

## ***The Great American Eclipse of 2017: Halachic and Philosophical Aspects***

**By: JEREMY BROWN**

On Monday, August 21, 2017, millions of people across the United States will experience one of nature's most dramatic phenomena. For a couple of minutes, the shadow of the moon will block the summer sun and plunge those on the ground into total darkness. In the middle of a summer's day, the birds will stop singing, sunlight will disappear, and the stars will become visible. The total eclipse will race across the continental United States at a speed of up to 3,000 miles per hour. At 10:18 a.m. local time, the total solar eclipse will first become visible in northern Oregon, about an hour's drive south of Portland. Then it will move in a gentle southeasterly direction. The eclipse will pass through Idaho Falls, Idaho; and Lincoln, Nebraska becomes dark at 11:37 a.m., local time. Kansas City will be on the very edge of the eclipse and, as the shadow of the moon turns south, Saint Louis, Missouri will experience only a partial eclipse. Nashville, Tennessee is luckier. The entire city will experience a total eclipse at 11:58 a.m., and it will go eerily dark there for almost two minutes. The eclipse races across the Blue Ridge Mountains and over Greenville, South Carolina, before it is seen over Charlotte at 1:16 p.m. local time. A couple of minutes later the eclipse sweeps into the Atlantic Ocean, becoming visible only to those at sea, before it disappears forever with sunset just southwest of Cape Verde.

Although solar eclipses are not rare, the visibility of the 2017 eclipse to so many Americans is without precedent in recent times. It provides us with an opportunity to review classic and modern Jewish teachings on the causes of, and religious responses to, a solar eclipse. In this paper, we will review the Talmudic understanding of why eclipses occur, and the friction this creates with our scientific understanding of the same phenomenon. We will then review the religious urge to mark a solar eclipse with a blessing, and close with less well known halachic questions that the occasion of a solar eclipse might raise.

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## The Talmud and the Science

The classic Talmudic source on the origins of a solar eclipse is found in *Succah* 29a:

תנו רבנן: בשביל ארבעה דברים חמה לוקה: על אב בית דין שמת ואינו  
נספד כהלכה, ועל נערה המאורסה שצעקה בעיר ואין מושיע לה, ועל משכב  
זכור, ועל שני אחין שנשפך דמן כאחד

Our Rabbis taught: A solar eclipse occurs on account of four things: Because the *Av Beis Din* died and was not properly eulogized, because a betrothed woman was raped in a city and none came to rescue her, because of homosexuality, and because of two brothers who were murdered together.

It is challenging to find a common thread to these four events that would satisfactorily relate them to a solar eclipse, and Rashi despaired of doing so: *לא שמעתי טעם בדבר*—“I do not know of an explanation for this.”<sup>1</sup>

As we now understand the phenomenon, a solar eclipse occurs when the moon gets in-between the sun and the earth. When it does, it blocks some of the sunlight and casts a shadow on the earth. A person standing in that shadow (called the umbra) will see an eclipse (see Figure 1). The time at which the moon is directly between the sun and the earth is also the start of every Jewish month (or close to it, as we will see below). And so it is clear that a solar eclipse can only occur on (or very close to) Rosh Chodesh. However, we certainly do not witness a solar eclipse on every Rosh Chodesh. The reason is that the moon’s orbit is inclined at 5 degrees from the sun-earth plane, so that each month the moon may be slightly above, or slightly below that plane. However, an eclipse will occur only when the three bodies line up on the same plane, which only occurs infrequently.

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<sup>1</sup> See R. Shmuel Eliezer Eidels (Maharsha), *Chiddushei Aggados, Succah* 29a. The Maharsha can explain only the first two sins. For an explanation of how a solar eclipse is reflected in all four sins, see R. Yaakov Ettlinger, *Aruch LaNer, Sichah* 29.

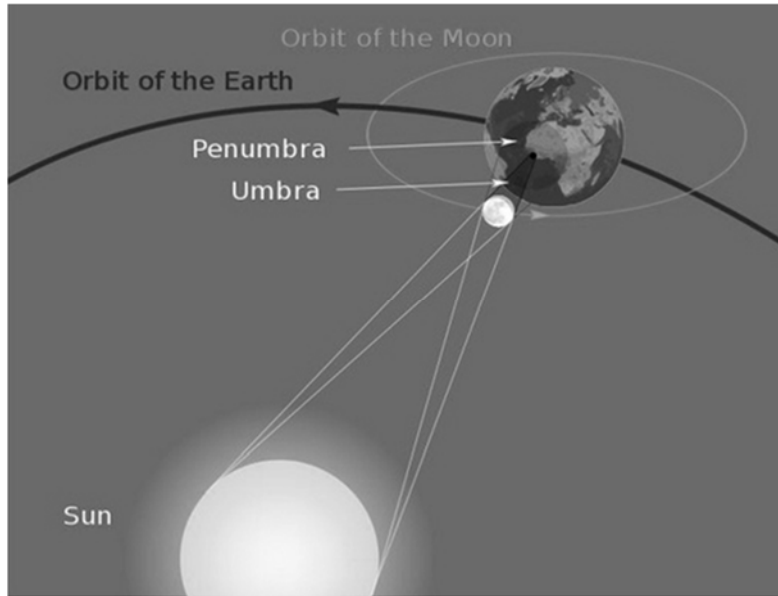


Figure 1.

If we know that a solar eclipse is a regular celestial event whose timing is predictable and precise, how are we to understand Talmud in *Succab*, which suggests that it is a Divine response to human conduct? We have already noted that Rashi was unable to explain the passage, but this did not prevent others from trying to do so. The Maharal of Prague (d. 1609) has a lengthy explanation in his work *Be'er Hagolah* which, for the sake of clarity, we shall summarize. The Maharal acknowledged that an eclipse is a mechanical and predictable event but he further suggested that if there was no sin, there would indeed never be a solar eclipse. G-d would have designed the universe differently, and in this hypothetical sin-free universe our solar system would have been created without the possibility for a solar eclipse. The conclusion from the Maharal's writings is that in a sin-free universe, the moon would not orbit as it does now, at a 5-degree angle to the sun-earth plane. But we now need to ask where, precisely, in a sin-free universe, *would* the moon be? It couldn't be in the *same* plane as the sun and the earth, since then there would be a solar eclipse *every* month. If the moon were, say, 20° above the earth-sun plane, there would still be solar eclipses, though they would be rarer than they are today. The only way for there to be no solar eclipses in the Maharal's imaginary sin-free universe would be for the moon to orbit the earth at 90° to the sun-earth axis. Then it would never come between the sun and the earth, and there could never be a solar eclipse. But this would lead to another problem. In such an orbit, the moon would always be visible, and so there could never

be a Rosh Chodesh. The Maharal's thought experiment seems to provide more complications than it does solutions.

Another attempt to explain the Talmud was offered by R. Yonason Eibenschutz (d. 1764). In 1751, R. Eibenschutz was elected as Chief Rabbi of the Three Communities (Altona, Hamburg and Wandsbek), although he was later accused of being a secret follower of the false messiah Shabsai Tzvi. In January 1751, R. Eibenschutz gave a *drashah* in Hamburg in which he addressed the very same problem that Maharal had noted: If a solar eclipse is a *predictable* event, how can it be in response to human conduct? His answer was quite different. The Talmud in *Succah* is *not* actually addressing the phenomenon that we call a solar eclipse. According to R. Eibenschutz, the phrase in *Succah* "בזמן שהחמה לוקה" actually means "when there are sunspots."

Inventive though this is, there are two problems with this suggestion. In the first place, sunspots were almost impossible to see before the invention of the telescope.<sup>2</sup> The first published description of sunspots in Western literature was in 1611 by the largely overlooked Johannes Fabricius<sup>3</sup> and later by a contemporary of Galileo named Christopher Scheiner (though Galileo quickly claimed that *he*, not Scheiner, was the first to correctly interpret what they were).<sup>4</sup> Because sunspots are so difficult to see with the naked eye, it seems very unlikely (though not impossible) that this is what the Rabbis in the Talmud were describing. Second, according to R. Eibenschutz, sunspots "have no known cause, and have no fixed period to their appearance." However, and even by the science of his day, this claim is not correct. In fact, both Scheiner and

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<sup>2</sup> There is, however, evidence of naked-eye observations of sunspots, so R. Eibenschutz's suggestion, implausible though it is, is not impossible. For example, the formal chronicle of the Chinese Song dynasty, *Soṅ ngshǐ* (CE 960–1279), includes descriptions of many naked-eye observations of the sun and moon. Among these are at least 38 observations of sunspots, like these: "On 11 January CE 1077, in the sun were black spots (*bēizǐ*) as large as plums. They disappeared on 22." "On June CE 1145, in the sun were black vapors (*bēiqǐ*) shifting back and forth." See Hayakawa et al., "Records of sunspot and aurora during CE 960–1279 in the Chinese chronicle of the Soṅ ng dynasty," *Earth, Planets and Space* (2015) 67:82. See also Vaquero J.M. and Vázquez M., *The Sun Recorded Through History* (Heidelberg: Springer, 2009), pp. 67–85.

<sup>3</sup> Johannes Fabricius. *Phrysi De Maculis in Sole Observatis, et Apparente earum cum Sole Conversione Narratio*. Wittenberg. Impensis Johan Borneri Senioris & Eliae Rehfeldii, 1611. For details about Fabricius see Galileo G., Scheiner C., *On Sunspots* (trans. Reeves E. and Van Helden A.), (Chicago: University of Chicago Press, 2010), pp. 30–34.

<sup>4</sup> Heilbron, J.L. Galileo. (Oxford: Oxford University Press, 2010), pp. 183–192.

Galileo knew—and wrote—that sunspots were permanent (at least for a while) and moved slowly across the face of the sun in a predictable way.<sup>5</sup> The suggestion that these spots are a response to human activity is therefore difficult to sustain. Furthermore, while a total solar eclipse is strikingly visible to those who are in its shadow, sunspots are, as we have noted, incredibly difficult to see with the naked eye. It would therefore make little sense to declare that these invisible sunspots serve as a warning (סימן רע) to humanity. Finally, the Talmud describes the phenomenon of a ליקוי as being visible in only some places on the earth. While this is a perfect description of a solar eclipse, sunspot activity would be visible from any place on earth, a situation that is clearly not the one described in the Talmud.

A different suggestion was offered by R. David Pardo (1718–1790) in his work *Chasdei David*, published in 1796. R. Pardo acknowledged that most solar eclipses are indeed predictable events, but suggested that there are other kinds of eclipses that cannot in fact be predicted, and it is these kinds of eclipses to which the Talmud is referring. Unfortunately, this suggestion has no factual basis. There are no such phenomena as an unpredictable lunar or solar eclipse, and R. Pardo's suggestion is untenable.

R. Menachem Mendel Schneerson, the Lubavitcher Rebbe, also addressed the Talmudic passage, and in a 1957 responsum he wrote that while a solar eclipse was predictable, the local weather was most certainly not. It could not be predicted whether or not a solar or lunar eclipse would be visible through the clouds, and since it was this aspect that was under Divine control, it presumably could change in response to the local

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<sup>5</sup> It is interesting to note that Galileo got very excited about the discovery that the spots moved across the face of the sun. This suggested (though it did not prove) that the sun itself was spinning. Galileo had also discovered that Jupiter was orbited by moons. Both of these discoveries added further support to the Copernican model in which the earth was spinning on its own axis, and was not the center of all the movement of objects in the sky. But R. Eibeschutz did not believe Copernicus was correct: “Copernicus and his supporters have made fools of themselves when they declare that the earth orbits [the sun]. They have left us with a lie, and the truth will bear itself witness that the Earth stands still forever” (R. Yonason Eibeschutz, *Ya'arot Devash* [Jerusalem: Even Yisroel, 1990], p. 127). R. Eibeschutz wanted to have sunspots explain away a Talmudic mystery, but he dismissed the evidence that they provided in other matters—namely, that the earth moves. For a detailed review of R. Eibeschutz and his rejection of the Copernican model, see my *New Heavens and a New Earth* (Oxford: Oxford University Press, 2013), pp. 155–158.

actions of people.<sup>6</sup> Elegant as this might be, this suggestion, too, has considerable problems. In the first place, the weather is indeed predictable, although of course the ability to predict the weather is relatively limited. But more problematic is the fact that a total solar eclipse will be completely visible whether or not there are clouds. A cloudy day will prevent a viewer on the ground from witnessing the moment of conjunction as the moon covers the disc of the sun, and also prevent him from seeing the stars. However, the other effect of a total solar eclipse—darkness as though it were night—will be just as visible.

### On the *Molad* and Astronomical Conjunction

The 2017 solar eclipse will bring to our attention another issue. It will occur on August 21, 2017, when the moon is directly between the sun and the earth (or, more technically, when the sun and the moon have the same *elliptical longitude*). This will start at sunrise over the Pacific Ocean northeast of Hawaii, at 4:48 p.m. UTC, or 6:48 p.m. in Jerusalem. The announced time for the *molad* of Rosh Chodesh Elul, however, is Tuesday, August 22, at 10:44 a.m. and 15 *chalakim*—about 16 hours later. The solar eclipse is therefore a visible reminder that the *molad* we announce on the Shabbos preceding Rosh Chodesh represents a theoretical time only, and has no relationship to an astronomical phenomenon. The announced *molad* is calculated by using the length between one new moon and the next. This figure assumes that every lunar month is of equal length, 29 days, 12 hours 44 minutes and 3 1/3 seconds.<sup>7</sup> The Jewish calendar is based on the axiom that all future times of the *molad* are based on the theoretical time for the first *molad*, which was in *Tishrei* of the first year of Creation. This is assumed to have occurred on a Monday night, at five hours and 204 *chalakim*—a time that occurred only in theory since, according to Jewish tradition, the world had not been created at that time.<sup>8</sup> To determine the time of any *molad* since then, we simply add 29 days, 5 hours and 204 *chalakim* for each month from the primordial *Tishrei*. But this calculated time differs from the actual length of time between one new month and the next, which is not constant. For this reason, the times announced for

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<sup>6</sup> *Iggerot Kodesh* 15:1079. See also יצחק יהודה רוזן, בשביל ארבעה דברים מאורות לוקין. תחומין כד: 517–520.

<sup>7</sup> Rambam, *Hil. Kiddush HaChodesh* 6:3.

<sup>8</sup> This primordial epoch is referred to as בהר"ד, where ב = the second day of the week, Monday; ה = the fifth hour of the day (which we assume starts at 6 p.m., which would make the fifth hour 11 p.m.); ד = 204, the number of *chalakim*. See *Tur Orach Chaim*, 427; Rambam, *Hil. Kiddush HaChodesh* 6:8; *Tosafos, Rosh Hashanah* 8a s.v. *LiTekufos*.

the *molad* are not astronomically accurate—and, as we have seen, this can result in a discrepancy of more than 16 hours between the astronomical conjunction and the calculated Jewish conjunction.

### Halachic Aspects of a Solar Eclipse

There are two categories of questions surrounding a solar eclipse. The first focuses on the technical aspects of the eclipse as a natural phenomenon, and the second on the eclipse as an omen of tragedy.

#### 1. Publicizing the date of a forthcoming eclipse

The *Mishnah Berurah* rules that it is forbidden to tell another person that a rainbow is visible, because this violates the prohibition of slander (מוציא דבה).<sup>9</sup> Since it appears as a sign of human sin, it might be suggested that it would also be forbidden to announce the time of a future solar eclipse. However, unlike a rainbow, a solar eclipse may be entirely predicted, and on the basis of this, R. Avigdor Nebenzahl (b. 1935) ruled that it is permitted to publicize the dates and times of a future eclipse.<sup>10</sup>

#### 2. Reciting a blessing on seeing a solar eclipse

There is halachic precedent for reciting a blessing on seeing an awe-inspiring vista or event. We make a *berachah* on seeing the Mediterranean Sea, or a rainbow, on hearing thunder and seeing lightening, and even on seeing a person of exceptional beauty. It is perfectly understandable, therefore, for a person witnessing one of the greatest of nature's spectacles, to wish to mark the event with a blessing. However, there appear to be no halachic authorities who would allow a *berachah* to be recited. Perhaps the first to write about this was R. Menachem Mendel

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<sup>9</sup> *Mishnah Berurah* 229:1, in the name of the *Chayei Adam* (63:4).

<sup>10</sup> R. Avigdor Nebenzahl, *Teshuvos Avigdor HaLevi (Sifrei Kedumim: 2012)*, p. 249 #105. R. Nebenzahl explained “when the Jewish people perform the will of G-d, they have nothing to fear from these events” (ibid). This is puzzling, since nowhere does the Talmud state that a solar eclipse might be due to sin *or* it might be a natural event. Only one opinion is cited in the Talmud, and it is the former. In addition, if the Jewish people were to behave without sin and the solar eclipse would then be a natural event and not an omen, there would be no prohibition against making a blessing over the event from the perspective of it being an omen (although it might remain prohibited for other reasons; see below). R. Menachem Lang also appears to allow informing others of a future eclipse. See his *Iggresa DeChedvasah* (n.p. 5772, p. 14).

Schneerson. In 1957, he was asked if it was permitted to say a *berachah* on seeing a solar or lunar eclipse, and his reply was unequivocal:

ידוע הכלל אשר אין לחדש ברכה שלא הוזכרה בש"ס (ב"י או"ח סמ"ו).  
וי"ל הטעם דאין מברכין ע"ז מפני שהוא סימן לפורעניות הבאה (סוכה כט,  
א). ואדרבה צריכה תפלה לבטלה וצעקה ולא ברכה.

There is a well-established principle that it is forbidden to institute a blessing that is not mentioned in the Talmud. And some say that the reason that no blessing was instituted is because the eclipse is a bad omen. To the contrary, it is important to pray for the omen to be annulled, and to cry out without a *berachah*.<sup>11</sup>

R. Schneerson combines a halachic justification for not reciting a *berachah* with the classic Talmudic teaching that a solar eclipse occurs as a result of human sin. However, there are two questions with R. Schneerson's ruling. First, it is normative Jewish practice to recite a *berachah* on hearing bad news such as the death of a person,<sup>12</sup> and second, the Talmud does not describe a solar eclipse as an omen of forthcoming disaster. It is a sign of sin, not of punishment.

R. Chaim Dovid HaLevi, *Av Beis Din* of Tel Aviv and Yaffo, also ruled that we are forbidden to create new *berachos*, although he understood the urge to do so:<sup>13</sup>

Our Rabbis instituted blessings over acts of creation and powerful natural events, like lightning and thunder and so on. However, they did not do so for a lunar or solar eclipse. And if only today we could institute a blessing when we are aware that an eclipse is indeed an incredible natural event. But we cannot, for a person is forbidden to make up a blessing. If a person still wants to make some form of a blessing, he should recite the verses "And David blessed...blessed are you, G-d, the L-rd of our father Israel, who performs acts of creation."

Finally, we should note the opinion of R. David Lau, then the Chief Rabbi of Modi'in, and currently the Ashkenazi Chief Rabbi of Israel. A

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<sup>11</sup> *Iggerot Kodesh* 15:1079.

<sup>12</sup> See R. Yitzchak Zilberstein, *Chashukei Chemed, Shabbos* 27b, where he questions if a blessing may be made when purchasing mosquito or mouse traps. He notes that no blessing is made when performing the mitzvah of *yibum*, or on tearing *kriyah* when becoming an *aveil*, because they are the result of tragedy.

<sup>13</sup> R. Chaim Dovid HaLevi, *Aseh Lecha Rav* (Tel Aviv, 5749), 150. Others who rule against making a blessing over a solar eclipse include Avraham Zevi Friedman (*Otzar Halachot* [Brooklyn, 5768], #230, p. 295).



certain David Eisen wrote to R. Lau about his experiences of observing the (partial) solar eclipse of 2001 that could be seen in Israel. He had been left wishing to make a blessing for what was, for him, an awe-inspiring cosmic occurrence.<sup>14</sup> R. Lau empathized with Eisen's feelings, but noted that since the Rabbis of the Talmud had not prescribed a blessing over an eclipse, it was not possible to institute such a blessing today.<sup>15</sup> R. Lau noted that his own religious response to witnessing the eclipse had been to say Psalm 19, "The Heavens tell of G-d's glory," and Psalm 104, "My soul will bless G-d."

### 3. Marriage and fasting on the day of a solar eclipse

The Chasidic leader R. Zvi Elimelech Shapira of Dinov (b. 1785), wrote in his classic work *Bnei Yissaschar* that a man should not marry a woman when the moon is waning, "and particularly not during a lunar eclipse, G-d forbid."<sup>16</sup> He does not mention whether this would apply to a solar eclipse. The *Mishnah Berurah* also notes the opinion of the *Sefer Chasidim* that one should fast on the day of a lunar eclipse, although he does not rule on the matter further.<sup>17</sup> The matter is more recently addressed by R. Menachem Lang, who notes that it might be forbidden to marry on the day of any kind of eclipse, but ultimately ruled that there is no such prohibition. When a solar eclipse occurs on the same day as Rosh Chodesh, any fast would be forbidden under the general prohibition of fasting on Rosh Chodesh.<sup>18</sup>

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<sup>14</sup> שאל את הרב, ז' ניסן התשס"ו.

<sup>15</sup> R. Lau noted that the suggested blessing of "עושה מעשה בראשית" cannot be said because nothing creative had in fact occurred: הסיבה שאיננו מברכים היא שלא נתחדש כאן מעשה בראשית.

<sup>16</sup> R. Zvi Elimelech Shapira, *Bnei Yissaschar, Ma'amarei Rosh Chodesh*, #2.

<sup>17</sup> *Mishnah Berurah* #580:2.

<sup>18</sup> See *Mishnah Berurah* #580:1. But there is another complication. Rosh Chodesh is commemorated on a day of the calculated *molad*, and not on the actual *molad*, which is the astronomical event that occurs when the sun, the moon and the earth are perfectly aligned. This year that alignment occurs on Monday, August 21, but Rosh Chodesh will not be celebrated until Tuesday, August 22 and Wednesday, August 23. It may then be argued that since the solar eclipse does not occur on the same day as we celebrate Rosh Chodesh, fasting could be permitted.

#### 4. Niddah

In his responsum on *Hilchos Niddah*, R. Yeshayahu Pinchas Rottenberg was asked whether a woman who first noted her menstruation during a total solar eclipse could count this as having occurred at night (ראית לילה). While not offering a conclusive ruling, R. Rottenberg opined that “regarding the menstrual cycle, since a woman’s body is affected by the sun’s position and when it disappears, it is possible that [the onset of menses seen during a total solar eclipse would have] the status of having occurred at night.”<sup>19</sup>

#### 5. *Tabarah* for a *tavul yom*

A person who has undergone ritual immersion (*tevilah*) in the day because of contact with a ritually impure source is required to wait until sunset before he is considered to have left his state of *tumah*, ritual impurity. R. Avigdor Nebenzahl wrote that a total solar eclipse does not bring to an end the period of *tumah*, even though the sky is dark enough to see the stars. Instead, sunset is required.<sup>20</sup> He derived this ruling from the verse (Lev. 22:7): וּבֹא הַשֶּׁמֶשׁ וְטָהַר — “the sun will come and he will become pure.” According to R. Nebenzahl, the sun is required to set in its normal fashion in order for the impurity to be lifted, a condition that does not occur in a solar eclipse.

The eclipse over North America this August will allow millions of people to witness a memorable celestial event. Even if we are not able to make a blessing, there are, as we have seen, several halachic suggestions for an appropriate religious response. Perhaps the most appropriate one of all is that suggested by the prophet Yeshayah (40:26):

שְׂאוּ-מַרוֹם עֵינֵיכֶם וּרְאוּ מִי-בָרָא אֱלֹהֵי הַמּוֹצֵיא בְּמִסְפָּר צְבָאָם לְכֹלֵם בְּשֵׁם  
 יְקָרָא מְרַב אוֹנִים וְאִמְיָן כֹּחַ אִישׁ לֹא נֶעְדָּר:

Lift up your eyes on high, and see who has created these things, who brings out their host by number; He calls them all by name, by the greatness of His might and the strength of His power; not one of them is missing. ❧

<sup>19</sup> Yeshayahu Pinchas Rottenberg, *Minchas Peri* (Jerusalem, n.p. 2006), p. 293.

<sup>20</sup> R. Avigdor Nebenzahl, *Yerushalayim BeMoadehab, Pesach* (Machon Kerem Ram, 2005), 317.