

2024 Solar Eclipse Q&A

by Joe Cali



Q2 What is the date of next months solar eclipse?

Q2 Quelle est la date de l'éclipse solaire du mois prochain ?

The eclipse occurs on 8 April / Avril around the middle of the day. Exact time depends upon your location in the path.

Q3 Which area has the best weather prospects?

Q3 Quelle région offre les meilleures perspectives météorologiques ?



Based on 24 years of data, Canadian meteorologist Jay Anderson has come up with the following probabilities of cloud cover: -

- *Maritime Canada 60-85% chance of cloud cover*
- *Ontario, Canada 70-85% chance of cloud cover*
- *Ohio, USA 60-78% chance of cloud cover*
- *Illinois, USA 60-75% chance of cloud cover*
- *Texas, USA 48-55% chance of cloud cover*
- *Sinaloa & Durango, Mexico 20-30% chance of cloud cover* ✓

Sinaloa & Durango, Mexico offers the best weather prospects and is also the location of the point of greatest eclipse.

Q4 When a total solar eclipse begins, which limb of the sun shows first contact?

Q4 Lorsqu'une éclipse solaire totale commence, quelle branche du soleil présente le premier contact ?

It depends whether you are in the north or south hemisphere.

- ⇒ North
- ⇒ East
- ⇒ South
- ⇒ **West** ✓

Some thought it depends whether you are in the north or south hemisphere, some thought it comes from the east. In its orbit, the Moon progressively moves from west to east so it will always encounter the west limb of the Sun, perhaps slightly northwest or southwest, but primarily west. Had I asked, "Does the Moon come from the left or right?" then the hemisphere or at least the direction the observer is facing would have been a factor. First contact is always west, last contact always east.



Third Contact Exmouth 2023

Joseph Cali

Pentax K5 Rokinon 135mm f2 1/15 s f8

Q5 Typically how big do solar corona streamers appear to the naked eye?

Q5 En général, quelle est la taille des banderoles de la couronne solaire à l'œil nu?

The purpose of this question was to prepare observers for the visual appearance. Many answered based on photographs they have seen and selected higher values. Typically, and I stress typically, it is 1-2 lunar diameters $\frac{1}{2}$ to 1° extension from the limb. On one occasion, I was observing from crystal clear air at 14000 feet altitude, and at solar minimum when streamers are longer from the equator and short at the poles. Streamers extended 3-4 $^\circ$ from each side of the limb. This was at my first eclipse in the Andes. 15 eclipses later, I have yet to repeat this observation and the extent visible at most eclipses, depending on transparency, has been 1-2 lunar diameters $\frac{1}{2}^\circ$ to 1° extension from each of the limbs making the total span some 2 $\frac{1}{2}^\circ$. The eye, adrenaline, excitement, and the fact that we don't normally see objects this big in the sky can greatly exaggerate your impression of the streamer length.

Q6 What is the recommended minimum optical density for a visual solar filter?

Q6 Quelle est la densité optique minimale recommandée pour un filtre solaire visuel ?

- ⇒ ND 3.0 1000 x reduction / réduction
- ⇒ ND 3.8 6400 x reduction / réduction
- ⇒ ND 4.0 10000 x reduction / réduction
- ⇒ **ND 5.0 100000 x reduction / réduction ✓**
- ⇒ ND 6.0 1000000 x reduction / réduction

The recommended value is ND5 with 100000 x reduction. However that is not the whole story. Filters must conform to ISO 12312-2, a standard that has been developed by collaboration between solar eclipse observers and health authorities to ensure safe blockage of the visible wavelengths as well as the damaging yet invisible UV and IR wavelengths. Baader make an ND 3.8 (6400x). This filter is deliberately made with lower density to give usable shutter speed when used for photography in optical systems with long focal ratios, f25-f50. It has been shown that the filter has sufficient protection in UV and IR not to damage your eyes but it won't be comfortable to use visually. The same advice applies to ND4(10000x) filters. For example, an old Kodak gelatin ND4 filter, does not protect your eyes against IR.



Q7 If you cast the image of the sun from a 5 mm pinhole to a surface 11.5 metres away, how big is the diameter of the sun's image?

Q7 Si vous projetez l'image du soleil depuis un trou d'épingle de 5 mm vers une surface située à 11,5 mètres, quelle est la taille du diamètre de l'image du soleil?

- ⇒ 5 mm
- ⇒ 15 mm
- ⇒ 57.5 mm
- ⇒ **100 mm** ✓
- ⇒ 155 mm

The size of the image of the sun or moon can be easily calculated by dividing the focal length by $(360/\pi)$ or 114.6. In the case of a pinhole projector, the projection distance is the focal length.

11.5 metres = $11,500\text{mm} \div 115 = 100\text{mm}$.

Q8 What is the longest possible duration of a total solar eclipse as seen by a stationary observer?

Q8 Quelle est la durée la plus longue possible d'une éclipse totale de Soleil vue par un observateur stationnaire ?

- ⇒ 6 minutes
- ⇒ 6 ½ minutes
- ⇒ 7 minutes
- ⇒ **7 ½ minutes** ✓
- ⇒ 8 minutes

The exact theoretical maximum, when the moon is at perigee and earth at apohelion, umbra projected onto the equator is 7m 32s. (Jean Meeus-Mathematical Morsels)

Q9 Over a long term average, how often does a total solar eclipse occur somewhere on Earth?

Q9 Sur une moyenne à long terme, à quelle fréquence une éclipse solaire totale se produit-elle quelque part sur Terre?

- ⇒ 6 months / mois
- ⇒ 12 months / mois
- ⇒ **18 months / mois** ✓
- ⇒ 24 months / mois
- ⇒ 36 months / mois

Total eclipses are sometimes only 12 months apart, eg April 2023 & April 2024. Sometimes the gap is 2 years or more, eg April 2024 & August 2026. The average frequency of solar eclipses anywhere on Earth over the last few millennia is 18 months.

Q10 On June 30, 1973, a specially equipped prototype Concorde, flew along the path of a total solar eclipse. Instruments pointed through special portholes in the roof at the sun, but the crew could not see. The eclipse was directly overhead, and the instruments had the only outlook. They only viewed instruments. The eclipse from the ground was 7m04s. To the nearest minute, how many minutes was the extended totality duration from the Concorde and experienced by the crew?

Q10 Le 30 juin 1973, un prototype Concorde spécialement équipé a survolé la trajectoire d'une éclipse solaire totale. Les instruments pointaient vers le soleil à travers des hublots spéciaux dans le toit, mais l'équipage ne pouvait pas voir. L'éclipse était directement au-dessus de nous et les instruments avaient la seule perspective. Ils ne regardaient que les instruments. L'éclipse depuis le sol a duré 7m04s. À la minute près, combien de minutes a duré la totalité étendue du Concorde et vécue par l'équipage ?

⇒ 13 mins

⇒ 27 mins

⇒ 58 mins

⇒ **74 mins** ✓

⇒ 87 mins

Concorde tracked totality for a whopping 74 minutes. Unfortunately, none of the scientists and technicians on board could see anything aside from instrument readouts because the eclipse was too high in the sky above the plane, not visible from the portholes and they all had assigned tasks operating instruments. The path of totality carved a huge arc across central north Africa. Concorde was fast but still not as fast as the umbra. However, the path was quite wide, and the course of the aircraft cut the corner of that huge arc allowing them to travel a shorter distance than the centreline length. This allowed the aircraft to keep up for 74 minutes.

Eclipse chasers Glenn Schneider and John Beatty organised an air chase in French Polynesia in July 2010. Those of us on the ground observed 4m 45s of totality. Using a regular Airbus A319, corner cutting using Glenn's amazing Eclipse Flight intercept software, they extended totality to 9m23s from an altitude of 39000 ft.



Q11 When is the first time it's safe to remove solar filters or glasses and view totality with the unprotected naked eye?

- ⇒ When the crescent is really thin.
- ⇒ When everybody around screams and yells yahoo and yehaw.
- ⇒ At the appearance of the first Baily Bead
- ⇒ **As the diamond ring begins to shrink** ✓
- ⇒ After the lunar disc covers the chromosphere
- ⇒ At the middle of totality
- ⇒ It is never safe to remove filters

Q11 Quand est-il sécuritaire de retirer les filtres solaires ou les lunettes et de regarder à l'œil nu sans protection ?

- ⇒ Quand le croissant est vraiment fin.
- ⇒ Quand tout le monde crie et crie yahoo et ouais.
- ⇒ A l'apparition du premier Baily Bead
- ⇒ **Alors que la bague en diamant commence à rétrécir** ✓
- ⇒ Après que le disque lunaire recouvre la chromosphère
- ⇒ Au milieu de la totalité
- ⇒ Il n'est jamais prudent de supprimer les filtres

When the crescent is very thin, the dangerously bright photosphere is still visible, just as intense and just as capable of burning the retina. Some observe the Baily's Beads phenomena naked eye and this is possibly safe. I prefer to keep my eclipse filters protecting my eyes until the diamond ring begins it's fade into totality. I have never had any problems even with temporary spots observing the diamond ring naked eye. I remove filters from camera/telescope lenses being used for photography about 30s before totality commences(2nd contact) but never use optical devices to view Baily's Beads or the diamond ring. Apart from the danger to the eyesight, the dazzling bright light will diminish the appearance of the corona and I don't believe that viewing beads diamond rings visually through optics has any advantage over naked eye.

Veteran Canadian eclipse chaser and retired professor of Optometry and Ophthalmology, Ralph Chou, offers very similar advice:-

“For unaided eye viewing of the eclipse you will want to use a protective viewer until you can only see one or two Baily's beads through it. At that time, you are very close to C2 and can see the diamond ring effect as that last bead winks out. That should be around 10 to 15 seconds before C2. It is tricky in that you could be early, but if the beads are too bright for comfort resume using the filter a bit longer. A second or two of unprotected view of the beads will not put your eyes in any danger but the glare might make it harder to see the corona for the first seconds of totality.

As for C3 as soon as the beads reappear at the terminating diamond ring, it will be time to resume using your protective viewer.

Again, these remarks only apply to unaided viewing. If you use an optical system like a telescope the threshold exposure for retinal injury will be much shorter and you need to err

on the side of caution by delaying removal of the protective filter. The larger the diameter of the objective aperture the shorter the critical exposure time. And both the eye and the camera sensor are at risk.

I hope this helps. If you're in any doubt, it's better to miss the in-going diamond ring than risk eye damage. The April eclipse will be total number 20 for me and I will still be cautious around C2.

*B. Ralph Chou
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This photo by Joe Cali is taken about 10 seconds before totality when too much of the Sun's surface, the photosphere, is still visible. Joe was not looking through the camera at the time making the capture quite safe.

Q12 By how many degrees does the temperature typically drop at totality compared to the temperature before first contact?

Q12 De combien de degrés la température chute-t-elle généralement au total par rapport à la température avant le premier contact ?

It doesn't change / Ça ne change pas

- ⇒ 0-1C / 0-2F
- ⇒ 1-2C / 2-4F
- ⇒ 2-5C / 4-10F
- ⇒ **5-10C / 8-18F** ✓

This is another question where a single answer was problematic. In Romania, in 1999, we were on a roasting hot tennis court. I had a dual thermometer. The ground temperature in the sun at the surface was 50C and the temperature 1m above was 40C. Both temperatures dropped to 29C during the eclipse. However, this was an extreme case. At most eclipses, the recorded temperature drop is between 5-10C and sometimes a little less depending upon many factors such as ambient temperature, humidity, ground albedo.