>
<tr>
<td>20°</td>
<td>2.9</td>
</tr>
<tr>
<td>15°</td>
<td>3.82</td>
</tr>
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<td>10°</td>
<td>5.6</td>
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<tr>
<td>7°</td>
<td>7.77</td>
</tr>
<tr>
<td>5°</td>
<td>10.4</td>
</tr>
<tr>
<td>4°</td>
<td>13.4</td>
</tr>
<tr>
<td>3°</td>
<td>16.3</td>
</tr>
<tr>
<td>2°</td>
<td>22</td>
</tr>
<tr>
<td>1°</td>
<td>28</td>
</tr>
<tr>
<td>0.5°</td>
<td>33.5</td>
</tr>
<tr>
<td>0°</td>
<td>38</td>
</tr>
</tbody>
</table>

The formula for the visible magnitude of a celestial object anywhere in the sky is:

\[ \text{Visual magnitude} = \text{Mag.} + \text{Extinction} \times (\text{number of airmasses}) \tag{3} \]

Suppose Jupiter in the zenith is with -2 mag.

Then at altitude of 1° degree and at place with extinction of 0.20 Jupiter will be bright:

Visual mag. of Jupiter= -2 mag. + 0.20 \times 28 = -2 + 5.6 = +3.6

Now, whether we will see Jupiter, at +1° altitude, depends on the zenith limiting magnitude.

If the zenith limiting magnitude is brighter than +3.6 (mathematically < +3.6), then we will not see Jupiter.

Suppose the limiting magnitude is 3.3. This means that we hardly see star in the zenith with magnitude of 3.3. If this is the case then we certainly will not be able to see a less bright star at 1° altitude!

The logic here is that a celestial object has its brightness diminished as it goes closer to the horizon and at the end vanishes from sight when reaching the zenith limiting magnitude...

Now if we put down for the visual magnitude of the star to be equal to the zenith limiting magnitude, this will be the moment when the star is becoming visible when rising (or invisible when setting)

\[ \text{Visual mag.} = \text{Mag.} + \text{Extinction} \times (\text{number of airmasses}) = \text{Zenith Limiting Mag.} \tag{4} \]

We can transform the formula so that the extinction can come on the left side:

\[ \text{Extinction} = (\text{Zenith Limiting Mag.– Mag. Of star}) / (\text{number of airmasses}) \tag{5} \]

**EXAMPLE**

Observations data: 12th of February, 2004 Seattle, The vista point at 5th North ave. and Lynn str. in Queen Anne Clear Night. 11:00 PM start At 11:06 PM Spica becomes visible, Mag.= +1.0 ; alt. = +1.8°

At 11:17 PM Vega becomes visible, Mag.= 0.0 ; alt. = +0.65°.

At this location I have measured the Zenith limiting magnitude to be 5.0 on very clear nights.

The number of the airmasses for the altitudes of Spica and Vega can be interpolated by hand from the table or with my computer program Babylonia 4.0. Now we can compute the atmospheric extinction for the Queen Anne hill in Seattle.

With the data for Spica: Extinction = (Zenith Limit Mag. – Mag. Of star) / (number of airmasses) = Extinction = 5 – 1 / 23.2 = 4 / 23.2 = 0.17

With the data for Vega: Extinction = 5 – 0 / 31.8 = 5 / 31.8 = 0.16

( If we use 4.5 mag. for the Zenith Lim. Mag. we will have respectively 0.15 and 0.13 for the extinction )

Now when we know the extinction for a given place, we can easily compute the arcus visionis of Sirius for the day of its supposed heliacal rise. The next step will be to use a computer program with a planetarium and find out the day when Sirius will have the just computed arcus visionis. For the purpose we put Sirius exactly on the horizon and then look up at the altitude of the Sun below horizon. When it reaches the arcus visionis of Sirius, this is the day of its heliacal rising.

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REFERENCES

   The information of great interest is in chapter 21, paragraphs 10-11. For many of the Egyptologists
   this is a key piece of information for the purpose of chronology and in the developing of the theory of
   the Great Sothic Cycle. Here is the original Latin and my English translation of this passage:
   ‘Sed horum initia semper a primo die mensis eius sumuntur cui apud Aegyptios nomen est
   Thoyth, quique hoc anno fuit ante diem VII Kal. Iul., cum abhinc annos centum imperatore
   Antonino Pio II et Bruttio Praesente Romae Coss. idem dies fuerit ante diem XIII Kal. Aug.,
   quo tempore solet canicula in Aegypto facere eortum. Quare scire etiam licet anni illius
   magni, qui, ut supra dictum est, solaris et canicularis et dei annus vocatur, nunc agi
   vertentem annum centensimum’

   ‘But their beginning always starts from the first day of the month whose name among the Egyptians
   is Thot, and in this year it was the 7th day before the Kallendes of July and from now 100 years ago
   during the second consulate of the emperor Antoninus Pius and Brutius Praesens, the same day was
   the 13th before the Kallendes of August at what time usually Sirius appears in Egypt. From these it
   is possible to know that now is passing the 100th year of that great year which, as was said above, is
   being called solar and canicular and year of the God.’

   Explanations to the superscripts in the translated text:
   1: of the different Egyptian eras;
   2: +238, the year Censorinus was writing his book;
   3: 25th of June;
   4: +139;
   5: 20th of July;
   6: In some manuscripts it is the 12th before the Kallendes of August i.e. 21st of July. Many authors opt
      for this version. I think that 20th of July is the more probable case. Please see the end of the this
      note;
   7: the Sothic cycle of 1460 tropical years which Censorinus discussed in chapter 18;
      It is the 20th of July Censorinus is writing about since, there are also 25 days between the 25th of June
      and the 20th of July which is exactly the number of days with which the heliacal rise of Sirius would
      shift in 100 years of the Egyptian civic calendar (which had only 365 days)

   OrientForschung, BeiHeft 24, Horn, Austria, 1989
   In Tablet I, ii 42 is said that Sirius rises on 15th of Duuzu when also the summer solstice occurs.

3. Many Greek and Roman authors wrote astrometeorological almanacs called sometimes ‘parapegma’.
   Aratus, Geminus, Ptolemy among them.

4. The Danovists or the ‘White Brotherhood’ as they call themselves are followers of the Bulgarian
   spiritual teacher Peter Danov (passed away in 1945). The data reported here comes through Filip
   Filipov- a member of the brotherhood and a hobby astronomer from Varna, Bulgaria.

5. For bright objects the function approaches linearity.

6. Rumen Kolev ‘Witnessing the Heliacal Rise of Sirius ad Procyon’ Journal for the History of Astronomy,

7. This journal ‘The Babylonian Sky Observer’ is edited by me.

8. The simple AV method uses only the altitude of the Sun when the star is exactly on the horizon.

9. Look in the end of the article in the section ‘Finding the Atmospheric Extinction’.