

## Birkas HaChammah – The blessing of the Sun

### The Astronomical Calendar

Solar year:	365 days, 5 hours, 48 minutes, and 46 seconds	=	365.24 days
Lunar month:	29 days, 12 hours, 44 minutes and 2.841 seconds	=	29.53 days
Lunar year:	354 days, 8 hours, 48 minutes and 29.77 seconds	=	354.37 days

The Jewish calendar is based on a combination of solar and lunar cycles. However, since the lunar year is approximately 11 days shorter than the solar year, the two cycles are not easily combined. Without any sort of correction, our festivals, that are based on the lunar cycle, would wander backwards through the solar year and occur during different seasons.

A

שמות פרק לד:יח

את חג המצות תשמר שבעת ימים תאכל מצות אשר צויתך למועד חדש האביב כי בחדש האביב יצאת ממצרים:

#### Exodus 34:18

You shall keep the feast of *matza*. Seven days you shall eat *matza*, as I commanded you, in the time of the month Aviv; for in the month Aviv you came out from Egypt.

In just a few years the difference between the solar and lunar cycles would become so great Pesach would end up during the winter. Therefore, for the Jewish calendar to work, some sort of correction is needed which reconciles the two systems.

### Hillel II and the fixing of the calendar

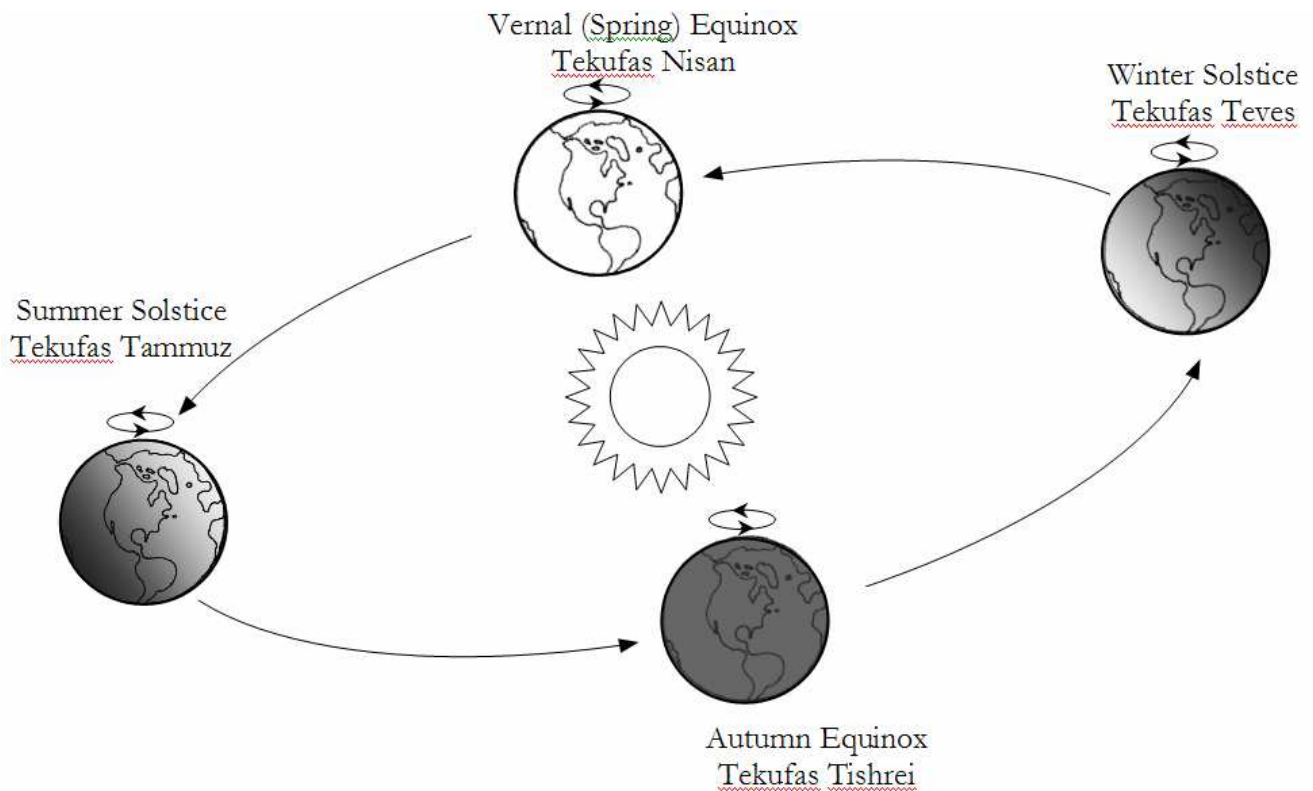
Hillel II held the office of Nasi of the Sanhedrin between 320 and 385 CE. After the destruction of the first Temple, the Jewish people suffered much persecution under Constantius II (337 CE – 361 CE) and advances in Astronomical science led to the gradual replacement of observation by calculation. According to Rav Hai Gaon (939 CE – 1038 CE) the head of a leading Talmudic academy in Babylonia, Hillel II introduced a fixed a continuous calendar in 359 CE. Based on calculations by the *amora* (Rabbi of the Gemora) Rav Adda bar Ahavah, Hillel II realised that in 19 solar years, you could find, to an extremely accurate degree, 235 lunar months (see below).

$$365.24 \times 19 = 6939.56$$

$$29.53 \times 235 = 6939.55$$

In 19 years there should be  $(19 \times 12)$  228 months, so by adding Adar II seven times during the 19 year cycle, the Jewish calendar is able to reconcile the solar and lunar cycles. However, there is a very small inaccuracy in Hillel's calculation as the length of the solar year is 365 days, 5 hours, 55 minutes and  $25/57$  seconds. But as stated above, the true astronomical length of a solar year is 365 days, 5 hours, 48 minutes, and 46 seconds! The Jewish year is about 6.66 minutes more than the astronomical year. Because the Jewish year is a tiny bit too big, it will gain an extra full day every 216 years. Because of this extremely tiny error, over a long period of time extra days would be created and therefore delay our holidays later and later. This means that we currently celebrate Pesach about 9 days later than Jews would 2000 years ago.

## The Tekufos



The Tekufos have great importance in the Jewish calendar. For example we begin reciting ותן טל ומטר in our prayers for God to grant dew and rain from 60 days after the beginning of Tekufas Tishrei. However, the Tekufos are important for understanding Birkas HaChammah.

## Tekufos of Shmuel

B

### תלמוד בבלי מסכת עירובין דף נו עמוד א

שמואל: אין תקופת ניסן נופלת אלא בארבעה רבעי היום, או בתחלת היום, או בתחלת הלילה, או בחצי היום או בחצי הלילה. ואין תקופת תמוז נופלת אלא או באחת ומחצה או בשבע ומחצה, בין ביום ובין בלילה. ואין תקופת תשרי נופלת אלא או בשלש שעות או בתשע שעות, בין ביום ובין בלילה. ואין תקופת טבת נופלת אלא או בארבע ומחצה או בעשר ומחצה, בין ביום ובין בלילה. ואין בין תקופה לתקופה אלא תשעים ואחד יום ושבע שעות ומחצה, ואין תקופה מושכת מחברתה אלא חצי שעה.

### Babylonian Talmud tractate Eiruvim 56a

Shmuel stated: The vernal equinox occurs only at the beginning of one of the four quarters of the day, either at the beginning of the day or at the beginning of the night or at midday or at midnight. The summer solstice only occurs either at the end of one and a half, or at the end of seven and a half hours of the day or the night. The autumnal equinox only occurs at the end of three, or nine hours of the day or the night, and the winter solstice only occurs at the end of four and a half, or ten and a half hours of the day or the night. The duration of a season of the year is no longer than ninety-one days and seven and a half hours; and the beginning of one season is removed from that of the other by no more than one half of a planetary hour.

Therefore, according to Shmuel, each Tekufah lasts for 91 days and 7.5 hours. This means that the length of the year is precisely 365 days and 6 hours long.

### Shmuel and the Julian calendar

The Julian calendar, a reform of the Roman calendar, was introduced by Julius Caesar in 46 BC after consultation with the astronomer Sosigenes of Alexandria. It has a regular year of 365 days divided into 12 months, and a leap day is added to February every four years to account for the extra 6 hours of the true solar year. This calendar, although fairly accurate and simple to use was still an approximation of the true solar year. The year according to Shmuel's (and the Julian calendar) is 11 minutes and 14 seconds longer than the true astronomical year which will create an extra full day every 128 years.

### The Gregorian calendar

As a result of this seemingly minor inaccuracy, when the Julian calendar was first established in 46 BCE the spring equinox fell on March 25th. By 1582, the equinox had backtracked through the calendar to March 11<sup>th</sup>. In order to correct this problem Pope Gregory XIII decided to simply delete the 10 days between October 5th and October 14th in order to correct the error. Consequently, the spring equinox that was supposed to fall on March 11th now fell on March 21st.



However, in order to prevent the problem from reoccurring, the Gregorian calendar changed the rules about adding a leap day every four years. The correction would have to account for the fact that the Julian calendar was slightly longer than the true solar year, adding an extra day every 128 years. Simply removing one day every 128 years would have over complicated the calendar, so Pope Gregory decreed that 3 days should be removed every 400 years, which is still very close to the true solar year. In the new system leap years would still occur every 4 years except 3 out of four centenary years. The rule of thumb is that if the year is divisible by 100, it is not a leap year unless it is also divisible by 400. According to the Gregorian system, the year is only 26 seconds longer than the true astronomical year and will only create an extra full day every 3326 years.

### The problem with Hillel II fixing the calendar

#### The two calculations of the solar year

Rav Adda bar Ahavah: 365 days, 5 hours, 55 minutes and  $25 \frac{25}{57}$  seconds

Shmuel: 365 days and 6 hours long

Neither opinion is exact. Rav Adda is 6.66 minutes too long while Shmuel is about 11.23 minutes too long.

When Hillel formulated the Jewish calendar, both opinions were used for different calculations. As mentioned before, Rav Adda's calculation is used for the purpose of intercalation (reconciling the lunar and solar system in a 19 year and 235 month cycle). Yet, Shmuel's figure is used to determine the length of each tekufah (season) for the sake of tal u'matar and birkas hachamah. Now, obviously Hillel realized these two figures contradict each other. The discrepancy is 4 and a half minutes and over time could lead to some serious problems. The reason Hillel did this is because the recital of tal u'matar and birkat hahamah are primarily private. Hillel believed that since many people would say it to themselves, or even if Jews were able to create a minyan, it would likely be a small minyan in an area devoid of other Jews. Additionally, Hillel feared anti Jewish laws and persecution forbidding gathering for prayers. Moreover, back then, global communication was unreliable and difficult. Therefore Hillel adopted the simple calculation for these prayers. On the other hand, Hillel employed Rav Adda's figures for intercalation since for in this specific regard Rav Adda's numbers were also simple to use (having 7 leap years in a 19 year cycle is not complicated) and even more accurate.

**The source of Birkas HaChammah**

C **תלמוד בבלי מסכת ברכות דף נט:**

תנו רבנן: הרוואה חמה בתקופתה לבנה בגבורתה וכוכבים במסילותם ומזלות כסדרן, אומר ברוך עושה בראשית. ואימת הוי? - אמר אביי: כל עשרים ושמונה שנים, והדר מחזור ונפלה תקופת ניסן בשבתאי באורתא דתלת נגהי ארבע.

Babylonian Talmud tractate Brachos 59b  
 Our Rabbis taught: On seeing the sun at its tekufah, the moon at its strength, the stars in their paths, and the Zodiacal constellations in their order, one says 'Blessed be the Maker of creation'. And when does this happen? Abaye said: Every 28 years when the cycle begins again and the Nisan equinox falls into Saturn on the evening of Tuesday, going into Wednesday.

Abaye's explanation is based on Shmuel's calculation of each Tekufah, meaning that one solar year is approximated to 365.25 days. This is 52 weeks and 1.25 days. Therefore, each year the beginning of the Tekufah advances by 1.25 days.

מחזור גדול	Year	Day	Date	Time	מחזור גדול	Year	Day	Date	Time
1	1981	Tuesday	April 7th	18:00	16	1996*	Sunday	April 7th	12:00
2	1982	Thursday	April 8th	0:00	17	1997	Monday	April 7th	18:00
3	1983	Friday	April 8th	6:00	18	1998	Tuesday	April 8th	0:00
4	1984*	Saturday	April 7th	12:00	19	1999	Thursday	April 8th	6:00
5	1985	Sunday	April 7th	18:00	20	2000*	Friday	April 7th	12:00
6	1986	Tuesday	April 8th	0:00	21	2001	Saturday	April 7th	18:00
7	1987	Wednesday	April 8th	6:00	22	2002	Sunday	April 8th	0:00
8	1988*	Thursday	April 7th	12:00	23	2003	Tuesday	April 8th	6:00
9	1989	Friday	April 7th	18:00	24	2004*	Wednesday	April 7th	12:00
10	1990	Sunday	April 8th	0:00	25	2005	Thursday	April 7th	18:00
11	1991	Monday	April 8th	6:00	26	2006	Saturday	April 8th	0:00
12	1992*	Tuesday	April 7th	12:00	27	2007	Sunday	April 8th	6:00
13	1993	Wednesday	April 7th	18:00	28	2008*	Monday	April 7th	12:00
14	1994	Friday	April 8th	0:00	29	2009	Tuesday	April 7th	18:00
15	1995	Saturday	April 8th	6:00	1	2010	Thursday	April 8th	0:00

Table 1 A summary of the dates and times of the Tekufah of Shmuel demonstrating the 28 year cycle. Years marked with an asterix (\*) are civil leap years.

D

**תלמוד בבלי מסכת ראש השנה דף י: - יא.**

תניא, רבי אליעזר אומר: בתשרי נברא העולם, בתשרי נולדו אבות, בתשרי מתו אבות, בפסח נולד יצחק, בראש השנה נפקדה שרה רחל וחנה, בראש השנה יצא יוסף מבית האסורין, בראש השנה בטלה עבודה מאבותינו במצרים, בניסן נגאלו, בתשרי עתידין ליגאל. רבי יהושע אומר: בניסן נברא העולם, בניסן נולדו אבות, בניסן מתו אבות, בפסח נולד יצחק, בראש השנה נפקדה שרה רחל וחנה, בראש השנה יצא יוסף מבית האסורין, בראש השנה בטלה עבודה מאבותינו במצרים, בניסן נגאלו, בניסן עתידין ליגאל.

Babylonian Talmud Tractate Rosh HaShannah 10b – 11a

It has been taught: Rabbi Eliezer says: In Tishri the world was created; in Tishri the Patriarchs [Abraham and Jacob] were born; in Tishri the Patriarchs died; on Passover Isaac was born; on the New Year Sarah, Rachel and Hannah were visited; on the New Year Joseph went forth from prison; on the New Year the bondage of our ancestors in Egypt ceased; in Nisan they were redeemed and in Nisan they will be redeemed in the time to come. Rabbi Yehoshua says: In Nisan the world was created; in Nisan the Patriarchs were born; in Nisan the Patriarchs died; on Passover Isaac was born; on the New Year Sarah, Rachel and Hannah were visited; on the New Year Joseph went forth from prison; on the New Year the bondage of our ancestors ceased in Egypt; and in Nisan they will be redeemed in time to come.

Abaye's explanation assumes Rav Yehoshua's position regarding the creation of the world.

E

**תלמוד בבלי מסכת ראש השנה דף יב.**

תנו רבנן: חכמי ישראל מונין למבול כרבי אליעזר ולתקופה כרבי יהושע. חכמי אומות העולם מונין אף למבול כרבי יהושע.

Babylonian Talmud Tractate Rosh HaShannah 12a

Our Rabbis taught: The sages of Israel follow Rabbi Eliezer in dating the Flood and Rabbi Yehoshua in dating the annual cycles [as they hold that the world was created in Nisan], while the scholars of other peoples follow Rabbi Yehoshua in dating the Flood also.

**רש"י מסכת ראש השנה דף יב.**

חכמי ישראל מונין למבול כרבי אליעזר - מונין שנות נח ובריאת עולם ושנות הדורות כרבי אליעזר, מונין מתשרי תחלת השנים, ולא משום דסבירא להו בתשרי נברא העולם, אלא דתשרי ראש השנה לשנים, ובניסן נברא העולם כדקתני. ולתקופה כרבי יהושע - כשמונין תקופת החמה והלכנה מונין מניסן, לומר שמניסן נבראו, ובתחלת ליל רביעי שמשה חמה בניסן, לפיכך אין תקופת ניסן נופלת אלא בארבע רביעי היום לפי שלעולם יום ורביעי בין תקופת שנה זו לתקופה שכנגדה לשנה הבאה, וכן מולדות הלכנה מונין מולד ניסן ראשון כליל רביעי בתשעה שעות ושש מאות וארבעים ושנים חלקים.

Commentary of Rashi, Rabbi Shlomo Yitzhaki (France 1040 CE –1105 CE)

THE SAGES OF ISRAEL FOLLOW REBBI ELIEZER IN DATING THE FLOOD – in dating the years of Noah and the creation of the world and the years of the generations like Rabbi Eliezer. They count the beginning of the year from Tishrei but not because they believe that the world was created in Tishrei, but rather because Tishrei is the Rosh HaShannah for years and in Nisan the world was created as it was taught. AND [THEY FOLLOW] REBBI YEHOSHUA IN DATING THE ANNUAL CYCLES – when they count the Tekufah of the sun and the moon they count from Nisan to say that they were created in Nisan, and the sun began to serve at the beginning of the night of the fourth [day], and so the birth of the moon is counted from the first Nisan in the evening of the fourth day at nine hours and 642 *chalakim* [35 minutes and 40 seconds].

This means that in some way, Birkas HaChammah reflects the relative position of the Sun to the Earth at the time of creation. According to the above gemara, the world was created in Nisan at the spring equinox. We also know that the sun was created on the fourth day of Creation, as is related at the beginning of Bereishis and since the Jewish day starts at nightfall, we know that the sun was created on Tuesday evening, and since it was the start of the spring equinox, when the night and day are of equal length, the time in the evening was 6:00 p.m.

**מחזור לראש השנה**

זה היום תחלת מעשיך, זכרון ליום ראשון. ... היום הרת עולם ...

**Machzor for Rosh HaShannah**

This is the day of the beginning of Your work, a remembrance to the first day. ... Today is the anniversary [of the creation] of the universe.

**תלמוד בבלי מסכת ראש השנה דף כז עמוד א**

שוה היובל לראש השנה לתקיעה ולברכות וכו'. אמר רב שמואל בר יצחק: כמאן מצלינן האידנא זה היום תחלת מעשיך זכרון ליום ראשון, כמאן - כרבי אליעזר, דאמר: בתשרי נברא העולם. מתיב רב עינא: שוה יובל לראש השנה לתקיעה ולברכות, והא איכא זה היום תחלת מעשיך זכרון ליום ראשון, דבראש השנה איתא וביובל ליתא! - כי קתני - אשאר.

**Babylonian Talmud tractate Rosh HaShannah 27a**

THE JUBILEE IS ON A PAR WITH ROSH HASHANNAH FOR BLOWING THE SHOFAR AND FOR BLESSINGS. Rabbi Shmuel bar Yitzchak asked: What authority do we follow in saying nowadays [on New Year] the prayer, "This day is the beginning of Your works, the commemoration of the first day"? What authority? Rabbi Eliezer, who said that the world was created in Tishri. R. Ena raised an objection [against this view]: [It is stated], THE JUBILEE IS ON A PAR WITH ROSH HASHANNAH FOR BLOWING THE SHOFAR AND FOR BLESSINGS. [Now how can this be on your view] seeing that there is [the prayer], "This day is the beginning of Your works, the commemoration of the first day"? [Which cannot be said on the Day of Atonement of the Jubilee]. The statement of the Mishnah refers to the other [features].

**תוספות מסכת ראש השנה דף כז.**

כמאן מצלינן זה היום תחלת מעשיך - תימה הא קי"ל כרבי יהושע כדאמרינן בפ"ק (דף יב.) לתקופה כר' יהושע ואומר ר"ת דקי"ל כרב עינא דפריך משוה יובל ורב עינא ה"ק והא איכא זה היום תחלת מעשיך דאיתיה בראש השנה וליתיה ביובל אלא ודאי הא דאמרינן ליה לאו משום ברייתו של עולם אלא משום תחלת מעשה דין שהעולם נדון בו להתקיים או לאו וזה שייך נמי ביוה"כ דיובל דהוקש לר"ה כדלקמן בפרק בתרא (דף לד.) (אבל בשאר יומי לא) ואע"ג דמשני ליה שפיר רב עינא לא הדר ביה ומיהו לאידך לישנא קשיא דקאמר מתני' דלא כר"א הוה ליה לשנויי דזה היום תחלת מעשיך לאו אבריאת עולם קאי ומה שסד ר"א הקליר בגשם דשמיני עצרת כר"א דאמר בתשרי נברא העולם ובשל פסח יסד כר' יהושע אומר ר"ת דאלו ואלו דברי אלהים חיים ואיכא למימר דבתשרי עלה במחשבה לבראות ולא נברא עד ניסן ודכוותה אשכחן בפרק עושין פסין (עירובין דף יח. ושם) גבי אדם שעלה במחשבה לבראות שנים ולבסוף לא נברא אלא אחד.

**Tosafos on Babylonian Talmud tractate Rosh HaShannah 27a**

WHAT AUTHORITY DO WE FOLLOW IN SAYING [ON NEW YEAR] THE PRAYER, "THIS DAY IS THE BEGINNING OF YOUR WORKS, THE COMMEMORATION OF THE FIRST DAY"? – Surely we have established that *Machlokes* like Rabbi Yehoshua [that the world was created in Nisan] as we stated earlier (page 12a) like Rabbi Yehoshua for the *tekufos*. And Rabbeinu Tam says that [here] we establish [the gemara] like Rav Ena who asks from [the Mishna] equating [Rosh HaShannah] to the Jubilee and Rav Ena surely said "and this [that is said] "This day is the beginning of Your works, the commemoration of the first day" is said on Rosh HaShannah and not on the Jubilee" rather, it is certain that we say that it is not because the creation of the world [as we agree that the creation occurred in Nisan in accordance with Rabbi Yehoshua], but rather because it was the beginning of God's judgement whether the world should continue or not, and this is also relevant to Yom Kippur of the Jubilee that is connected to Rosh HaShannah as will be explained later in that last chapter. And even though Rav Ena answered well and didn't retract, nevertheless for the other version there is a problem, for our Mishna did not state in accordance with Rabbi Eliezer, it taught that 'this day is the beginning of Your works' is not going on the creation of the world and that which Rabbi Eliezer Hakalir based in the rains on Shmini Atzeres according to Rabbi Eliezer that the world was created in Tishrei and for Pesach according to Rabbi Yehoshua, Rabbeinu Tam says that these and those are the words of the Living God, and it is possible to say that in Tishrei it came up in God's thought to create the world and it wasn't created until Nisan and we find [an issue] like it in chapter *Osin Passin* (Eruvin 18a) regarding someone who thought to make two and in the end he made only one.

**ספר בניהו בן יהוידע על ראש השנה דף י:**

שם רבי יהושע אומר בניסן נברא העולם וכו'. הנה רבינו האר"י ז"ל בשער הכוונות בדרוש ראש השנה השווה דברי ר' אליעזר ור' יהושע דמר אמר חדא ומר אמר חדא ולא פליגי דמר איירי בבחינת החיצוניות שהוא כללות העולמות בעצמם ומר איירי בבחינת הפנימיות שהוא ענין הנשמות, עיין שם. ובספרי גורי האר"י ז"ל איתא הישוב באופן זה והוא דההריון היה בתשרי והלידה בניסן ולזה אומרים במוסף ראש השנה היום הרת עולם ואין אומרים לידת עולם עד כאן לשונו ואמרת לפי דבריהם יתישב שפיר מה שמברכין ברכת החמה מן כ"ח שנה לכ"ח שנה בניסן ולא בתשרי.

Ben Yehoyadah, Ben Ish Chai, Rabbi Yosef Chaim ben Eliyahu (Baghdad, 1832 CE – 1909 CE)

REBBI YEHOSHUA SAYS THE WORLD WAS CREATED IN NISAN ETC. – Behold, Rabeinu Ari z'l (Rabbi Yitzchak Luria (Tzefas, 1534 – 1572) in *sha'ar HaKanos* in his discourse on Rosh HaShannah equated the words of Rabbi Eliezer and Rabbi Yehoshua that one said one [thing] and the other said one [i.e. another] thing, and they are not arguing, as one is speaking about the nature of the external that is all of the worlds in their essence, and the other one is speaking about the nature of the inner essence that is the matter of the souls, see there. And in the *Gurei HaAri* ז"ל an answer was brought in this manner, that the pregnancy of the world was in Tishrei and the birth of the world in Nisan, and that is what we say in Musaf on Rosh HaShannah 'Today is the anniversary [of the creation] of the universe' and not the birth of the world, end quote. And I say according to their words that the question of saying Birkas HaChammah every 28 years in Nisan and not in Tishrei is settled well.

F

**רבינו יונה על הרי"ף מסכת ברכות דף מג עמוד ב**

הרואה חמה בתקופתה וכו'. פ"א דבר ידוע הוא שלסוף מחזור של שמונה ועשרים שנה תקופת ניסן חוזרת למקום אשר היה שם בתחילת ברייתה והוא לעולם בליל רביעי למחר בבקר וכשרואה החמה מברך עושה בראשית:

Rabbeinu Yonah (Gerona and Barcelona, during the 13<sup>th</sup> century and died in 1263)

ONE WHO SEES THE SUN ETC. – The explanation to the matter is that at the end of the cycle of 28 years in the *tekufah* of Nisan, the sun returns to its place in which it was fixed at the creation, and it is always in the evening of the fourth day (Tuesday night) for the next day in the morning, and when the sun is seen, bless "Who makes works of creation".

**But 5769 is not divisible by 28?**

The years are counted from Tishrei as Adam HaRishon was created on Rosh HaShannah (1<sup>st</sup> Tishrei). The five days of creation before the creation of Adam are called the **שנת תוהו** and so Adam was created in the second year even though only 6 days had passed since the beginning of creation. Therefore 5769 is in truth 5768 years after the beginning of creation, which is divisible by 28 [5768 ÷ 28 = 206].

**Why does the civil calendar say that the Spring equinox is on Friday 20 March 2009?**

Shmuel's calculation is an approximation and differs from the astronomical reality by approximately 11 minutes and 14 seconds every year. This means that the astronomical year is approximately 0.0078 days shorter than Shmuel's calculation. The astronomical Spring equinox always falls between the 20<sup>th</sup> and 21<sup>st</sup> of March every year (according to the Gregorian calendar). By a simple extrapolation, Shmuel's calculation would have been accurate around 2435 years ago (426 BCE)<sup>1</sup>.

<sup>1</sup> Nevertheless, Shmuel bar Abba was a first generation Amora (230 – 250 CE) who lived in Nehardea, in Babylonia and died there about 257 BCE. Rav Adda bar Ahavah was a second generation Amora (250 – 290 CE) and disciple of Rav. It seems that their calculations were based on a previous *mesora*.

**שולחן ערוך אורח חיים סימן רכט סעיף ב**  
 הרואה חמה (ו) בתקופתה, והוא מכ"ח לכ"ח שנה, (ז) והתקופה בתחלת ליל ד', כשרואה אותה ביום ד' (ח) ה בבוקר, אומר: ברוך עושה בראשית; (ט) וכן מברך ג"כ כשרואה לבנה בטוהרתה, וכוכבים במשמרותם, ומזלות בעתם דהיינו כשתחזור הלבנה בתחלת מזל טלה בתחלת החדש ולא תהיה נוטה לא לצפון ולא לדרום, וכן כשיחזרו כל כוכב מחמשה הנשארם לתחלת מזל טלה ולא יהא נוטה לא לצפון ולא לדרום, וכן בכל עת שיראה מזל טלה עולה מקצות המזרח.

Shulchan Aruch Orach Chayim Siman 229 Seif 2, Rabbi Yosef Karo (Toledo, T'sfas 1488 CE – 1575 CE)

**2** If one sees the sun at the beginning of its cycle, which happens at intervals of twenty-eight years, when the *tekufah* is at the beginning of the night of the fourth 3\* day, then, when he sees the sun on the fourth day (8) in the morning he should say ברוך וכו' עושה מעשה בראשית (Who performs the work of creation). (9) One should likewise make this blessing also when he sees the moon in its purity, planets in their watches or the signs of the zodiac in their proper time. I.e., when the moon returns at the beginning of the sign of Aries (the ram), i.e., the first sign of the zodiac, at the beginning of the month and does not incline either to the north or the south; likewise, when every one of the five remaining planets returns to the beginning of the sign of Aries and is not inclined either to the north or to the south and, likewise, at any time when one sees the sign of Aries ascend from the eastern edge.

**משנה ברורה סימן רכט ס"ק ו**

(ו) בתקופתה - מקום שהיא חוזרת שם לתחלת הקיפה היא שעת תליית המאורות בעת הבריאה ומאז התחילה להקיף ולשמש והוא נמשך כ"ח שנה עד שבא לאותו המקום בצמצום בתחלת ליל רביעי כבעת הבריאה:

Mishnah Berurah Siman 229 Seif Katan 6, Rabbi Yisrael Meir Kagan (Dzyatlava, 1838 CE - Raduń, 1933 CE)

**(6) At its cycle.** I.e., at the point where it returns to begin its cycle which is where it was when the luminaries were suspended in the heavens at the time of the creation. From then the sun began to move around and serve its function. It takes twenty-eight years until it comes back to this precise position at the beginning of the night of the fourth day, which is when it occupied this position at the time of the creation.

**משנה ברורה סימן רכט ס"ק ח**

(ח) בבוקר - היינו לכתחלה מצותה מיד להקדים מה דאפשר וטוב לברך אותה ברוב עם ובדיעבד עד ג' שעות על היום [לבוש ומ"א] אבל הרבה אחרונים הסכימו דיוכל לברך בשעת הדחק עד חצות והיינו אפילו בשם ומלכות ואם נתכסה השמש בעבים ואין רואין אותה עיין בשע"ת. ובתשובת חתם סופר סימן נ"ו כתב דאם היתה מכוסה בעבים אך נראית רשמה מבין העבים מברכין אבל כשלא נראה כלל לא נראה לברך. וע"ש שכתב מנהגו בענין ברכה זו קודם הברכה אמרו הללו את ה' מן השמים ואחר ברכת עושה מעשה בראשית אמרו פיוט אל אדון על כל המעשים עד וחיות הקודש ואח"כ מזמור השמים מספרים כבוד אל ואח"כ עלינו לשבח וקדיש:

Mishnah Berurah Siman 229 Seif Katan 8, Rabbi Yisrael Meir Kagan (Dzyatlava, 1838 CE - Raduń, 1933 CE)

**(8) In the morning.** I.e., initially, one should perform the mitzvah immediately one can, as early as possible. It is desirable to make the blessing together with a multitude of people. Once it is after the event one can still make the blessing until the third hour of the day [9:00 am]. [*Levush* and *Magen Avraham*] However, many Acharonim are agreed that in a time of pressing need one can make the blessing until noon, which means that one may even do so then with mention of the Divine Name and the fact that He is King. As to how one must act if the sun is covered by clouds and cannot be seen, see the *Sha.T.* The *Chasam Sofer* writes in a responsum, Sec. 56, that if the sun is covered by clouds but its traces are visible between the clouds one may make the blessing, but if it is not visible at all it does not seem that one may make the blessing. See what the *Chasam Sofer* writes there, that his custom with respect to this blessing was to say the psalm [Psalms 148] *Halelu Es Ha-Sheym Min Ha-Shamayim* before the blessing and after the blessing *Oseh Ma'aseih Vereysbis* to say the liturgical poem *Keyl Adon Al Kol Ha-Ma'asim* until the words *v'Chayos HaKodesh*. Afterwards, he would say the psalm [Psalms 19] *Ha-Shamayim Mesaperim Kevod Keyl* and subsequently the prayer *Aleynu LeShabeyach* and then Kaddish.



**What is the deeper meaning of Birkas HaChammah?**

H

**בראשית פרק א: יד - יט**

וַיֹּאמֶר אֱלֹהִים יְהִי מְאֹרֶת בְּרָקִיעַ הַשָּׁמַיִם לְהַבְדִּיל בֵּין הַיּוֹם וּבֵין הַלַּיְלָה וְהָיוּ לְאֹתוֹת וּלְמוֹעֲדִים וּלְיָמִים וּלְשָׁנִים: וְהָיוּ לְמְאֹרֶת בְּרָקִיעַ הַשָּׁמַיִם לְהָאִיר עַל הָאָרֶץ וַיְהִי כֵן: וַיַּעַשׂ אֱלֹהִים אֶת שְׁנֵי הַמְּאֹרֶת הַגְּדֹלִים אֶת הַמְּאֹרֶת הַגָּדֹל לְמַשְׁלַת הַיּוֹם וְאֶת הַמְּאֹרֶת הַקָּטָן לְמַשְׁלַת הַלַּיְלָה וְאֶת הַכּוֹכָבִים: וַיִּתֵּן אֹתָם אֱלֹהִים בְּרָקִיעַ הַשָּׁמַיִם לְהָאִיר עַל הָאָרֶץ: וּלְמִשְׁלַת בְּיּוֹם וּבַלַּיְלָה וּלְהַבְדִּיל בֵּין הָאֹר וּבֵין הַחֹשֶׁךְ וַיְהִי אֱלֹהִים כִּי טוֹב: וַיְהִי עֶרֶב וַיְהִי בֹקֶר יוֹם רְבִיעִי:

**Genesis 1:14-19**

And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and years; And let them be for lights in the firmament of the heaven to give light upon the earth; and it was so. And God made two great lights; the large light to rule the day, and the small light to rule the night; and he made the stars. And God set them in the firmament of the heaven to give light upon the earth. And to rule over the day and over the night, and to divide the light from the darkness; and God saw that it was good. And there was evening and there was morning, the fourth day.

I

**ישעיהו פרק מ:כו**

שָׂאוּ מְרוֹם עֵינֵיכֶם וּרְאוּ מִי בָרָא אֱלֹהֵי הַמּוֹצֵיא בְּמִסְפָּר צְבָאָם לְכֻלָּם בְּשֵׁם יְקָרָא מְרֹב אוֹנִים וְאִמְיָן כַּח אִישׁ לֹא נֶעְדָּר:

**Isaiah 40:26**

Lift up your eyes on high, and behold who has created these things; the One Who brings out their host by number, He calls them all by name by the greatness of his might, because he is strong in power not one is missing.

J

**תהלים פרק יט:ב - ג**

הַשָּׁמַיִם מְסַפְּרִים כְּבוֹד אֱלֹהִים וּמַעֲשֵׂה יְדָיו מְגִיד הִרְקִיעַ: יוֹם לְיוֹם יִבְיַע אֹמֶר וּלְיָלַה לְיָלַה: חֲנוּה דְעֵת:

**Psalms 19:2-3**

The heavens declare the glory of God; and the firmament proclaims his handiwork. Day to day it utters speech, and night to night it expresses knowledge.

K

**תלמוד בבלי מסכת שבת דף עה.**

אמר רב זוטרא בר טוביה אמר רב: המותח חוט של תפירה בשבת - חייב חטאת. והלומד דבר אחד מן המגוש - חייב מיתה, והיודע לחשב תקופות ומזלות ואינו חושב - אסור לספר הימנו. ... אמר רבי שמעון בן פזי אמר רבי יהושע בן לוי משום בר קפרא: כל היודע לחשב בתקופות ומזלות ואינו חושב - עליו הכתוב ואומר (ישעיהו ה:יב) ואת פעל ה' לא יביטו ומעשה ידיו לא ראו. אמר רבי שמואל בר נחמני אמר רבי יוחנן: מנין שמצוה על האדם לחשב תקופות ומזלות - שנאמר +דברים ד+ ושמרתם ועשיתם כי היא חכמתכם ובינתכם לעיני העמים איזו חכמה ובינה שהיא לעיני העמים - הוי אומר זה חישוב תקופות ומזלות.

**Babylonian Talmud tractate Shabbat 75a**

Rebbi Zutra bar Tuviah said in the name of Rav: He who pulls the thread of a seam on Shabbos is liable to a sin-offering; and he who learns a single thing from a Magian [One of the priestcraft of Ancient Persia] is worthy of death [This is an idiom expressing strong abhorrence, cf. similar expressions in Sanhedrin 58b and 59a. The Magi were hostile to Jews, and caused them much suffering] and he who is able to calculate the tekufas and planetary courses but does not, one may hold no conversation with him. Rebbi Shimon bar Pazzi said in the name of Rebbi Yehoshua ben Levi on the authority of Bar Kappara: He who knows how to calculate the cycles and planetary courses, but does not, Scripture says of him [Isaiah 5:12]: "but they do not regard the work of the Lord, neither have they considered the actions of his hands." Rebbi Shmuel bar Nachmani said in the name of Rebbi Yochanan: How do we know that it is one's duty to calculate the cycles and planetary courses? Because it is written [Deuteronomy 4:6]: "for this is your wisdom and understanding in the sight of the peoples." What wisdom and understanding is in the sight of the peoples? Say, that it is the science of cycles and planets.

L

**ספר חובות הלבבות שער ב - שער הבחינה פרק ב**

אך אם אנו חייבין לבחון בברואים אם לא, נאמר, כי הבחינה בברואים והבאת ראיה מהם לחכמת הבורא ית', אנו חייבין בה מן המושכל, מן הכתוב ומן הקבלה. מן המושכל, כי השכל מעיד שיתרון המדבר על שאינו מדבר הוא רק ביתרון הכרתו והבנתו וקבולו דעת סודי החכמה המקויימים בכל העולם, כמו שאמר הכתוב מלפנו מבהמות ארץ ומעוף השמים יחכמו. וכשהאדם חושב ומתבונן בסודי החכמה ובוחר סימניה, יהיה יתרונו על הבהמה כפי הבנתו. ואם יתעלם מהם, לא יהיה דומה לבהמה, אך יותר גרוע ממנה, כמ"ש הכתוב ידע שור קונהו וחמור אבוס בעליו ישראל לא ידע וגו'.

Chovos HaLevavos Shaar HaBechinah Chapter 2, Bahya ibn Paquda (Spain 11<sup>th</sup> century)

The question whether it is our duty to study the creation or not, we reply that the obligation of doing so and deducing from it proof of the wisdom of the Creator, can be established by reasoning, from the scriptures and from traditional lore. We know from reasoning, for our reason bears witness that a rational creature's superiority over an irrational one consists in the former's superior ability to perceive, understand and acquire knowledge of the mysteries of the Supernal Wisdom – mysteries, the existence of which is confirmed throughout the Universe, as it says (Job 35:11) "He Who teaches us more than the animals of the field, and makes us wiser than the birds of the heaven." And when man contemplates and reflects on these foundations of wisdom and studies its remnants in the universe, his superiority over the animal rises in proportion to his intelligence. If he fails to observe and reflect, he is not equal to the animal, but inferior to it, and it says (Isaiah 1:3) "The ox knows its owner, and the ass his master's crib, but Israel do not know, My people do not know."

M

**רמב"ם הלכות יסודי התורה פרק ב הלכה א - ב**

האל הנכבד והנורא הזה מצוה לאהבו וליראה אותו שנאמר ואהבת את ה' אלהיך, ונאמר את ה' אלהיך תירא.

והיאך היא הדרך לאהבתו ויראתו, בשעה שיתבונן האדם במעשיו וברואיו הנפלאים הגדולים ויראה מהן חכמתו שאין לה ערך ולא קץ מיד הוא אוהב ומשבח ומפאר ומתאוה תאוה גדולה לידע השם הגדול כמו שאמר דוד צמאה נפשי לאלהים לאל חי, וכשמחשב בדברים האלו עצמן מיד הוא נרתע לאחוריו ויפחד ויודע שהוא בריה קטנה שפלה אפלה עומדת בדעת קלה מעוטה לפני תמים דעות, כמו שאמר דוד כי אראה שמך מעשה אצבעותיך מה אנוש כי תזכרנו, ולפי הדברים האלו אני מבאר כללים גדולים ממעשה רבון העולמים כדי שיהיו פתח למבין לאהוב את השם, כמו שאמרו חכמים בענין אהבה שמתוך כך אתה מכיר את מי שאמר והיה העולם.

Laws of Foundations of the Torah, Chapter 2 Laws 1-2, Rambam (Cordoba, Spain 1135 CE - 1204 CE).

**1** It is a commandment to love and fear the venerable and feared Almighty, for it is written, "And you shall love the Lord your God", and it is also written, "You shall fear the Lord your God".

**2** What is the way to love and fear God? Whenever one contemplates the great wonders of God's works and creations, and one sees that they are a product of a wisdom that has no bounds or limits, one will immediately love, laud and glorify [God] with an immense passion to know the Great Name, like David has said, "My soul thirsts for God, for the living God". When one thinks about these matters one will feel a great fear and trepidation, and one will know that one is a low and insignificant creation, with hardly an iota of intelligence compared to that of God, like David has said, "When I observe Your heavens, the work of Your fingers...what is man, that You are mindful of him?". Bearing these things in mind, I shall explain important concepts of the Creator's work, as a guide to understanding and loving God. Concerning this love the Sages said that from it will come to know God.

N

**סדר**

ובטובו מחדש בכל יום תמיד מעשה בראשית. מה רבו מעשיו ידוד. כלם בחכמה עשית. מלאה הארץ קננו:

Siddur

And in His goodness He renews the acts of creation every day constantly. How numerous are Your works HaShem, all were created with wisdom, the earth is full of your creatures [Psalms 104:24].

O

**רד"ק תהלים פרק קד: כד**

מלאה הארץ קניניך, מלא כל הארץ הכל קניניך ומעשיך, אין דבר במקרה. ואמר מלאה כי אין בארץ מקום ריק שלא יראו בו מעשי האל. ופירוש קניניך, כמו (בראשית יד:יט) קונה שמים וארץ:

Radak on Psalms 104:24, Rabbi Dovid Kimchi (France 1160 CE – 1235 CE)

THE EARTH IS FULL OF YOUR CREATURES – the entire earth is filled with His acquisition and actions, nothing happens by chance. And he said ‘filled’ because there is no place on earth empty in which the actions of God are not seen. And קניניך is explained like (Genesis 14:19) ‘Who possesses heaven and earth.’

### What about the fact that there is a discrepancy between Shmuel and the astronomical reality?

Shmuel's calculation is not astronomically accurate; there is a difference of 11 minutes and 2.33 seconds. Therefore, a simple computation shows that the cycle of the Machzor HaGadol has shifted some 45 days in 5769 years, by approximately 0.0078 days per year.

P

**תלמוד בבלי מסכת ברכות דף נח.**

ואמר שמואל: נהירין לי שבילי דשמיא כשבילי דנהרדעא, לבר מכוכבא דשביט דלא ידענא מאי ניהו.

Babylonian Talmud tractate Berachos 58b

Samuel also said: I am as familiar with the paths of heaven as with the streets of Nehardea, with the exception of the comet, about which I am ignorant.

Q

**תלמוד בבלי מסכת בבא בתרא דף כג:**

מתני'. ניפול הנמצא בתוך חמשים אמה - הרי הוא של בעל השוכך, חוץ מחמשים אמה - הרי הוא של מוצאו; נמצא בין שני שוככות, קרוב לזה - שלו, קרוב לזה - שלו, מחצה על מחצה - שניהם יחלוקו. גמ'. תנן: ניפול הנמצא בתוך חמשים אמה - הרי הוא של בעל השוכך; ואף על גב דאיכא אחרינא דנפיש מיניה! בדליכא. אי הכי, אימא סיפא: חוץ מחמשים אמה - הרי הוא של מוצאו; ואי דליכא, ודאי מההוא נפל! הכא במאי עסקינן - במדדה, דאמר רב עוקבא בר חמא: כל המדדה - אין מדדה יותר מנ'. בעי ר' ירמיה: רגלו אחת בתוך נ' אמה ורגלו אחת חוץ מחמשים אמה, מהו? ועל דא אפקוהו לרבי ירמיה מבי מדרשא.

Babylonian Talmud tractate Bava Basra 23b

MISHNA: A YOUNG PIGEON WHICH IS FOUND ON THE GROUND WITHIN FIFTY CUBITS FROM A COTE BELONGS TO THE OWNER OF THE COTE; IF FOUND BEYOND FIFTY CUBITS FROM THE COTE, IT BELONGS TO THE FINDER. IF IT IS FOUND BETWEEN TWO COTES IT BELONGS TO THE ONE TO WHOSE COTE IT IS NEARER. IF IT IS EXACTLY MIDWAY, THEY MUST SHARE IT. GEMARA: It was taught: A YOUNG PIGEON WHICH IS FOUND ON THE GROUND WITHIN FIFTY CUBITS OF A COTE BELONGS TO THE OWNER OF THE COTE; and this even though there may be a bigger cote in the neighbourhood? We assume that there is not. If that is so, then what of the next clause: IF FOUND BEYOND FIFTY CUBITS FROM THE COTE, IT BELONGS TO THE FINDER? Now if there are no other cotes in the neighbourhood, there can be no question that the bird comes from this one? Our Mishnah speaks [in the first clause] of a bird which can only hop. Since Mar Ukva has laid down that a bird which can only hop does not go further than fifty cubits [so if it is found beyond 50 cubits it must have flown and may have come from a different cote and therefore belongs to the finder]. Rabbi Yirmiyah raised the question: If one foot is within fifty cubits and the other beyond, how do we decide? It was for this that they threw Rabbi Yirmiyah out of the Beis HaMidrash.

R

**רש"י מסכת בבא בתרא דף כג עמוד ב**

ועל דא אפקוהו - שיהיה מטריח עליהם.

Commentary of Rashi, Rabbi Shlomo Yitzhaki (France 1040 CE – 1105 CE)

IT WAS FOR THIS THAT THEY THREW [REBBI YIRMIYAH OUT OF THE BEIS HAMIDRASH] – since [his question] annoyed them [i.e. his question was regarded as foolish].

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**תוספות מסכת בבא בתרא דף כג:**

ועל דא אפקוהו לרבי ירמיה מבי מדרשא - אין לפרש משום דבעי מילתא דלא שכיחא כלל דהיכי איתרמי דרגלו אחת תוך חמשים ורגלו אחת חוץ לחמשים בצמצום דהא אשכחנא דמתניתין נמי בכהאי גוונא איירי דקתני מחצה על מחצה יחלוקו ונראה לרבינו תם דמשום הכי אפקוהו משום דמדדה אינו מדדה כלל יותר מחמשים אמה אפילו רגלו אחת דכל מדות חכמים כן הוא.

Tosafos on Babylonian Talmud tractate Bava Basra 23b

IT WAS FOR THIS THAT THEY THREW [REBBI YIRMIYAH OUT OF THE BEIS HAMIDRASH] – do not explain that it [that they disagreed with Rabbi Yirmiyah] because it is so unusual [as to be a ridiculus question], as how can they contradict [Rebba Yirmiyah's case that the pigeon] has one leg within 50 cubits and one leg outside of fifty cubits? In short, given that we find that our Mishna also speaks in this manner since it taught 'if it is found exactly halfway, they must share it'. And it seems that to Rabeinu Tam that they expelled [Rebba Yirmiyah from the Beis HaMidrash] because it measurement was not a measurement at all for all of the measurements of the Chachomim are true [i.e. Rebba Yirmiyah had questioned the statement of the Chachomim that a young bird can only hop fifty cubits].

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**אבן עזרא שמות פרק יב פסוק ב**

והיתה קבלה בידם, שלעולם יקבע ב"ד שבע שנים בכל י"ט שנה שהם רל"ה חדשים, והם ו' אלפים יום תתקל"ט, גם שתי שלישיות יום גם תקצ"ה חלקים ואלה הם י"ט שנות החמה בלי תוספת ומגרעת. ואל תחוש לשעה ותפ"ה לחשבון תקופת שמואל. וידענו כי לא נעלם ממנו זה. רק תפש דרך קרובה בזמנו לאנשי דורו.

Commentary of Rabbi Abraham ibn Ezra, Spain(1089 CE – c. 1164 CE)

And they received a *kabalah*, that the *Beis Din* always fixed seven years in every 19 years, which is 235 months which is 6939 days and 16 hours and 595 *chalakim*<sup>2</sup> and that is 19 years without adding or subtracting [according to Rav Adda's calculation]. And do not be concerned over the hour and 485 *chalakim* for the calculation of Shmuel.<sup>3</sup> And he knew this and it was not hidden from him. Only [Shmuel] approximated for the people of his generation.

**Summary of the practical Halachos**

Essentially the mitzvah is just the bracha, but many have the custom to add in other prayers. A minyan is not necessary but saying it in a large group fulfils **עם הדרת המלך**. It should be recited while standing, but may be recited while sitting. It may be recited through a window. The blessing should be said as early as possible after **נץ החמה**. In order to say the blessing with the **שם ומלכות** one must say it before the end of the 3rd hour of the day. If the sun is covered with clouds for the entire first 3 hours of the day, the blessing may still be said so long as its outline can be seen through the clouds or if any part of the sun is visible. If the sun is entirely covered with clouds - and one is not able to say it before 3 hours into the day, he may say the bracha without **שם ומלכות** all day. There is no shecheyanu. Some have the custom to wear a new shirt and then say shecheyanu on the shirt and patur the sun. Women generally make their own bracha, although some have the custom not so. This applies to both Sefardim and Ashkenazim. A blind person should either hear the bracha from someone else and answer amen or say it by himself without **שם ומלכות**.

<sup>2</sup> There are 1080 *chalakim* in one hour meaning that each *chelek* is 3.33 seconds. 595 *chalakim* are 33 minutes and 3.33 seconds.

<sup>3</sup> According to Rav Adda, 19 years is 6939 days 16 hours and 595 *chalakim* and according to Shmuel it is 6939 and 18 hours exactly. The difference is 1 hour and 485 *chalakim*.