LSO summer internship program: why are we here?

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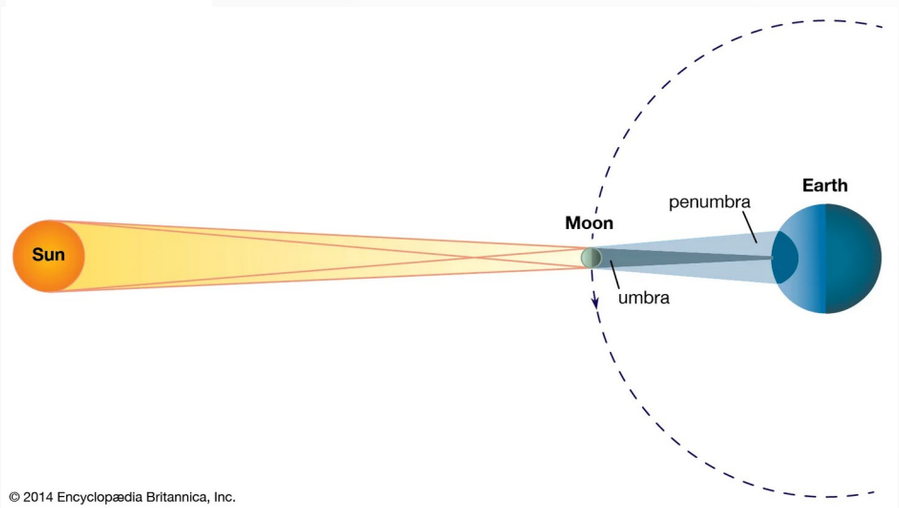
Content:

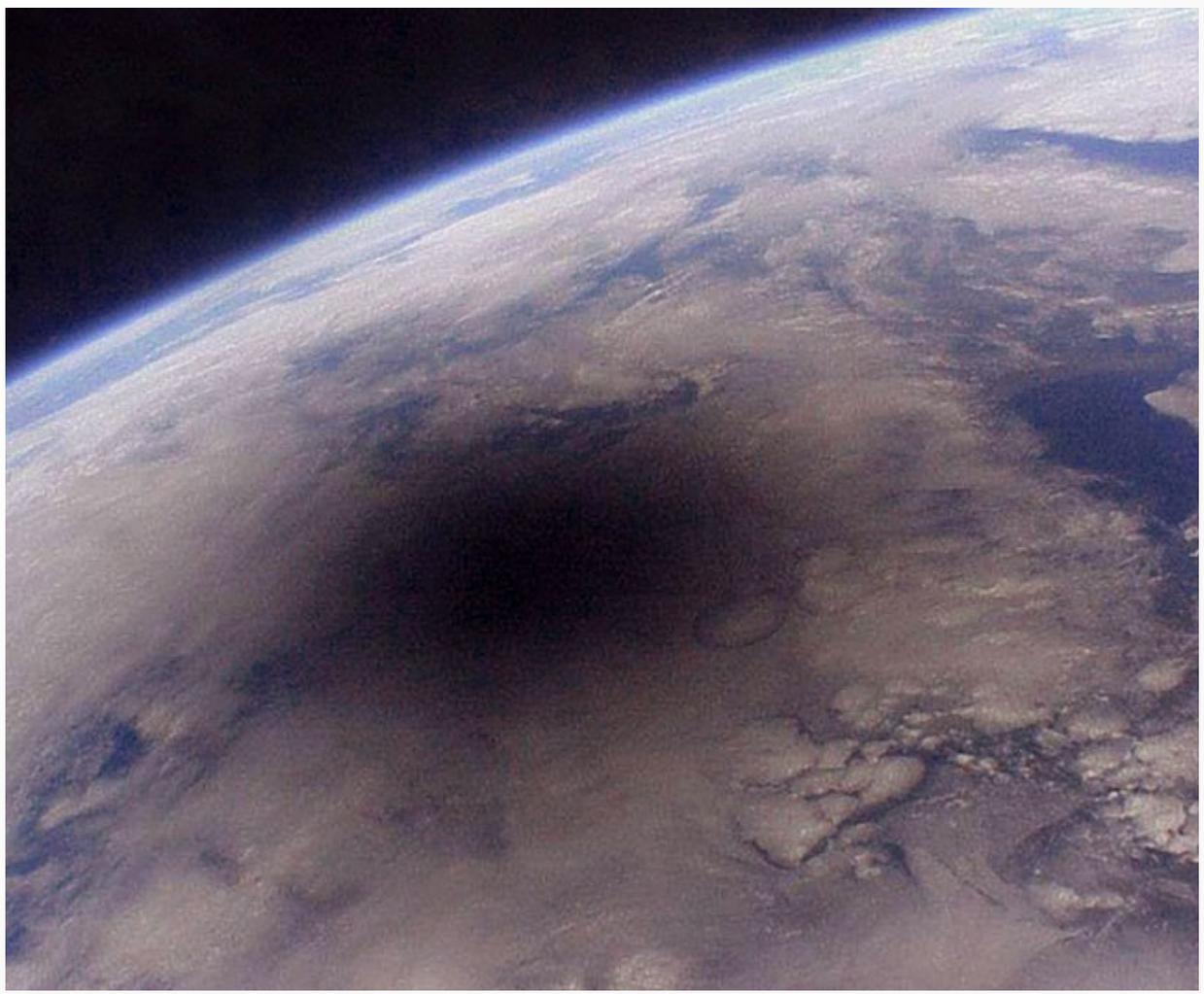
- Answer to the question: why are we here at 2633 m asl?

- Two main topics + one extension:
  - Natural solar eclipse
  - How to make it artificially at ground?
  - (Solar) observatories nowadays

LSO: natural solar eclipse

- Its clear what it is. Moon blocks the direct solar light toward me
- It is a little more: a huge part of the terrestrial atmosphere is not illumi-nated





LSO: outside natural solar eclipse

- Blue, not black sky
- Rayleigh scattering of the solar light at molecules of N and O in the terrestrial atmosphere → the scattered light intensity for a single “particle”:

$$I_s = I_0 \frac{\pi^2 \alpha^2}{{\varepsilon_0}^2 \lambda^4 R^2} \frac{1 + \cos^2(\theta)}{2}$$

- Quantitatively: air - refractive index of 1.0002793 at atmospheric pressure, there are about 2×10^25 molecules per m^3, and therefore the major constituent of the atmosphere, nitrogen, has a Rayleigh cross section of 5.1×10^−31 m^2 at a wavelength of 532 nm (green light). This means that about a fraction 10^−5 of the light will be scattered for every meter of travel (wiki: Rayleigh scattering)
- I_s ~ λ^(-4)
- Eye sensitivity

LSO: outside natural solar eclipse

- Result: less “particles” (molecules) → lower intensity of the scattered light → higher altitude = darker sky
- Let’s move the telescope to high altitude in order to decrease the number of molecules between the Sun and the telescope
- Results of experiments: triple achromat + coin → no coronal light seen, just scattered light level radially decreasing

LSO: outside natural solar eclipse

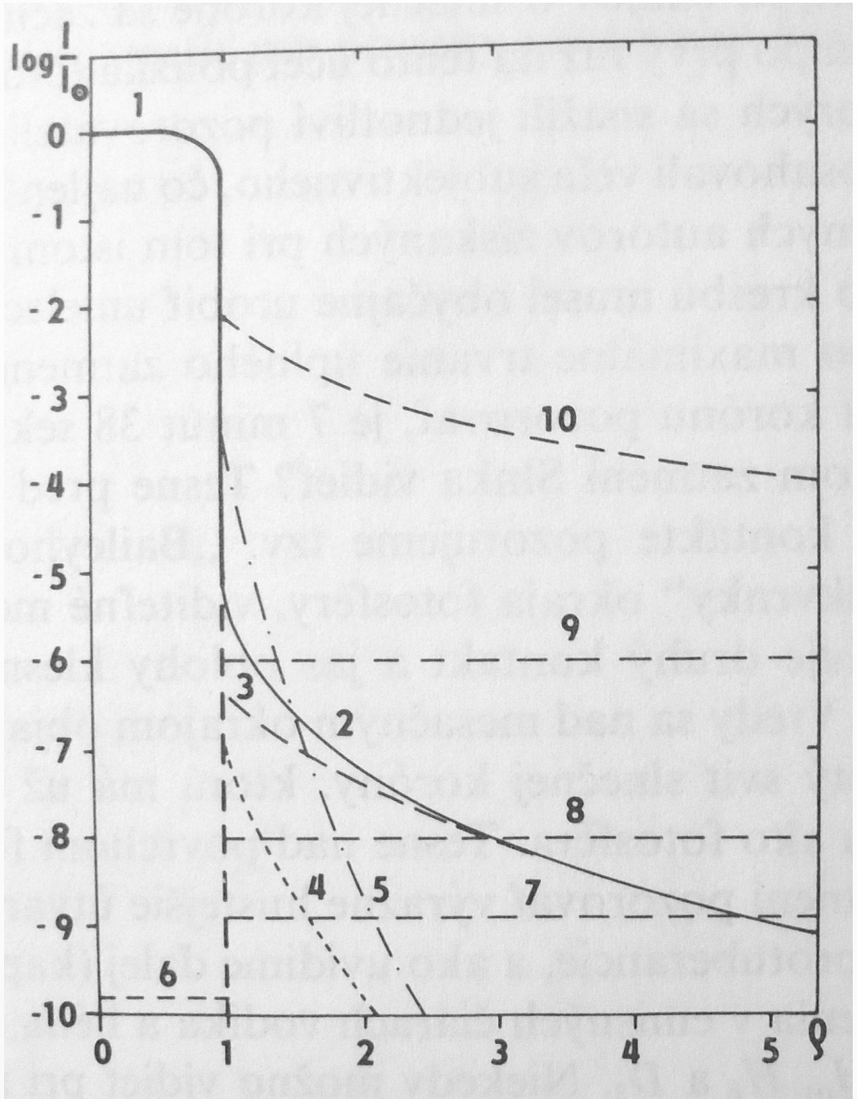
- An example related to Slovakia: the most admired Slovak man: Milan Rastislav Štefánik
- The first really paid job: director of the Mont Blanc Observatory (4810 m asl, under supervision of J. Jansen), 1906 – 1907
- No cable car, wooded barracks without heating, WC but several experiments (not quantitative...)
- Astronomy and politics – a historical story → creation of the Czechoslovakia after the WWI

LSO: sky and coronal light intensity

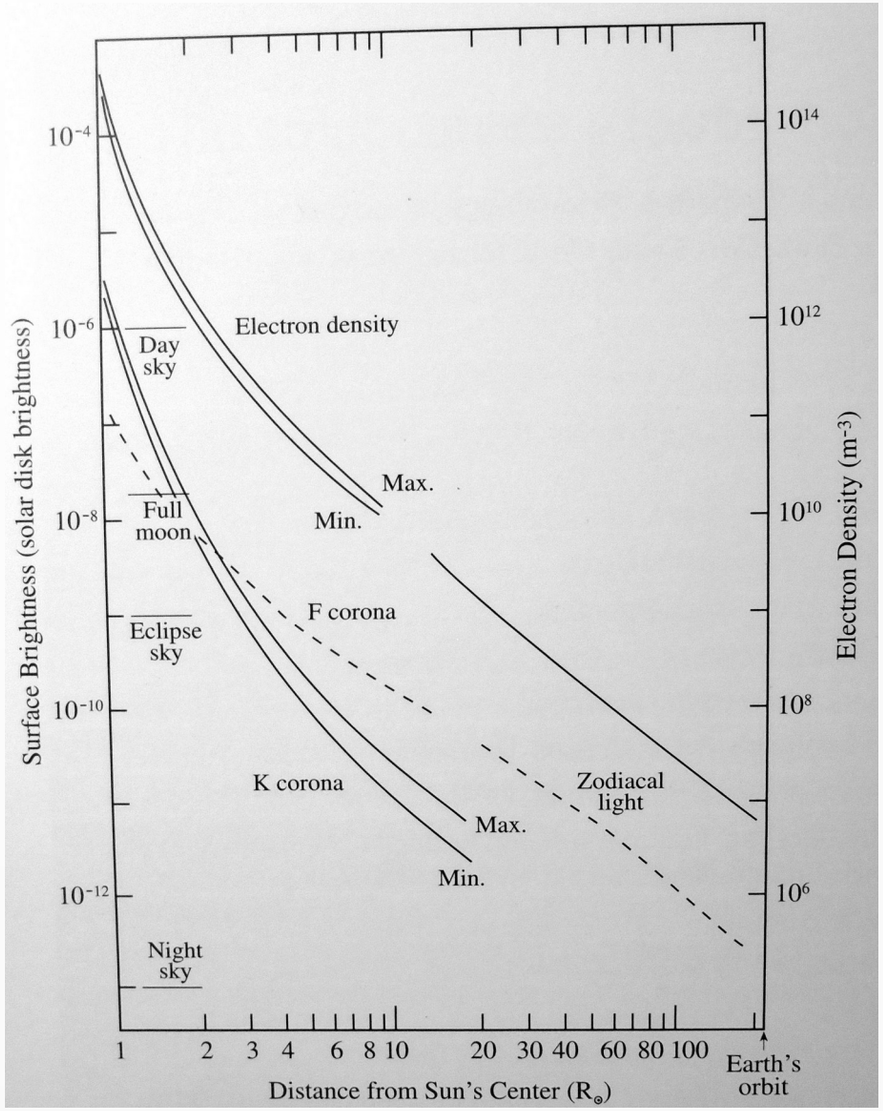
Legend:

1 - solar disk
2 - K corona
3 - F corona
4 - E corona (total)
5 - green line

6 - Moon – total eclipse
7 – sky – total eclipse
8 – sky – 25 km asl
(λ ~800 nm)
9 – ideal sky – 3 km asl
10 – sky – 0 km asl



Rušin & Rybanský, 1990, Slnečná koróna



K.R. Lang, 2001, Cambridge Encyclopedia of the Sun

LSO: observatories nowadays

- History:
  - in/close to the city – luxury and honor but still OK
  - start of the 20th century: USA - Mt. Wilson (1.7 km, 2.5 m), Mt. Palomar (1.8 km, 5.1 m), Europe: Canary Islands (70ties)
  - Solar telescopes: USA: Sacramento Peak (50ties), Europe: Canary Islands (70ties)
  - “Coronal” stations; an exception

LSO: observatories nowadays

- Is the high altitude enough? Not!
- We really need:
  - weather (high air pressure, wind),
  - altitude (inversion layer below the telescope) +
  - infrastructure (power, road, internet, luxury,...)
  - People of a special sort