Excerpts from the calendar passage in Babylonian Talmud, *Rosh Hashanah* 20b:

I.   Samuel said: I am able to arrange it (viz. the calendar) for the entire Diaspora.

II.   Abba, the father of Rabbi Simlai, said to Samuel, 'Does the master (= Samuel) know that which we learnt in the '*sōd*[1] of the (Jewish) calendar (= '*ibbūr*)': '… if it (viz. the moon) was 'born'[2] before mid[day] or after mid[day]'? 'No', said he to him; whereupon he said, 'Since the master does not know this, there are other matters that the master does not know'.

III.   When Rabbi Zera went up (to the Land of Israel), he sent word back to them (in Babylon), 'There must be a night and a day of the new [moon]'.

IV.   This is the meaning of the statement of Abba, father of Rabbi Simlai, before Samuel, '[… if its *mōlād* occurred before mid[day] or after mid[day]': we calculate its *mōlād*.] If it was born before mid[day], it is known that it will be seen close to sunset; if it was not born before mid[day], it is known that it will not be seen close to sunset.

V.   What practical difference do we derive from this? Rabbi Ashi said: for confuting witnesses.

VI.   Rabbi Zera said, 'Rabbi Naḥman said: For 24 hours the moon is covered over (= non-sightable). For us, six [hours] are of the old, and 18 are of the new; whereas for them, six are of the new, and 18 are of the old'.

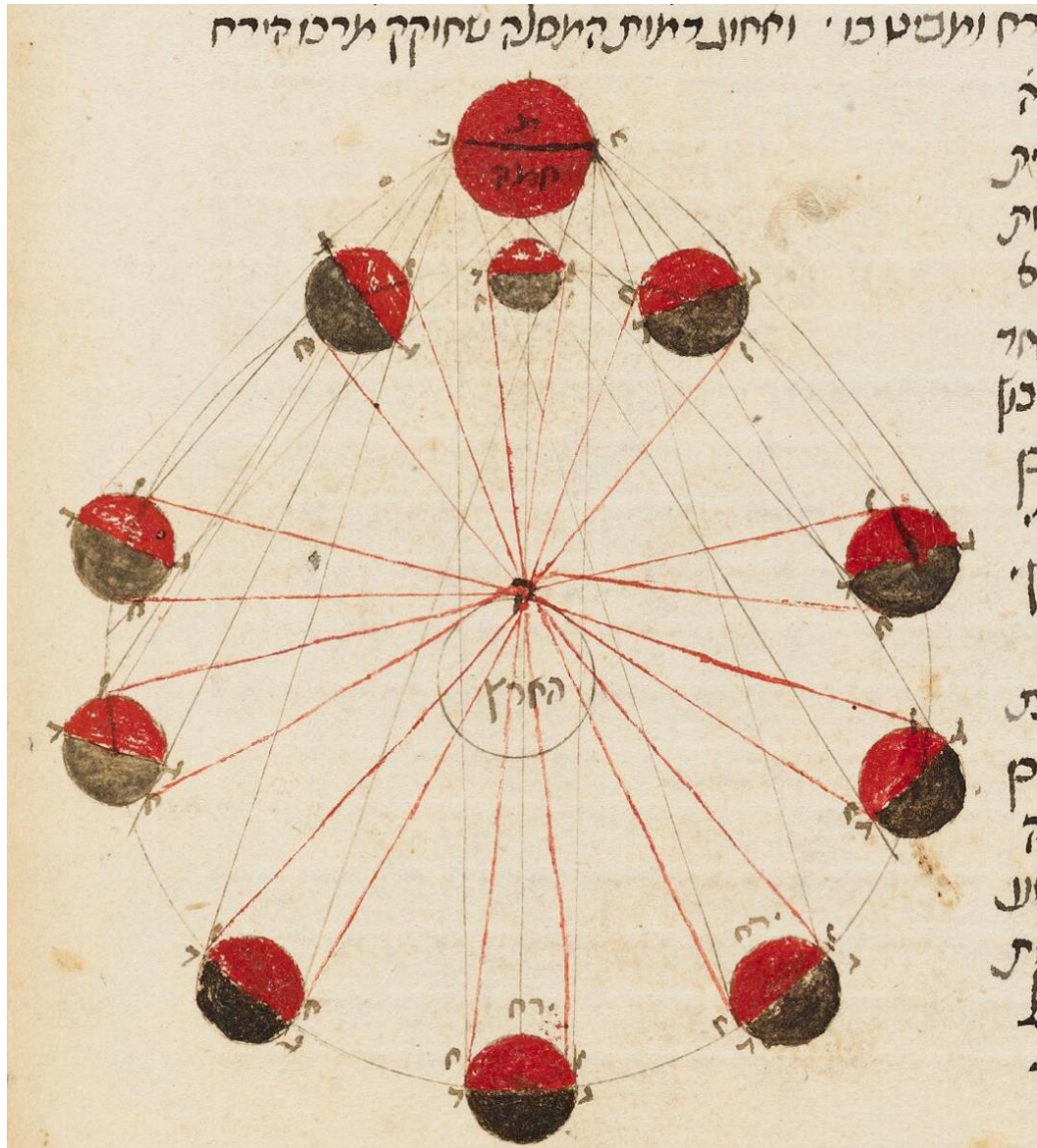Topic: Duration of non-sightability, constituting end of old moon, conjunction, beginning of new moon.

Difficulties: Initial, superficial analysis of the Talmud passage, before scientific commentary, renders apparently contradictory time-frames:

A) (section III) Night & Day of New moon (= 24 hours [from conjunction until sightability])

B) (section IV) just before midday to sunset (6 hours + [from conjunction until sightability])

C) (section VI) [12 hours average from conjunction until sightability], viz. 24 hours total non-sightability, including two periods: 1) time from end of sightability of old moon to the conjunction; plus 2) from the conjunction to the sightability of the new moon.

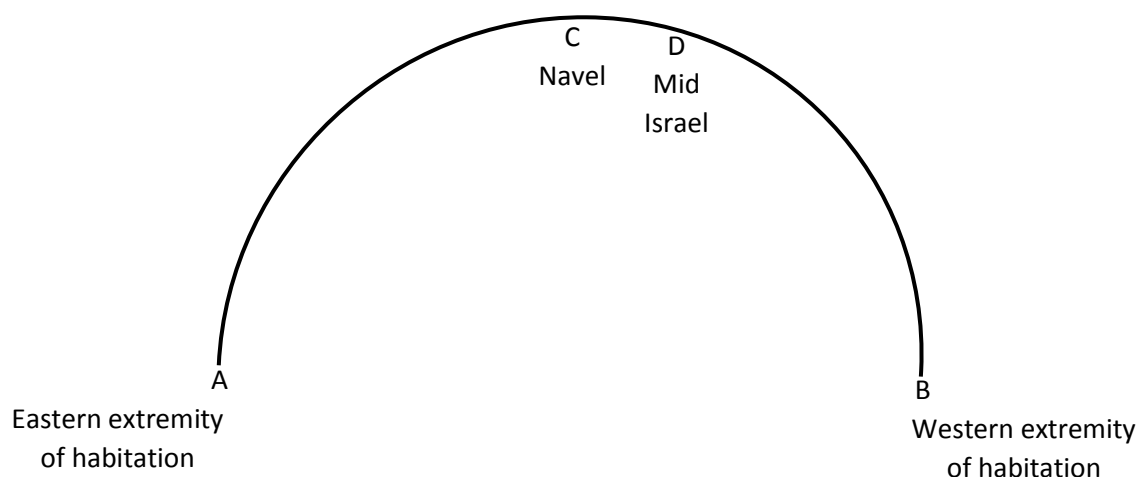   C.1: why not 12 + 12, but rather 6 + 18 in one location, and 18 + 6 in another?

---

[1] Lit. 'secret'. Two main interpretations of this are 'esoterica' (due to its difficulty) or 'council' (an exclusive body of sages).

[2] Heb. *nōlad* / נולד (cf. *mōlād*). In *Yesod Olam* 4:8, Israeli analyses the exact connotation of this technical term.

'Phases of the Moon', MS Oxford Bodleian Huntington 299 f. 104b, detail

Diagram of Israeli's explanation of IV: '… born before midday … may be seen at sunset'

C
Navel

D
Mid
Israel

A
Eastern extremity
of habitation
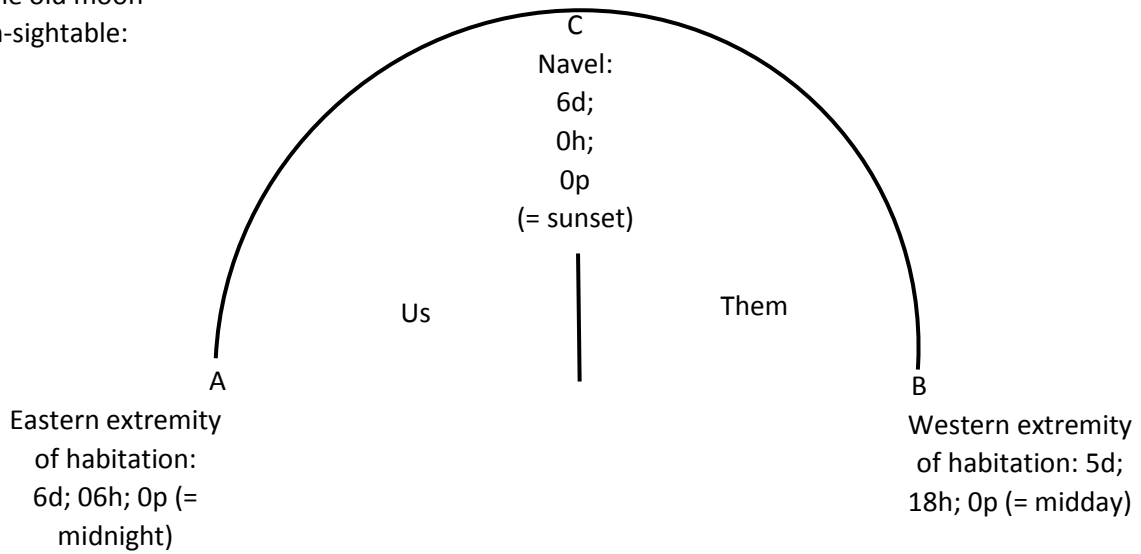
B
Western extremity
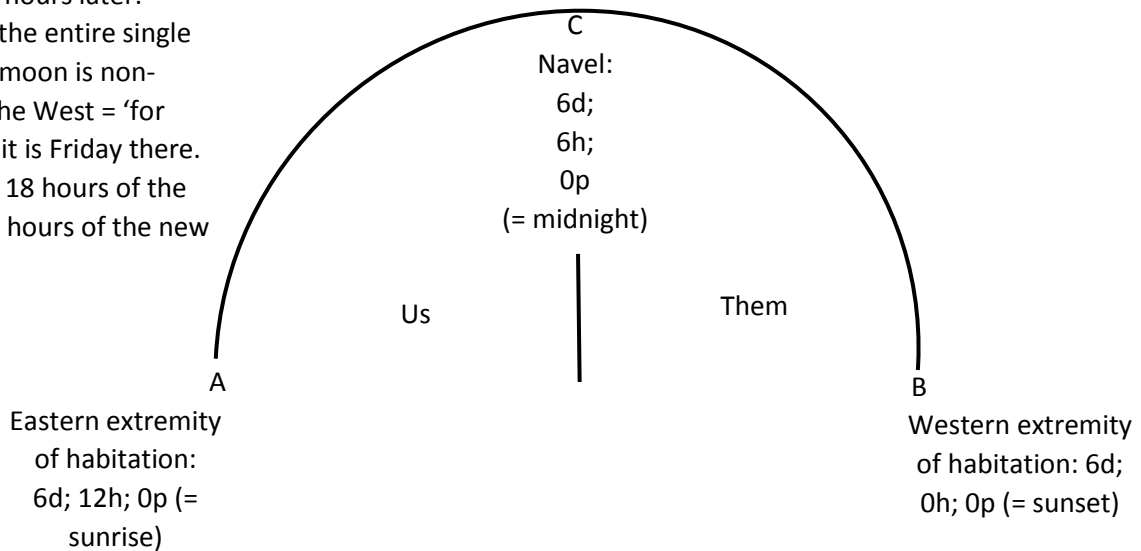of habitation

(Image not necessarily to scale)

1. The renewal (= true conjunction) of Tišrī is at least 22½ hours before the first possible sightability of its new moon.

2. The *mōlād* (= mean conjunction) of the month of Tišrī may fall up to 14h; 648p after that month's renewal.

3. Times given for the *mōlād* are for what time it is at point C, the earth's navel, when the *mōlād* falls.

4. In contrast, first sightability is calculated for the middle of the Land of Israel, viz. point D.

5. Point D is approximately 1h; 612p to the west of point C. Thus, sunset (= 24h) at point D is 7h; 612p after midday (= 18h) at point C (= 6h for noon to sunset, + the 1h; 612p).

6. 14h; 648p (= amount by which *mōlād* may precede renewal) + 7h; 612p (= amount by which sunset Israel follows noon Navel) = 22h 180p. This is 360p = 1/3h shy of 22½ hours = 1st possible sightability from renewal, which will thus be 1/3h after sunset.

7. Thus, if, when the *mōlād* occurs, at point C it is 18h or earlier of 29d, then there is a chance that the new moon will be sightable at point D when, at point D, it is 1/3h (= 360p) into 30d.

8. However, if, when the *mōlād* occurs, at point C it is later than 18h of 29d, then it will be impossible for the new moon to be sightable at point D when, at point D, it is 1/3h into 30d.

Diagram of 1 of Israeli's interpretations of VI: 24 hours covered, 6:18: us, old:new; them, new:old
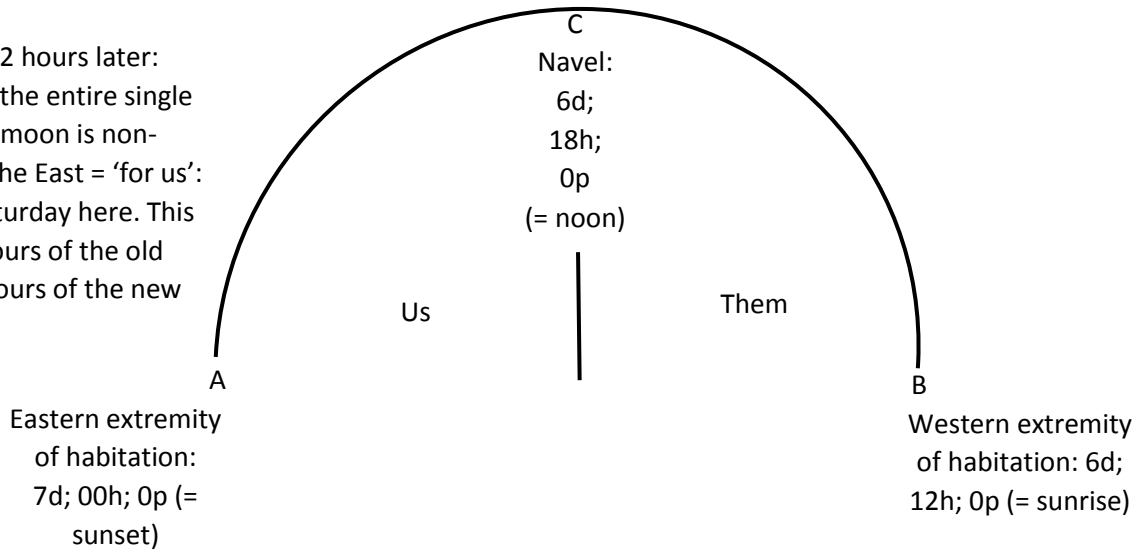
Moment 1: the old moon becomes non-sightable:

C
Navel:
6d;
0h;
0p
(= sunset)

Us

Them

A
Eastern extremity
of habitation:
6d; 06h; 0p (=
midnight)

B
Western extremity
of habitation: 5d;
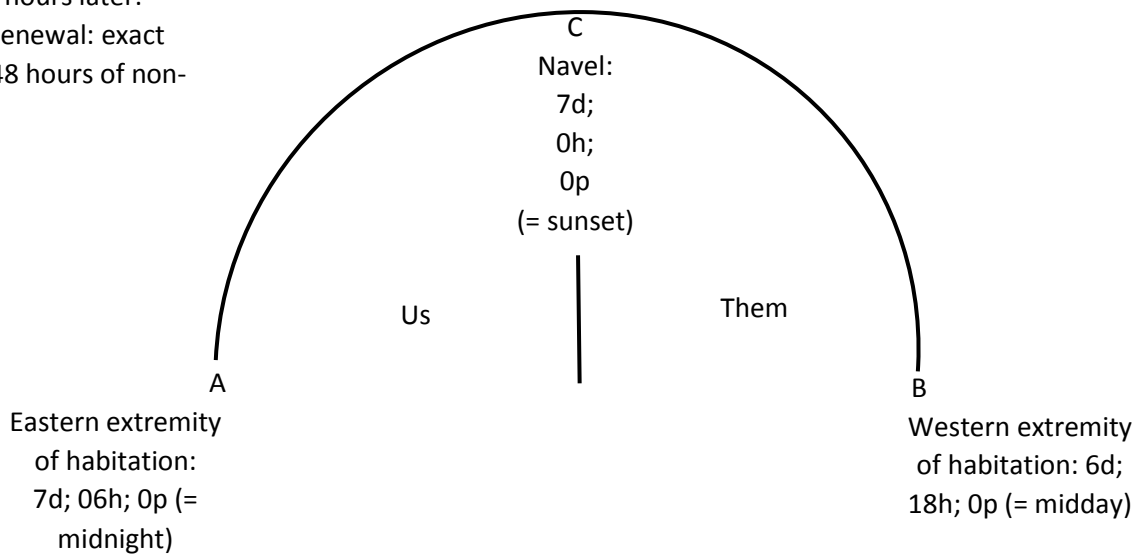18h; 0p (= midday)

Moment 2: 6 hours later: beginning of the entire single day in which moon is non-sightable in the West = 'for them': when it is Friday there. This contains 18 hours of the old moon + 6 hours of the new moon.

C
Navel:
6d;
6h;
0p
(= midnight)

Us

Them

A
Eastern extremity
of habitation:
6d; 12h; 0p (=
sunrise)

B
Western extremity
of habitation: 6d;
0h; 0p (= sunset)

4

Moment 3: 12 hours later:
beginning of the entire single
day in which moon is non-
sightable in the East = 'for us':
when it is Saturday here. This
contains 6 hours of the old
moon + 18 hours of the new
moon.

C
Navel:
6d;
18h;
0p
(= noon)

Us   Them

A

B

Eastern extremity
of habitation:
7d; 00h; 0p (=
sunset)

Western extremity
of habitation: 6d;
12h; 0p (= sunrise)

Moment 4: 6 hours later:
Moment of Renewal: exact
midpoint of 48 hours of non-
sightability

C
Navel:
7d;
0h;
0p
(= sunset)

Us   Them

A

B

Eastern extremity
of habitation:
7d; 06h; 0p (=
midnight)

Western extremity
of habitation: 6d;
18h; 0p (= midday)

Moment 5: 24 hours later:
Moment of first sightability
{caveat: in truth, an additional
1/3h is required}

C
Navel:
1d;
0h;
0p
(= sunset)

Us

Them

A
Eastern extremity
of habitation:
1d; 06h; 0p (=
midnight)

B
Western extremity
of habitation: 7d;
18h; 0p (= midday)

6