Laws of Sanctification of the New Month, Chapter 13 (Auto Translated)

English

Auto Translated

Shiur Overview

Summary of Shiur — Laws of Sanctifying the New Moon, Chapter 13

General Introduction to the Chapter

The Goal of Chapter 13

The entire goal of the calculations in the Laws of Sanctifying the New Moon is to know whether we will be able to see the moon on the night of the 30th (after 29 days), which is relevant for sanctifying the new month. Therefore, one must know where the sun is, because the sun and moon have a relationship — if the sun is too close, we won't be able to see the moon. Chapter 13 deals with how to calculate the **true position of the sun** — the actual place of the sun.

Review of the Foundation from Chapter 12 — Mean Position

In Chapter 12, the Rambam taught that the sun travels 59 minutes (approximately) each day on its sphere, and one can calculate from the **epoch** (3 Nisan year 4938) by adding the daily motion. However, this only gives the **mean position** — not the true position.

The Difference Between Mean Position and True Position

The word "true" is interesting — it doesn't just mean "what appears to a person," but rather it is truly where the sun is. The mean position is also true — on the sun's sphere itself, the sun truly travels uniformly. But **for us** on earth there is a deviation because the earth is not in the center of the sun's sphere.

The **mean position** is built on the assumption that the sun travels on a perfect circle with uniform speed each day. On the sun's sphere itself, this is 100% correct. The **true position**, however, is how we see it from earth, where it appears that the sun travels faster at certain times and slower at others.

The Foundation of the Eccentric Circle

The reason we see a difference is because the earth does not lie in the center of the sun's sphere (eccentric circle). The zodiacal sphere (ecliptic) is larger, and the sun's sphere lies to one side. Consequently: when the sun is on the closer side to earth, it appears to travel faster (more degrees for the same distance); when it is on the farther side, it appears to travel slower.

The Rambam's Method — Correction

To calculate the true position directly would be very complicated. The Rambam's solution is: one begins with the mean position (from Chapter 12) and adds a **correction** which is different for each degree where the sun stands. The correction reflects how great the difference is between mean and true at that location.

Law 1 — Course of the Sun

The Rambam's Language: "If you wish to know the true position of the sun on any day you desire — first calculate its mean position for that day according to the method we explained, and calculate the position of the sun's apogee, and subtract the position of the sun's apogee from the mean position of the sun, and what remains is called the course of the sun. And see how many degrees the course of the sun is..."

Explanation

One should first calculate the mean position of the sun for that day (according to Chapter 12), then calculate the position of the sun's apogee for that day (also according to Chapter 12), and subtract the sun's apogee from the mean position. What remains is called the **course of the sun**.

Insights and Explanations

1. **Sun's Apogee — Definition:** The sun's apogee is **not** when the sun is higher in the sky, but rather the farthest point of the sun from earth on its sphere — the **apogee**. In the diagram: when the earth is on one side of the sphere, the point opposite the earth is the farthest — that is the sun's apogee.

2. **The Sun's Apogee Moves:** The sun's apogee itself moves around — every 70 years a bit (as explained in Chapter 12). Therefore, one must calculate where the apogee stands today, by starting from the epoch and adding the motion.

3. **Course of the Sun — Meaning:** The course of the sun is simply how far the sun has moved from its apogee to its mean position today. That is, it measures the arc from apogee to mean position. The Rambam gives an example: if the mean position = 200° and apogee = 100°, then course = 100°.

4. **Why One Needs the Course:** The course tells us where the sun stands on its own sphere relative to the apogee. This is the key to knowing how much the correction should be — because the difference between mean and true depends on where on the sphere the sun stands relative to the apogee.

Law 3 — How to Calculate the True Position

The Rambam's Words: "And see how many degrees the course of the sun is. If the course was less than 180 degrees — subtract the portion of the course from the mean; if it was more than 180 — add the portion of the course to the mean. And what will be after you add to it or subtract from it — that is the true position of the sun."

Explanation

When one knows where the sun's apogee is, and where the mean sun is, one can calculate how many degrees the sun is away from its apogee (that is, the "course"). According to this, one calculates a correction ("portion of the course") which one subtracts or adds to the mean sun, in order to obtain the true position.

Insights and Explanations

1. **The Foundation of the Correction — Eccentric Sphere:** The sun travels on its own sphere (eccentric circle) with uniform speed. But because the center of the sphere is not the same as the center of the earth, it appears from earth as if the sun travels sometimes faster and sometimes slower. When

the sun is closer to earth (at perigee), it appears to travel faster; when it is farther (at apogee), it appears to travel slower. Therefore, the mean sun (which calculates uniformly) is not the same as the true sun (where we actually see the sun).

2. **How the Course Determines the Direction of the Correction:** When the course is less than 180° (i.e., the sun is on the side where it is closer to earth and travels "faster" toward us), the true sun is already ahead of the mean sun — therefore **one subtracts** the portion of the course. When the course is more than 180° (the sun is on the farther side, travels "slower"), the true sun is still behind the mean — therefore **one adds**.

3. **Two Points Where There Is No Difference:** At exactly 0° (the sun's apogee itself) and at exactly 180° (the point opposite the apogee), the mean sun equals the true sun — "there is no portion at all, but the mean position is the true position." These are the two days a year when no correction is needed, because at these two points the angle is "straight" — no difference between the eccentric circle and the observation circle.

Law 4 — The Chart of the Portion of the Course

The Rambam's Words: The Rambam gives a chart (in word form) which says for every ten degrees of course how much the portion of the course is: **10 degrees – 20 minutes; 20 – 40 minutes; 30 – 85 minutes; 40 – 150 minutes; 50 – one degree and 15 minutes; 60 – one degree and 41 minutes;** and so on until 180 degrees.

Explanation

The Rambam gives a practical table instead of requiring trigonometric calculations. For every 10° of course, it states how many degrees/minutes one must add or subtract.

Insights and Explanations

1. **Source of the Table — Al-Battani:** The Rambam copied this chart from **Al-Battani**, a Muslim astronomer. That is, the Rambam did not himself calculate the numbers through trigonometry, but rather he used an existing astronomical table.

2. **Why the Rambam Writes a Chart Instead of a Formula:** The Rambam's method throughout the Laws of Sanctifying the New Moon is to make the calculation accessible without higher mathematics. Whoever knows trigonometry can calculate on their own, but the Rambam doesn't want to burden the student with this — he simply gives the results. This is analogous to a "times table" for children — a look-up table instead of requiring that one calculate from scratch each time.

3. **The Pattern of the Table — Gets Larger Until 90° and Then Smaller:** The portion of the course gets larger as one goes from 0° to 90° (the maximum difference), and then it gets smaller again from 90° to 180°. This fits with the geometry: at 90° is the greatest angular difference between the eccentric circle and the observation circle; at 0° and 180° there is no difference.

4. **Why the Chart Only Goes to 180° — Symmetry:** The Rambam only gives numbers from 0° to 180°, because the second half (180°–360°) is a **mirror image** of the first half. Instead of making the chart twice as long, the Rambam says: if the course is more than 180°, subtract from 360° (i.e., 360° minus the course), and use the result in the same table — but with the opposite direction (adding instead of subtracting). **Example:** If the course is 300°, calculate 360° – 300° = 60°, and one already knows that at 60° the portion is one whole degree and 41 minutes — this is added.

5. **The Rambam's Rules for Using the Chart:** The Rambam gives not only numbers, but also **rules** for how to apply the chart practically — what to do when the course is less than 180°, more than 180°, or exactly 0°/180°. This is typical of the Rambam's style in these laws — he makes a "user's guide" for the calculation.

Interpolation Between Degrees in the Chart

The Rambam's Words: The chart gives the portion only for every ten degrees (60, 70, 80, etc.). For a number that falls between tens, one must interpolate.

Explanation: If the course is, for example, 65 degrees — and one knows that at 60 degrees the portion is 1 degree and 41 minutes, and at 70 it is 1 degree and 51 minutes — the difference between them is 10 minutes for 10 degrees, meaning 1 minute for each degree. Consequently, at 65 degrees the portion is 1 degree and 46 minutes (41 + 5). This is simple linear interpolation.

Insights: The Rambam's chart is built so that one can easily interpolate — the difference between tens is constant enough that one can simply divide. With more complicated numbers (like 76 or 77) it becomes a bit harder, but the principle remains the same.

Example of the Entire Calculation — Shabbat 14 Tammuz

The Rambam's Words: The Rambam gives a complete example: one wants to know the true position of the sun at the beginning of the night of Shabbat 14 Tammuz — this is 100 days after the epoch (3 Nisan), the same day he already used in previous chapters.

Explanation — The Course of the Calculation

1. **Mean sun** (already calculated earlier): 105 degrees, 37 minutes, 25 seconds.

2. **Sun's apogee**: 85 degrees, 45 minutes, 23 seconds.

3. **Course from apogee** = mean minus apogee = 18 degrees, 52 minutes, 2 seconds.

4. **Rounding**: 52 minutes is more than 30, so round up to 19 degrees.

5. **Portion for 19 degrees** (from chart): 38 minutes.

6. **Since 19 < 180**, subtract the portion from the mean sun.

7. **Result**: 104 degrees, 59 minutes, 21 seconds — this is the true position of the sun.

8. **Where is this?** In the constellation of Cancer, at approximately 15 degrees in that constellation (because 3×30=90 for Aries/Taurus/Gemini, plus ~15 in Cancer).

Insights

1. **Rounding at Degrees:** The Rambam says that one doesn't need to worry about minutes at the degrees of the course — less than 30 minutes round down, more than 30 round up to a whole degree. The reason: in order to know where the sun is, a degree is sufficient precision — one doesn't need to know so exactly.

2. **"Don't Pay Attention to Seconds at All":** The Rambam says clearly: don't worry about seconds — not at the sun's position, not at the moon's position, not at any calculations.

"But cut off only the minutes" — one only needs minutes, not seconds.

3. **Dispute Among Commentators About Rounding at Seconds:** The Rambam's language is "close to thirty" — which implies that for seconds one should even at less than 30 already add (unlike at degrees where only over 30). There is a dispute among commentators: some understand that for seconds the threshold is lower (one rounds up even at less than 30), others understand that it is the same rule as for degrees. The difference is small and won't make a large practical difference.

Last Law of Chapter 13 — True Seasons

The Rambam's Words: "Whenever you wish, you can know the day of the true season... whether seasons that come after it... or seasons that passed from ancient years." Once one knows the true calculation of the sun's position, one can calculate the **true season** — when the sun truly arrives at each of the four points (0°, 90°, 180°, 270°).

Explanation

The seasons (Nisan, Tammuz, Tishrei, Tevet) are when the sun is at 0°, 90°, 180°, 270° respectively. Both the season of Shmuel and the season of Rav Ada give only a **mean** — they calculate as if the sun travels uniformly. But because the sun doesn't travel uniformly (the sphere is offset), it doesn't take the same time to travel from 0° to 90° as from 90° to 180°. With the true calculation, one can know when the sun is truly at each point.

Insights

1. **Why the Seasons Are Not Equal:** Because the sun's sphere is offset from our sphere (eccentric), the quarter from 90° to 180° takes **longer** than from 0° to 90°. This is the same foundation as the entire correction of Chapter 13 — the difference between mean and true.

2. **The Season of Nisan Is Two Days Earlier:** The Rambam already noted earlier (in previous chapters) that according to the calculation it comes out that the true season of Nisan is approximately **two days earlier** than the mean season (according to Rav Ada). The **Rambam HaMevoar** makes a nice calculation showing why it comes out to exactly about two days — this fits with approximately two degrees offset according to the correction.

3. **Practical Halakhic Difference — Two Inaccuracies in Our Season Calculation:** Our current season calculation (for example, for Birkat HaChama, request for rain) is inaccurate in **two ways**: (1) We use the season of Shmuel which is itself not precise, (2) Even the season of Rav Ada is only a mean, not true — the true season is two days earlier. For laws like requesting rain and the like, one would actually need to know the true season, which can only be calculated with the calculation of Chapter 13.

4. **Does the Calculation Still Work Today?** Although today we have a different theory (Kepler's elliptical orbits instead of two spheres), **the calculation itself still works** — the results come out the same. The difference is only in the cause (ellipse instead of eccentric circle), but the mathematical calculation remains valid.

Conclusion of Chapter 13 — Summary

The main content of Chapter 13: (1) the concept of the course of the sun — how far the sun is from its apogee, (2) the foundation of the correction — eccentric sphere, (3) the chart of the portion of the course with rules for how to use it, (4) interpolation between degrees, (5) a complete example of the calculation for Shabbat 14 Tammuz, (6) rules of rounding (degrees — over 30 round up; seconds — "don't pay attention to seconds at all"), (7) how the true calculation enables calculating true seasons, and (8) the practical difference that our season calculation is inaccurate in two ways.

Full Transcript

Laws of Sanctifying the New Month, Chapter 13: The True Position of the Sun

General Introduction to Chapter 13

Speaker 1:

Dear Jews, we are learning the holy Torah, the Sefer Mishneh Torah, Laws of Sanctifying the New Month, Chapter 13. From Zemanim, if I forgot a level.

And in this chapter we are going to find out how to calculate where the sun truly is, correctly, in the true position of the sun (b'mekom hashemesh ha'amiti). According to kabbalah? No, just simply. Every thing has a true position, how we truly see it, and an approximate position. That is, according to the Rambam's Torah it is truly in its place, in heaven it truly travels that way, but when we see it here on earth it is not exactly as it appears in heaven. There is a big reason why it is different.

Review: The Goal of the Calculations — To Know If We Will See the Moon

So now, we have learned, let me say it more clearly and basically. We have learned in the previous chapter... ah, very good, start with what it says in [chapter] 12. We have learned in the previous chapter... that is, we want, let me start one step before that even.

We want to know everything about whether we will be able to see the moon on the night of the 30th after twenty-nine days. That is, the witnesses had to know whether they should expect witnesses. That was the witnesses, we want to know. This is not witnesses, we want to know.

Now, in order to know this, one of the things we need to know is where the sun is today. Very important, because the sun and the moon have much connection, and if the sun is too close we won't be able to see it, etc. We need to see where the sun is.

Review: Mean Position (Mekom Emtza'i) from Chapter 12

Now, how do we know where the sun is today? So first the Rambam taught us in the previous chapter, the sun travels on a certain calculation each day fifty-nine minutes (chalaqim) etc. each day. It divides the world into degrees (ma'alot), into three hundred and sixty degrees, and now we know how much the sun travels each day. So therefore, one can know it.

So therefore, if we start counting the numbers from the primary time (zman ha'ikar) that the Rambam said, which is

the 3rd of Nisan year 4938, if I remember, so then you calculate, you add how much it travels each day, every ten days, etc., the Rambam already gave numbers earlier, you know where the sun is.

The Difference Between Mean Position and True Position

Now, the problem is with the calculation, that the calculation is only the mean position (mekom ha'emtza'i), not the true position (mekom ha'amiti). We have already learned, the secret of the mean position and true position is, isn't there a picture of it?

The foundation is, because the world... let me put up some picture that simply shows this, so we can easily talk about it. What will be a good enough picture.

The mean position is made with the assumption. Let me say the way. The foundation is that the sun travels around the world every year, every day but also every year, and it travels, if it would travel equally each day, that is, we assume that it truly travels in its own sphere (galgal), it travels on a perfect circle a whole year, it comes out that the Rambam's calculation from the previous chapter is one hundred percent correct, accurate on the sphere of the sun (galgal hashemesh). The sphere of the sun travels each day exactly fifty-nine minutes (chalaqim). So each day you simply add from zero, from where we started, you know exactly where it is today.

The Foundation of the Eccentric Circle

The problem is that, we have already discussed, when we look in practice we don't see that it travels equally each day, we see that in certain periods of the year it travels faster or slower. And in order to explain and be able to calculate, that is the essence to be able to calculate, the explanation is not the main thing. In order to be able to calculate where the sun actually is today, you need to calculate essentially which day of the year it is, whether the sun today is in a period when it travels fast or slow, and how to calculate this?

So this depends on what is called in English, Eccentric Circle, in other words, that the sphere where the sun travels is not exactly around the earth, rather the earth, here it is very exaggerated, it's not that far, but in any case, the earth is a bit on one side of the circle, as if the large circle that is around the earth, which we call the constellations (mazalot) or the ecliptic, the sphere where we see the sun from the earth, is much larger than the sphere, or larger than the sphere of the sun. The sphere of the sun lies on one side of it.

So therefore everyone can use their common sense and understand that when the sun is here it travels, how do you say, faster. Because each day... it appears to us like it goes further, like it goes more. Faster. When the sun comes to the other side, it has more space, it travels slower. So therefore we won't see the sun according to how it travels on an equal path each day with the calculation that we saw. We need to still calculate how it is in practice relative to us. So in this chapter.

The Rambam's Method: Correction (Tiqun)

Now, just to say clearly, to calculate this directly would have been very complicated, to make the calculation of when it travels faster and when it travels slower would have been difficult. So the Rambam thought of an idea, a simple idea, that we start with the previous calculation and we add a fix, a correction (tiqun), which is built exactly on how far the difference is, the changes. Right.

And he will tell you in each degree, each area, where the sun can be, according to the year, he will tell you how much we need to fix, because it's not always the same. You understand yourself that here it is more that we need to fix than here and so on. So you can stay with the previous calculation, and only add the new problem that was created that our world is displaced. It's not displaced, rather rather. It's not a problem, we just need to fix it, and you will know exactly what it is. Thus far the matter.

Law 1: The Order of the Calculation

Speaker 1:

Says the holy Rambam, yes, come read it if you want.

Says the Rambam, **"If you want to know the true position of the sun (mekom hashemesh ha'amiti)"**... how the sun truly is, relative to how we see it, **"on any day you want"**.

Innovation: The Meaning of "True" (Amiti)

It's interesting, the word "true" (amiti) is interesting, that "true" means that it is true for the person. I already spoke about this last night, but it's also truly true, because that is the true, the sun travels, it's not only relative, I don't want anyone to say that it's true what appears to you. True is truly, the sun is truly there. Right, because what we learned last night is also true. It's just for us there is something of a contradiction. Mean (emtza'i) means we calculate everything equally according to how it is our own equal, or true is how it appears to us.

Okay, very good. If you want to know the true position of the sun on any day you want, it is thus: **"On any day you want"**, whichever day you want to calculate that day where we stand relative to the sun, and where the sun is relative to the degrees that exist in the world, so **"first extract its mean position for that day in the way we explained"**. You should first do the calculations that we learned last night, how a person can always start from a certain point that he calculated, and calculate, add how many degrees it has gone through etc., which from that, the previous calculations that we learned in chapter 12, we know where the sun should be, the mean position for that day in the way we explained.

Height of the Sun (Govah Hashemesh) — Definition

"And extract the position of the height of the sun (govah hashemesh)". Afterwards you should also extract what the Rambam called the height of the sun. That there are times when the sun is higher. The height of the sun is not times when the sun is higher, let me say clearly. The height of the sun is the farthest place where the sun is from the earth on its sphere. Again, if you look at my picture, the height of the sun is where it says here a gimel, right? The earth is here, so when the sun is here this is the height of the sun, the highest place where it can be relative to the earth, right? Because from alef to gimel is very long. Whereas when it will be here, the sun will be closer to us, right? And so on. So, that means the height of the sun.

We remembered that the height of the sun itself travels around and around throughout the year, not throughout the year, every seventy years a bit, so therefore we need to know where the height of the sun is, because we will need to start calculating from there, you will already see. So therefore you need to first know what the height of the sun is. And the height of the sun also was not included in the previous calculations.

He mentioned it, but extra, as it is not the essential calculation of the degrees.

How do we know where the height of the sun is? The Rambam said the same way, that is the Rambam said where the height of the sun is on his primary day (yom ha'ikar), and from then one can calculate further according to how long he said the height of the sun moves back each day, you can know where the height of the sun is today.

Course of the Sun (Maslul Hashemesh) — Definition

He says, do both calculations that we learned in chapter 12, the mean position and the height of the sun, and afterwards it is thus, **"and you will subtract the position of the height of the sun from the mean position of the sun"**, you will subtract. You will subtract the position of the height of the sun, you will make a minus from the mean position of the sun? Why? Because you want to know where the sun actually is. And in order you want where the sun actually is, you need to calculate the height of the sun, which will help us know how much further or closer the true is from the mean, **"and the remainder"**. That is, what remains over, means, as if the distance from the height of the sun to the mean position of the sun of today, **"is called the course of the sun (maslul hashemesh)"**.

That is, this is just now called the course of the sun. Course of the sun simply means how far the sun has traveled from its height until where it is today, the mean position of the sun of today. That is, the position of the height of today and the position of the course of today. Right? Yes. The height is not today, the height is perhaps every year, etc., we will see. They learned the previous chapters. Right? Yes.

Discussion: What is the Goal of the Calculation?

Now, so, yes? Now, what we need to do is find out how much the sun has moved from the mean of the sun, from the mean position, basically. Right? Right. That's what we want to find out. Right? Yes, yes. Yes, yes. Okay.

So therefore the Rambam says thus, now you will know what you need to do. **"And you will see"**, yes? Yes, yes. You will see. Yes, yes, yes, say it, yes. Break, "you will see," see, according to this you will see, right? That you know where the height of the sun is, and you know where the mean sun is, you can know from how far the sun is today. From its height. Right? **"And you will see how many degrees is the course of the sun"**, you can calculate how many degrees it is. Let's say the course of the sun is at one hundred, and the height of the sun is at two hundred, you know that there is one hundred in between. Right? That is how far it has a... how was it? I just want to show a simple picture to see what we're talking about here, what the course of the sun is, because otherwise we won't know.

Law 3 (Continued) – How to Calculate the True Position of the Sun

Speaker 1: That's what we want to find out, right?

Speaker 2: Yes, yes, yes.

Speaker 1: So therefore the Rambam says thus, now you will know what you need to do. **"And you will see"**, yes?

Speaker 2: Yes, yes.

Speaker 1: It's ten.

Speaker 2: Yes, yes, yes. Say it, say it.

Speaker 1: Break, **"and you will see"**, so according to this you will see, right? That you know where the height of the sun is, and you know where the mean sun is, you can know from how far the sun is today from its height. Right? **"And you will see, how many degrees is the course of the sun"**. You can calculate how many degrees it is. Let's say the course of the sun is at one hundred, and the height of the sun is at... is at two hundred, you know that there is one hundred in between. Right? That is how far it has a... how was it... I don't want to lose it.

Showing a Picture of the Course

I just want to show a very simple picture to see what we're talking about here, what the course of the sun is, because otherwise we won't know what we're talking about. Okay. We're learning chapter 13. Yes?

Speaker 2: Yes.

Speaker 1: Yes, very very simple, this state picture for example from here, and it shows you, can you be here? Can you see how the earth (kadur ha'aretz) is here in the middle. You will see the height of the sun is where he writes the letter gimel, that is here, the highest place where the sun is. So it is for example, in his example it is at zero. Afterwards, the mean position of the sun comes out for example here, sixty, let's say today the sun is at sixty degrees. You need to subtract 60 degrees, and you will know, now you will know, but you know that the sun is not at 60 degrees, right? Between the bodies, because where is it today? We don't know, because it doesn't travel equally each day. You need to know how much, you need to correct the course of the sun, you need to correct from the mean of the sun to subtract. So how much do we subtract? That is what the secret is. It subtracts according to how many degrees away the sun is. From the height of the sun. The calculation is amazingly simple. You will look at the light, the picture, he even made a better picture that we can see throughout the year. I want to show you a very simple thing, you'll understand why we do this, and afterwards the rest of the chapter is plain numbers with which we calculate.

The Foundation of the Correction – Eccentric Sphere

Yes, it's incredibly simple. Why? Because we discussed, the sun is from one side further from the earth, right? So the yellow thing is the sphere of the sun, right? And the black is how the sun appears to us, right? He makes it just far one from the other so we can see it, it won't appear in the same place. So now, it comes out the height of the sun is this, right? Here, today it is at zero further in his picture, he makes it easier, yes? So here from bet to gimel, that is when the sun is the farthest from us, right?

Now we already said earlier, common sense, you can see that when the sun travels here, it travels faster. Right? Whereas when it travels here, the further you go, the more on the side, that will have more area here, it travels slower, right? So therefore, according to where you are on this place, you will need to know, for example when the sun is here, it travels a bit faster. For example when the sun is thirty degrees on its sphere, it is a bit further than thirty on our sphere. Right? Because you need to add how much the red line here is. What do you add? Because here it travels faster as if than it is in its own sphere, but here it is still a bit faster, or do you understand? Still faster, because now you are still closer to the sun, and when you come to ninety degrees, you are the fastest. You see how the red line gets longer. Later it goes a bit further

from you, it becomes slower. Right? Until you come almost to the other side, it becomes still slower, and then it stands that what? That it comes to the place in its sphere after it comes to... sorry, before, yes? In other words, here it goes faster relative to us, here it goes slower relative to us. Right? When it is at thirty for us, it is not yet thirty at its sphere at all. So you need to subtract the correction. And so on, it depends where you are on the circle. Very simple to understand, we don't need great mathematics to understand, that it will depend each place on the circle, it will depend where the sun is, through this you will know how different our, the mean from the true is.

The Rambam's Method – A Chart Instead of a Formula

So this is basically what the Rambam will do. Since it is a complicated calculation, the Rambam will do a great favor, as he does in all laws, he won't explain who can measure, trigonometry, will know how we can also calculate this. That is, ask a question, how do I know how different the thirty degrees on the circle is from the thirty degrees on the circle? There is a way how to find this out mathematically, but the Rambam won't burden himself to bring this out, he will simply say on each degree how much it is different, and this you will subtract from your calculation, you will know where the sun truly is.

So simply, the knowledge, the Rambam says like this: Yes, **"See how many degrees it is, the maslul of the sun,"** meaning, maslul I mean to say from zero, that is from where do you start, from the govah hashemesh (height of the sun) until here, because that tells you where you are holding in the greater circle, that is in the circle where the sun travels, which helps you to know where to calculate. And the Rambam says like this, **"If it is less than 180 degrees,"** that is, if it is on the side of the circle, if it's on the left side, less than half, **"then you subtract the manas hamaslul."** The Rambam was mechadesh (innovated) a new thing, what does manas hamaslul mean? That is, the portion, manas hamaslul means hamaslul, the difference that exists and where the sun has traveled relative to the amiti (true position) when the... if until 180 it goes down, I'll tell you soon the number how much to subtract, so you'll know that the sun is by us already before it is by it. **"If the maslul was more than one hundred and eighty degrees,"** when you are holding more, that is you made a calculation where is the govah hashemesh today and where is the emtza hashemesh (mean sun) today, and it came out that the maslul, that is how far the sun has traveled from its govah, is today 190 miles, already more, until 360. Then one will subtract the manas hamaslul and add it, because now it's already traveling faster, you will add to the makom emtza'i (mean position) the manas hamaslul, and then you will know, **"and what will be after you add to it and subtract from it is the makom amiti (true position)."** That is where the sun truly is. Yes, that is a rule.

Two Points Where There Is No Difference

It can also simply be that this is only when it's not at three hundred and sixty or at one hundred and eighty. **"Certainly there is no manas equal, but rather it will be the makom ha'emtza'i."** That is two days a year. But when it is at zero, then everything is good. Or when it is exactly opposite. That is, why? If it is here, it is exactly here, and it is at zero after all. The same thing when it is at one hundred and eighty. One hundred and eighty doesn't change, only all, because then it's straight. All round ones change, and then one must calculate.

Halacha 4 – The Chart of Manas Hamaslul

Now, if someone wants to say, hold that one must say all these things, he can say, here is basically like a chart, and Rabbeinu wrote the chart in words for whatever reasons. At every ten degrees he says how much one must add. Yes, how much, not how much one must add, how much the difference is. If it's on the side, if it's less than one hundred and eighty, then one subtracts it. If it's more than one hundred and eighty, one adds it.

The Table of Manas Hamaslul

And the Rambam calculates in halacha 4, **"How much is the manas of the degree,"** the Rambam says a chart. And the chart the Rambam copied from al-Battani, from a Muslim astronomer who calculated this initially. That is, we don't need to toil and calculate. The mefarshim (commentators), as in the entire Rambam, try to recreate the calculation, see that it always matches, but we don't do that today.

But the Rambam simply says a chart:

- If it's ten degrees, the manas comes out, the difference that one must add or subtract, is twenty chalakim (parts)
- Twenty is forty
- And so on

It doesn't go, it doesn't travel straight. Thirty is eighty-five. Therefore he couldn't say, every ten degrees add twenty chalakim. That is only true in the beginning, because later it changes because there are different angles. It changes.

- Forty is one hundred and fifty chalakim
- Fifty is a whole degree with fifty chalakim
- A whole degree with ninety-nine chalakim
- Sixty is a whole degree with forty-one chalakim
- And so on

I must say everything that he should say.

The Pattern of the Table

In short, until one hundred and seventy it is twenty-one chalakim. It becomes smaller. And one should note that until ninety it becomes larger, and from ninety it becomes smaller again. Going back up, it's closer to the makom ha'amiti. As you say, there are two places where it's makom hamaslul. The closer one is to one of the two places, it's shorter. You can say so, yes. Makes sense.

And in short, this is how much one must add. If it's 180, we already learned that one doesn't need to.

Halacha 5 – How to Use the Chart for More Than 180 Degrees

If it's more than 180, you will subtract the... if, sorry, he says a... just a thing, if the mahalach (course) is more than 180 degrees... He says that sometimes it's practical to subtract rather than to add, to take down, because it's fewer numbers. Because you're playing with fewer numbers? It's easier?

Speaker 2: No, because he didn't say.

Speaker 1: No, no, no, the Rambam makes his job easier. The Rambam didn't tell us... Yes, that's the point, basically. The Rambam told us here a chart from ten until... Yes, all degrees from zero to 180. He doesn't tell us the chart for more than that. So the Rambam says, why? Because I don't need to. It's a

mirror image of the other side. The right side and the left side of our picture are the same, just reversed. So, reversed, make a minus, turn it into. That means, if it's more than 360, subtract, that means, you will have the same numbers on a smaller chart. And otherwise the Rambam's chart would have had to be twice as long, and it would repeat itself backwards, the same thing, it's a waste of time. So, he says, simply subtract, make that minus 360. 360 minus that, right? For example, 200, there remains 160, you will know what 160 is, and that you will add. Right?

Excellent. And he gives examples, if it's 300, you will subtract it from 360, there will remain 60, and you already know, the manas of 60 degrees is a whole degree and 41 chalakim. And so on bechol minyan uminyan (in every case). The Rambam simply gives rules, Yosef, I'll come to you in ten minutes. The Rambam simply gives rules how to use his chart, because he made a

Interpolation Between Degrees in the Chart

So he says further how to use it. On the second side you do the opposite. The same thing, for example, if it's in between. The Rambam only said every ten, right? If it's not a ten, it's not a ten.

The Rambam says a simple thing. For example, the Rambam is lengthy, he is... the mahalach is sixty-five degrees, and we already know that sixty, the manas of sixty degrees is one degree and forty-one chalakim, and seventy is one degree and fifty-one chalakim. So what is in between? One must simply calculate, fifty-one minus forty-one is ten. So it comes out that each degree is one chelek, very simple.

So it comes out, make half, right? It will be the mahalach of sixty-five will be one degree and forty-six chalakim. Why? Because that is exactly in the middle, you need to have five, right? It's divided by five.

The same thing is seventy-six, that will make even more, not exactly a half, that will become complicated. Yes, seventy-seven, right? And we already know but how much each degree is between sixty and seventy, you will calculate like this.

In short, so you know exactly how to calculate where the shemesh ha'amiti (true sun) is.

Example of the Entire Calculation — Shabbos 14 Tammuz

And now he's going to give an example of the entire calculation built on his... built on his principle how one can do it. Ah, he takes one example and he shows it, illustrates. How you use the charts, everything becomes very simple.

The Course of the Calculation

And you want to know the makom hashemesh ha'amiti, the beginning of Friday night the 14th, this is the same day that he already spoke about earlier in the previous chapter, yes? The hundredth day after the ikar (epoch), which is the 3rd of Nissan. You want to know Shabbos 14 Tammuz, when it's this year, that is the year that the Rambam holds, you will calculate the emtza hashemesh when it is, which we already learned is 105, 37, 25. And you will know the govah hashemesh, which is 85, 45, 23.

You will subtract the govah from the emtza, there will remain for us 18 degrees and 52 chalakim and 2 shniyos (seconds), 18, 52, 2.

Rounding by Degrees

And the Rambam says, you don't need to worry here about the chalakim by the degrees. Why? Because I can make it easier. If it's less than 30 — that is, each degree has 60 chalakim — he says, if it's less than 30, round down, leave it there, because it won't make any difference in the calculation. If it's more, you will count it as a whole degree.

So, we now said that we're holding at 18 and 52 chalakim, we make it 19. It comes out the manas is, as we learned, what is the manas of 19 degrees? It's 38 chalakim. It's with it the chelek.

If you want to know exactly how long in the chelek, you will yes leave the chalakim in the degree. I mean it doesn't come out. I think why it seems like it doesn't come out, in order to know where the sun is, a degree is enough for us, because we don't need to know so precisely. That's what I think, it's a reason. One must understand, but that's the thing.

The Result of the Calculation

And now the Rambam says, where am I holding? Am I holding more than 180 or less than 180? I'm holding less, because it's only 19 degrees. So subtract the manas, which is 38 chalakim, from that. There remains for us how much? 104 degrees and 59 chalakim and 21 shniyos, 104, 59, 21.

We know where the shemesh ha'amiti is tonight, that is the night that the Rambam calculates, which is Friday night 14 Tammuz. And where is it? At mazal Sartan (Cancer). What is mazal Sartan? Why? Because each mazal is 30, so he has Taleh (Aries), Shor (Taurus), Te'omim (Gemini) is 90, and after that you have 15 from the next which is Sartan, the mazal of the month of Tammuz, right? Approximately. And where in that mazal? 15 degrees, less than a few shniyos. Why? Because we spoke about 59 degrees, there are 60 minutes in a degree, so here you have 59, 21, approximately at 15 degrees, basically.

"Al Tifneh Al Hashniyos Klal" (Don't Pay Attention to the Seconds at All)

The Rambam says, don't worry about the shniyos. **"Al tifneh al hashniyos klal (Don't pay attention to the seconds at all)." Al tifneh al hashniyos, "Not in the place of the sun and not in the place of the moon and not in the time of the other calculations."** Why? Further for the same reason, because it doesn't come out. **"But cut off only the chalakim."** That is, here you do need to know chalakim.

Dispute Among Commentators About Rounding by Seconds

What does the Rambam say? You don't need to know shniyos? If there are shniyos further, close to thirty, make it a chelek and add it. He says the opposite, he says even... It's not clear what the Rambam means here, I saw here a dispute among commentators.

That is, simply according to our understanding from before one would have had to say the same thing: less than thirty keep it as it is, more than thirty round it up, like rounding. But the Rambam's language is not clear, he says "karov lishloshim" (close to thirty), implying that by the shniyos one should even add less. It's not clear, there are mefarshim who understand this way, there are those who understand that way. I think it's all small differences, I don't know how big a difference it will make.

In short, until now we know, until now we know where the sun is. This will be a nafka mina (practical difference) for us for the calculations of sighting.

True Tekufos (Seasons)

Now the Rambam tells us another interesting thing which is very relevant according to what we know the true calculation. What is that? The tekufos.

Why the Mean Tekufos Are Not the True Ones

We learned before, it's important, regarding kiddush ibur hashanah (sanctification of the leap year) one must know about the tekufa. And the Rambam gave us two calculations of tekufa in two chapters, how long is between each tekufa according to how long the year is from the sun.

Now, the Rambam told us that this is all emtza'i (mean), right? Both tekufas Shmuel and tekufas Rav Ada don't tell us the true tekufa. Why? For the same reason why one needs here a tikun (correction), right? Because we learned that the sun doesn't travel equally a whole year.

So it's true, at the four corners it's the same place, yes? One must understand, at mazal Nissan and mazal Tishrei and mazal... what is it called? Another in between, mazal Tammuz, so, the four tekufos of the year, the sun is found exactly at the four corners as it were of the circle, right? Because at Nissan it's at zero, at Tammuz it's at 90, at... what is it called? At Tishrei it's at 180, at Teves it's at 270. This is always exactly where the sun is, this one can calculate, one can even see it, one looks at the sun, one makes comparisons and so on.

But it doesn't take the same time to arrive from zero to ninety as it takes from ninety to one hundred eighty, or from one hundred eighty to two hundred and seventy. Why? For the same reason, because its circle is displaced from our circle. So you can understand yourself that from ninety to one hundred eighty will take longer than from zero to ninety.

How to Calculate the True Tekufa

Therefore the Rambam must give you each individual the number. He doesn't say the number, what he says comes out, that if you want to know when the true tekufas Tammuz of the sun is, which tekufas Tammuz is when the sun arrives at mazal Taleh, that is to degree zero, you will do the same tikun that we just said. You will know where the govah hashemesh is today, and you will know how far the sun is from the govah hashemesh. You will add the tikun that we have, the manas that we have. You will know when the true tekufas Nissan is in the year.

So it says the makom hashemesh, bechol asher tirtzeh teda yom hatekufa ha'amiti (in all that you desire you will know the day of the true tekufa), because the true tekufa is simply when the sun enters into a certain degree, into a certain mazal. Between the tekufos that come after it like the one from which we began, that is, you can know both the tekufos after the tekufa, and the tekufos that passed from previous years, the same thing, make the calculation according to then, as the Rambam already said, one can calculate backwards also. Once one knows one tekufa, one can always calculate all tekufos.

Tekufas Nissan Is Two Days Earlier

Right, as the Rambam said, that about this you can know when tekufas Nissan was truly. Not only be'emtza'i, the Rambam already said before that in current times, that is, according to what we learned that this changes, the govah hashemesh changes according to the time, so it's not always the same, because the Rambam already said before that all the calculations that one learns tekufas Rav Ada it even comes out that tekufas Nissan is two days before the calculation.

This is because according to the calculation you understand, he explained very clearly the note is there below, why it comes out exactly two days. Approximately two degrees displaced according to the calculation, so one makes the whole calculation, if someone will come in the commentary of the Rav, what does it mean? The Rambam Hamevo'ar says, makes very nicely the calculation why it comes out according to the same tikun, it comes out that tekufas Nissan is two days earlier than the tekufa ha'emtza'is, which is what was calculated until now essentially, and apparently there is a nafka mina, because the beis din would have had to truly calculate according to the true tekufa, not according to the mean tekufa.

Practical Difference in Halacha — Two Inaccuracies in Our Tekufa Calculation

For example, we who calculate the tekufa, that means regarding whatever matter, regarding Birkas HaChama (Blessing of the Sun) and so on, it's not only that it's tekufas Shmuel which is not precise even Rav Ada knows, it's also only the mean tekufa, because the true tekufa is two days earlier altogether. So there are two inaccuracies in the way we calculate the tekufa.

That means, it's only a nafka mina for the small halachos, such as questions of rain and the like, because one must know that it's not exactly for the two reasons, and so for over an hour one would have had to know the true one, which to know the true one one will do the calculation of chapter 13.

The Rambam's Emphasis in Chapter 13 — Practical Method, Not Theory

One sees here very clearly in this chapter how the Rambam didn't want to teach us how the calculations work, and even how the sun travels, all these things are not his main emphasis. He simply wants to say how to calculate the sun, so he did such a favor, he even gave a chart of the conclusions, instead of making... like for example today, one teaches it to children, yes, times tables, right? There is such a way, there is a look-up table in math, that they have certain things that are hard to calculate, so instead of calculating each time, one makes a chart. Yes, one reviews the chart, and it's easier to remember. That is what the Rambam did here, and so one can know where the sun truly is.

The Calculation Still Works Today

And this I think is correct. That is, even though today there are other theories for why the sun is indeed different in different seasons (tekufos) of the year, we have a simpler theory. Instead of making two spheres, Kepler simply decided that the sun travels on an ellipse, and consequently the entire question doesn't arise. But it's still true, the calculation that he calculates will still come out the same thing according to the order. So, it fits with the calculation, and that's the end of chapter 13. Good.