The Pocket Planetarium ★

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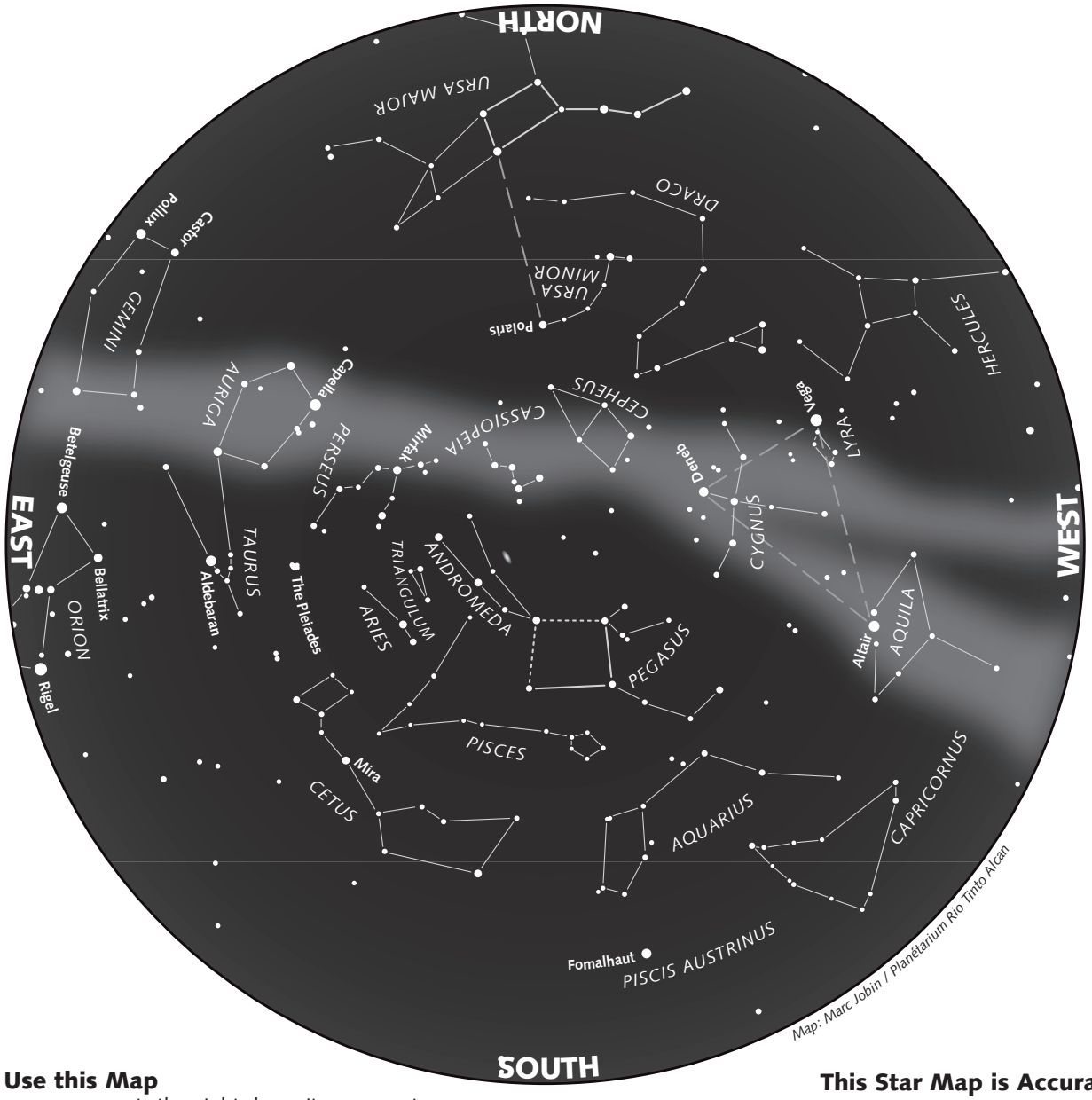
Astronomical Information Newsletter of the Rio Tinto Alcan Planetarium

The Starry Sky — Autumn 2019



How to Use this Map

The above map represents the night sky as it appears at the indicated times, and remains usable several hours before and after.

Hold the map up to the sky in front of you and turn it so the direction you are facing appears at the bottom. Lines identify the constellations. The light-coloured area outlines the Milky Way.

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This Star Map is Accurate on...

(Eastern Daylight Time, except where mentioned otherwise)

September 21 at 1 a.m.
October 6 at midnight
October 21 at 11 p.m.
November 6 at 9 p.m. EST
November 21 at 8 p.m. EST
December 6 at 7 p.m. EST

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Further details and more phenomena at espacepourlavie.ca/en/monthly-sky

The Sky This Autumn

This fall, Jupiter and Saturn continue to draw our attention after sunset, until Venus takes over as the twilight star in December. But the celestial event of the season goes to... Mercury!

Jupiter and Saturn, the evening "stars"

Jupiter's exceptional glow grabs our attention at dusk and nightfall. Until mid-November, the giant planet is the first to appear above the southwestern horizon after sunset, but as the weeks go by, it shines ever lower in the fall sky. But Jupiter will have competition in the second half of November when dazzling Venus emerges at twilight and cozies up to the giant planet: The two bright planets cross paths **on the evening of November 24,** less than 1½ degrees apart. Jupiter sets earlier and earlier each night and disappears in the Sun's glare during the first evenings of December. The giant planet will be in conjunction with the Sun on December 27.

Situated about 20 degrees to its upper left will be **Saturn,** which follows a path similar to that of Jupiter above the southwestern horizon, but just over an hour later. The two gaseous giants are currently in the southernmost leg of their celestial journey, one at the border of the constellation Ophiuchus, the other in the eastern part of the constellation Sagittarius. It's the same section of sky where the Sun passes through in November, December and January, which explains why the two planets don't gain much altitude.

Saturn also gets a visit from Venus, and the two planets are in conjunction **on the evening of December 10.** The ringed planet then disappears in the twilight glow over the second half of December and will be in conjunction with the Sun on January 13, 2020.

The Moon regularly swings by Jupiter and Saturn during its monthly trips through the constellations. Some of these encounters are worth noting. **On October 3 at dusk and nightfall,** the waxing Moon lies less than 1 degree above Jupiter. The following evening, the Moon shines between Jupiter and Saturn. **On October 5 at twilight,** you'll find the first quarter Moon less than 2 degrees to the left of Saturn. The lunar crescent lies between Venus and Jupiter **on the evening of October 30,** and can be seen 4 degrees to the left of Jupiter **the next evening, on the 31st. On November 1,** the Moon shines less than 5 degrees to the right of Saturn at dusk and nightfall. **On November 28 at twilight,** be sure to check out the thin crescent Moon lying 1½ degrees above Venus, with Jupiter less than 5 degrees to their right. **The evening of November 29,** the lunar crescent appears just 1¾ degrees below Saturn.

Phases of the Moon

*(Eastern Daylight Time, except * = Standard Time)*

First quarter	Full moon
September 5 at 23:10	September 14 at 0:33
October 5 at 12:47	October 13 at 17:08
November 4 at 5:23*	November 12 at 8:34*
December 4 at 1:58*	December 12 at 0:12*
Last quarter	**New moon**
September 21 at 22:41	September 28 at 14:26
October 21 at 8:39	October 27 at 23:38
November 19 at 16:11*	November 26 at 10:06*
December 18 at 23:57*	December 26 at 0:13*

Venus reappears at twilight

Venus re-emerges as the Evening Star during the early days of fall. Although hard to spot, it becomes increasingly visible at the end of September or early October: Look for the bright planet very low in the west, about 20 minutes after sunset, when civil twilight has not yet ended. **On October 29,** a half-hour after sunset, the thin crescent Moon hangs 4 degrees above Venus. The planet rises to an appreciable height only in November and shines 5 degrees above the southwestern horizon by mid-month, 30 minutes after sunset.

Venus slowly inches upward to meet Jupiter, which sinks lower with each passing evening. **From November 22 to 26,** the gap between the two bright planets is less than 3 degrees and shrinks to 1½ degrees **the evening of November 24. On November 28 at twilight,** the thin crescent Moon lies a mere 1½ degrees above Venus, while Jupiter shines less than 5 degrees to their right.

After its conjunction with Jupiter, Venus draws ever-closer to Saturn: **From December 9 to 12,** the Evening Star and the ringed planet are less than 3 degrees apart, and **on the evening of December 10,** the gap is less than 2 degrees. You'll find the two planets low on the southwestern horizon at the end of nautical twilight. Venus soars upward between December 1st and 31st, dramatically doubling its altitude in the southwest from 8 to 17 degrees at the end of civil twilight.

Mercury visible at dawn

Mercury, the closest planet to the Sun, alternates between appearances in the evening and morning sky all year long. The least favourable evening apparition will be around mid-October, when Mercury's orbital inclination with respect to the horizon keeps the planet obscured in the glare of the setting Sun. As it transitions to the morning sky, Mercury reaches inferior conjunction **on November 11** and spends a few hours passing directly across the Sun's face **(see other text on page 4).**

It then graces us with a very good apparition in the morning sky **between November 18 and December 14.** Look for the tiny planet above the east-southeastern horizon 30 to 60 minutes before sunrise. Too dim before November 18, Mercury is much brighter at the end of this apparition. However, it becomes harder to make out because it remains too low on the horizon. The prime viewing window extends from November 20 to December 10.

On the morning of November 25, about thirty minutes before sunrise, the crescent moon can be found 5 degrees to the lower left of Mercury, low in the east-southeast.

Mars is back in the morning sky

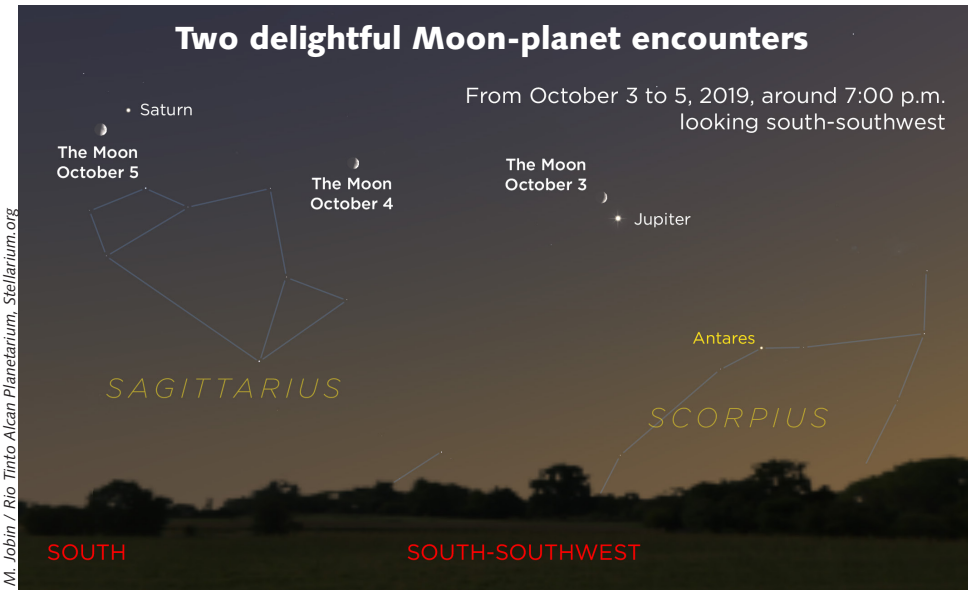
On September 2, **Mars** was in conjunction with the Sun, on the opposite side of our star from Earth. This fall, the Red Planet slowly pulls away from the Sun's glare and re-emerges in the dawn sky, finally visible above the eastern horizon in October. Given the great distance separating us, Mars is still quite dim and difficult to make out in the glow of dawn. But come November, the Red Planet will be visible in the still-dark sky, very low in the south-southeast by night's end, just before daybreak. By late fall, you'll be able to spot Mars about 15 degrees above the southeast horizon at first dawn.

The thin waning Moon lies a few degrees above Mars **on the morning of October 26,** and to the immediate left of the Red Planet **on the morning of November 24.** The crescent Moon will also sit next to Mars on the mornings of December 22 and 23.

Clear skies!

Research and text: **Marc Jobin**

Two delightful Moon-planet encounters

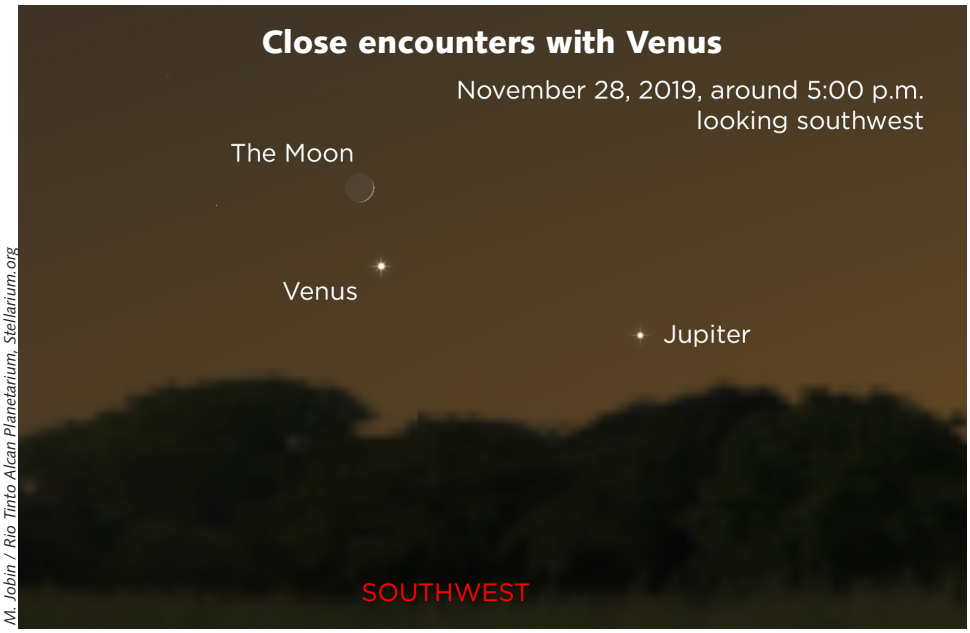


M. Jobin / Rio Tinto Alcan Planetarium, Stellarium.org

In early October, the waxing Moon snuggles up to two brilliant planets winking down at us from the darkening sky, resulting in some of the finest conjunctions of 2019. **At dusk on October 3rd,** the lunar crescent glides just over 1 degree to the upper left of Jupiter. The next day, on October 4, the Moon will continue on its orbit and sit midway between Jupiter and Saturn. And finally, **on the evening of October 5,** the first quarter Moon shines 1½ degrees to the left of Saturn, slightly lower than the ringed planet.

The show will take place low on the horizon, between the south and southwest, producing beautiful scenes set against the colours of twilight some 30-60 minutes after sunset. Get your cameras ready!

Close encounters with Venus



M. Jobin / Rio Tinto Alcan Planetarium, Stellarium.org

Venus finally makes a shy return to the evening sky! The dazzling planet re-emerges in November, low on the southwestern horizon at twilight. It first sidles up to Jupiter: The gap between the two bright planets is less than 3 degrees from November 22 to 26 and shrinks to 1½ degrees the evening of the 24th.

Don't miss the beautiful conjunction **on the evening of November 28,** when the thin crescent Moon lies a mere 1½ degrees above Venus, and Jupiter shines just less than 5 degrees to their right. Enjoy this celestial pairing 30 to 45 minutes after the Sun sets.

As the evenings progress, Venus steadily approaches Saturn: The two planets are neighbours from December 9 to 12 and hang less than 2 degrees apart the evening of the 10th.

A bad year for fall meteor showers

Like the Perseids in August, the "big three" meteor showers that are active in the fall will be hampered by moonlight this year.

The **Orionids** reach peak activity on October 21. Although long-lasting, this annual shower is the least showy. These meteors' main claim to fame comes from being the product of the famous Halley's Comet, just like the Eta Aquarids in May. Orionid meteors are generally faint but very fast (67 km/s), often exploding in terminal bursts that sometimes leave persistent trains behind them. The radiant rises around 10 p.m., reaches a reasonable height after midnight and culminates at dawn. Unfortunately, the meteors don't have much of a chance this year as the waning Moon will rise at half-past midnight and spoil most of the show. Optimal observation time is after 11 p.m. and before the Moon rises.

The **Leonids** are expected to peak around midnight the night of November 17-18. This typically minor shower is associated with comet 55P/Tempel-Tuttle, which has an orbital period of 33.2 years and last passed perihelion in 1998. At that time, the Leonids produced some of the greatest meteor storms on record. That won't be the case in 2019, however, with models predicting no notable increase in activity this year. The Leonid radiant rises above the eastern horizon after midnight and culminates at dawn. However, the waning gibbous Moon will be lighting up the sky, seriously interfering with viewing.

The **Geminids** in mid-December are considered the most consistent and reliable meteor shower year after year; they're also one of the most prolific, alongside the Quadrantids in January. The Geminids are a slower moving (36 km/s) but brighter family of meteors. In 2019, the shower is expected to peak around midday on December 14, but the waning gibbous Moon (which will be full on the 12th) will be located close to the radiant, effectively washing out most of the meteors for a few nights before and after this date. Not a memorable year for the Geminids…

Seasonal Milestones

The **autumn equinox** takes place on September 23, 2019 at 3:50 a.m. EDT, and the **winter solstice** occurs on December 21 at 11:19 p.m. EST. Autumn will last exactly 89 days 20 hours 29 minutes.

We **return to Eastern Standard Time** early on the morning of Sunday, November 3: Clocks are set back one hour.

Transit of Mercury on November 11

Mark your calendars: **On the morning of November 11, 2019,** Mercury will be in inferior conjunction, as it is every 116 days or so. But this time, the tiny planet will pass directly in front of the Sun. This planetary transit starts with the first contact (**C1**), when Mercury's disk touches the edge of the Sun. The second contact (**C2**) occurs a few minutes later, when the planet appears completely silhouetted in front of our star. In Montreal, the Sun will rise at 6:47 a.m. and hang a mere 6 degrees above the southeastern horizon at the time of C1.

For 5 hours and 29 minutes, we'll be able to track the planet's progress across the solar disk. At maximum transit (**MAX**), Mercury will be very close to the centre of the Sun's disk, which will then stand 25 degrees high in the south-southeast. The phenomenon ends with Mercury's gradual egress, between contacts three (**C3**) and four (**C4**). At that point, the Sun will be 24 degrees above the south-southwestern horizon.

Mercury is very small, with an apparent diameter of only 10 arc seconds at the moment of inferior conjunction. That's only one-sixth the apparent diameter of Venus during its previous two transits. To detect Mercury's tiny round silhouette in front of the Sun, you'll need an optical instrument with sufficient magnification (the naked eye just isn't enough), **equipped with a filter specially designed for solar viewing.** The same precautions apply as for observing sunspots.

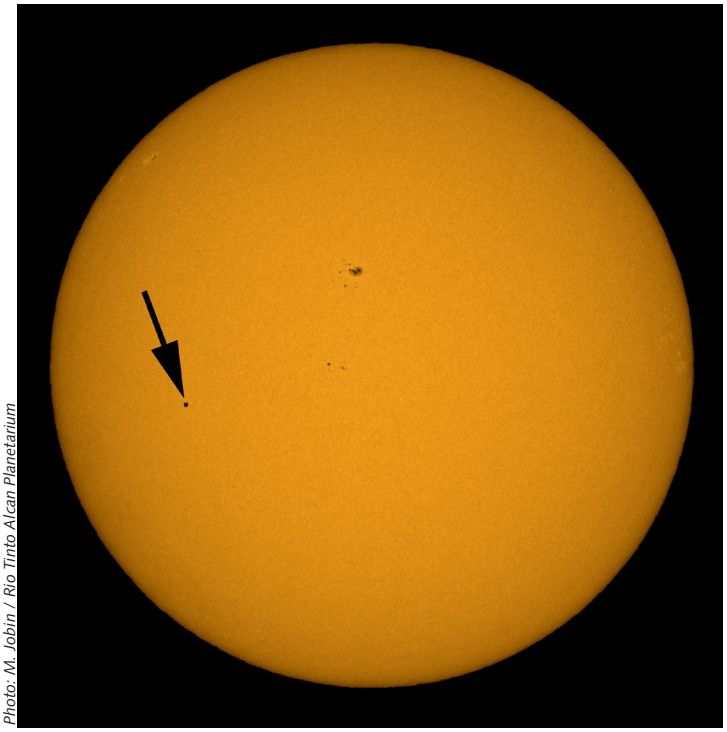
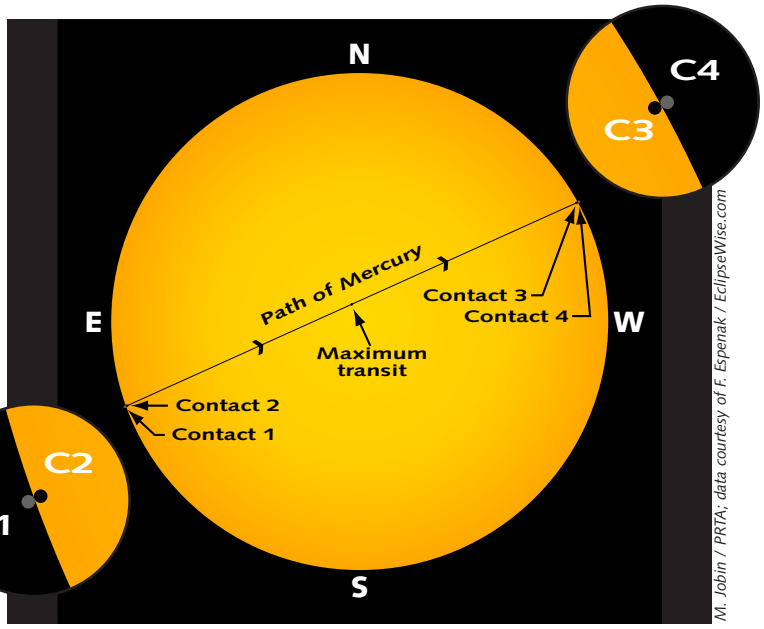


Photo: M. Jobin / Rio Tinto Alcan Planetarium

Mercury's tiny silhouette, photographed in front of the Sun during its transit on May 9, 2016.



M. Jobin / PRTA; data courtesy of F. Espenak / EclipseWise.com

Mercury's apparent path across the Sun's disk during its transit on November 11, 2019.

Transit of Mercury — November 11, 2019
Contact times in Montreal

C1:	7:36:02
C2:	7:37:44
MAX:	10:20:13
C3:	13:02:41
C4:	13:04:22

(Eastern Standard Time. Precise contact times may differ by a few seconds for locations farther from Montreal.)

Rare occurrences

Mercury and Venus are the only planets with smaller orbits than Earth and, as such, the only planets that can get between us and the Sun. But because their orbits are inclined, they usually swing above or below the Sun during inferior conjunction. Transits of Venus are very rare: The last ones occurred in 2004 and 2012, while the next will be in 2117 and 2125. As for Mercury, there are an average of only 13 transits each century.

But viewers need to be positioned on the daytime side of the globe to see them! The last time a Mercury transit was visible in its entirety from Montreal was on May 9, 2016. The next two (on November 13, 2032, and November 7, 2039) will not be visible at all from Eastern Canada, so we'll have to wait until May 7, 2049, to see the next fully visible transit from our skies—all the more reason not to miss this one!

Consult the Planetarium website for more information on planetary transits and safe observation methods:

espacepourlavie.ca/en/transit-mercury-november-11-2019

The Pocket Planetarium *is a seasonal information newsletter published by the Rio Tinto Alcan Planetarium, 4801, avenue Pierre-De Coubertin, Montréal (Québec) H1V 3V4*
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