DARK SKIES for November 2020:

S/M Nov.	1/2	none
M/T Nov.	2/3	none
T/W Nov.	3/4	6:25 p.m. - 6:47 p.m.
W/T Nov.	4/5	6:24 p.m. - 7:30 p.m.
T/F Nov.	5/6	6:23 p.m. - 8:21 p.m.
F/S Nov.	6/7	6:22 p.m. - 9:20 p.m.
S/S Nov.	7/8	6:21 p.m. - 10:25 p.m.
S/M Nov.	8/9	6:20 p.m. - 11:35 p.m.
M/T Nov.	9/10	6:19 p.m. - 12:47 a.m.
T/W Nov.	10/11	6:18 p.m. - 2:02 a.m.
W/T Nov.	11/12	6:17 p.m. - 3:18 a.m.
T/F Nov.	12/13	6:17 p.m. - 4:36 a.m.
F/S Nov.	**13/14**	**6:16 p.m. - 5:14 a.m.**
S/S Nov.	**14/15**	**6:15 p.m. - 5:15 a.m.**
S/M Nov.	**15/16**	**6:14 p.m. - 5:16 a.m.**
M/T Nov.	**16/17**	**6:14 p.m. - 5:17 a.m.**
T/W Nov.	17/18	6:49 p.m. - 5:18 a.m.
W/T Nov.	18/19	7:50 p.m. - 5:19 a.m.
T/F Nov.	19/20	8:56 p.m. - 5:20 a.m.
F/S Nov.	20/21	10:03 p.m. - 5:21 a.m.
S/S Nov.	21/22	11:09 p.m. - 5:22 a.m.
S/M Nov.	22/23	12:14 a.m. - 5:23 a.m.
M/T Nov.	23/24	1:16 a.m. - 5:24 a.m.
T/W Nov.	24/25	2:16 a.m. - 5:25 a.m.
W/T Nov.	25/26	3:16 a.m. - 5:26 a.m.
T/F Nov.	26/27	4:16 a.m. - 5:27 a.m.
F/S Nov.	27/28	5:17 a.m. - 5:28 a.m.
S/S Nov.	28/29	none
S/M Nov.	29/30	none
M/T Nov.	30/1	none

Times listed are for Dodgeville, Wisconsin when
(1) Moon is below the horizon
(2) Sun is > 18° below the horizon
(astronomical twilight)

Please minimize your use of outdoor lighting during these times to give everyone the best possible view of the night sky.

Time Travel

conducted by David Oesper

Continued from last month...

Hunting for Comets and Planets*

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(Received 1991 November 4)

We shall need to try out the system first on as small a scale as possible, with two or three telescopes looking at a small number of stars. If all goes well and some real occultations are seen, the system will grow larger, with the changes and improvements dictated by practical experience. I hope that we might in this way arrive at a large array of small telescopes, perhaps a hundred telescopes arranged in 25 rows of four, the four in each row defining an East-West track, and the 25 rows giving the array a North-South coverage of 50 km. The optimistic estimate for the frequency of occultations observed by the array would then be about one per minute. We could expect to see many of the rarer types of object in the Kuiper Belt, not merely the common-or-garden comets.

4 DIFFRACTION AND LENSING

Another happy coincidence makes the observation of occultations even more interesting. The distance of the Kuiper Belt is just great enough for the diffraction of light around the edges of a comet to produce a noticeable smearing of the shadow. For a comet at a distance of 50 astronomical units, the scale of the smearing on the Earth is about 2 km, which happens coincidentally to be the same size as a typical comet. The smearing has two consequences, one good and one bad. The bad news is that the occultations will be harder to see because the shadows are not sharp. The good news is that the effects of diffraction will be different for light of different colours, and will depend on the distance of the diffracting object. If we measure the brightness of a star separately in two or three colours, we can measure the differential effects of diffraction during an occultation, and this will enable us to determine both the size and the distance of the comet. In this way, if all goes well, an array of telescopes observing occultations in three colours will give us a true three-dimensional map of the Kuiper Belt.

Until now I have been talking only about comets and not about planets. Occultation astronomy gives us a way to search for dark objects of any kind, including planets as well as comets. The obvious place to look for planets is in orbit around stars. But it is also possible that the Galaxy is populated by huge numbers of loose planets unattached to stars. I put forward, as a hypothesis to be tested, the idea that planets may form before stars when an interstellar dust-cloud condenses. Then we might have a large population of loose planets, of which only a few grow big enough to accrete major quantities of gas and turn into stars. For example, the mass of elements other than hydrogen and helium now in the Sun might have made 5000 planets as big as the Earth, if the Sun had not happened to gobble it up first.

One good place to look for loose planets is the Hyades, a region where substantial numbers of stars have formed recently not too far from the Sun. It happens that the Hyades lie in the constellation Taurus, in the area where comet occultations are likely to be most frequent. If we are lucky, we may find an occasional loose planet as a by-product of the search for comets.

* The text of the Milne Lecture, delivered 1991 October 24.

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To be continued next month...