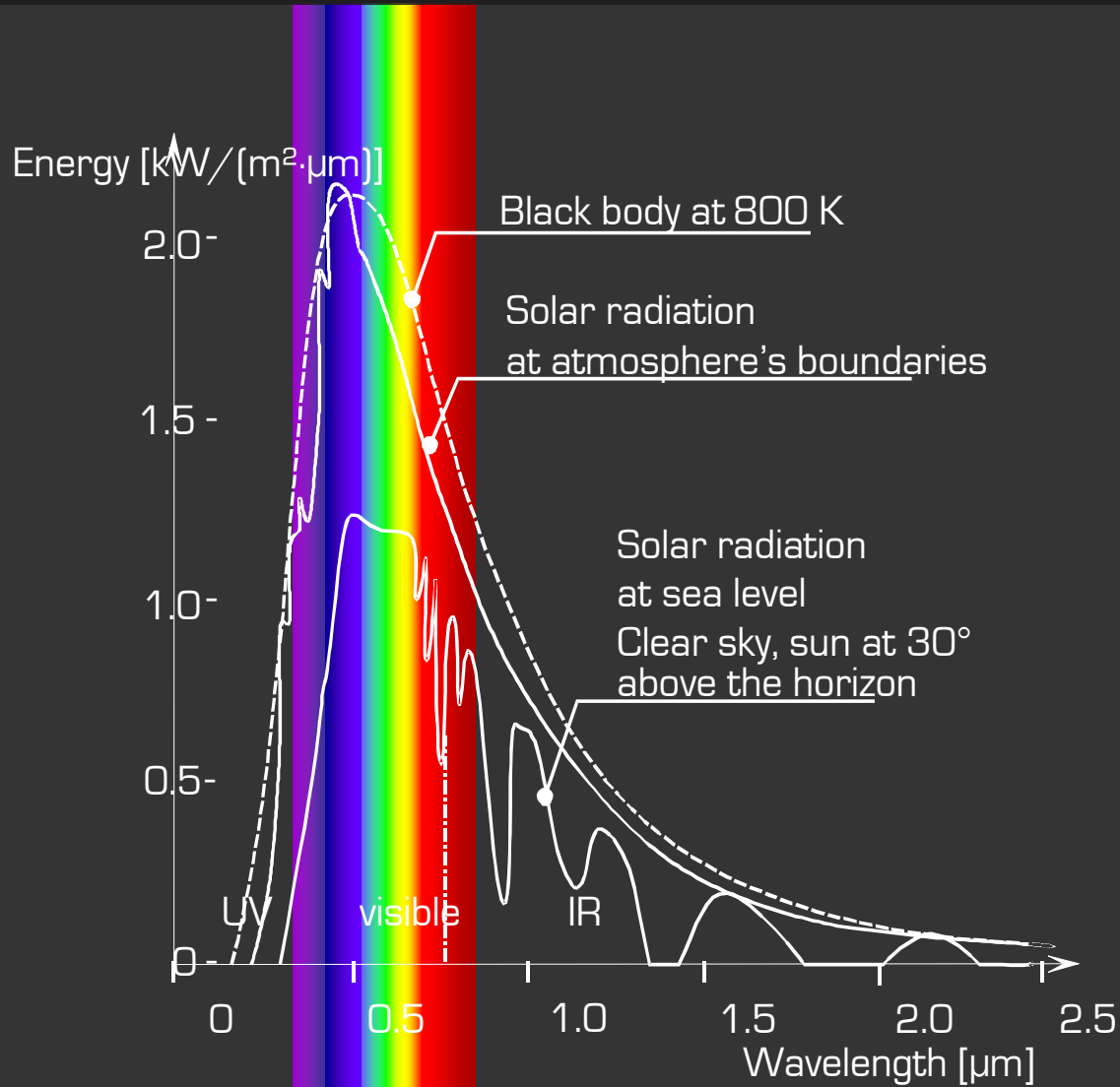


What is light ?

- ▶ Dual nature: wave and particles
 - electromagnetic theory, quantum theory, unified theory
- ▶ Visual sensation
- ▶ Electronic process

Solar radiation



Solar radiation

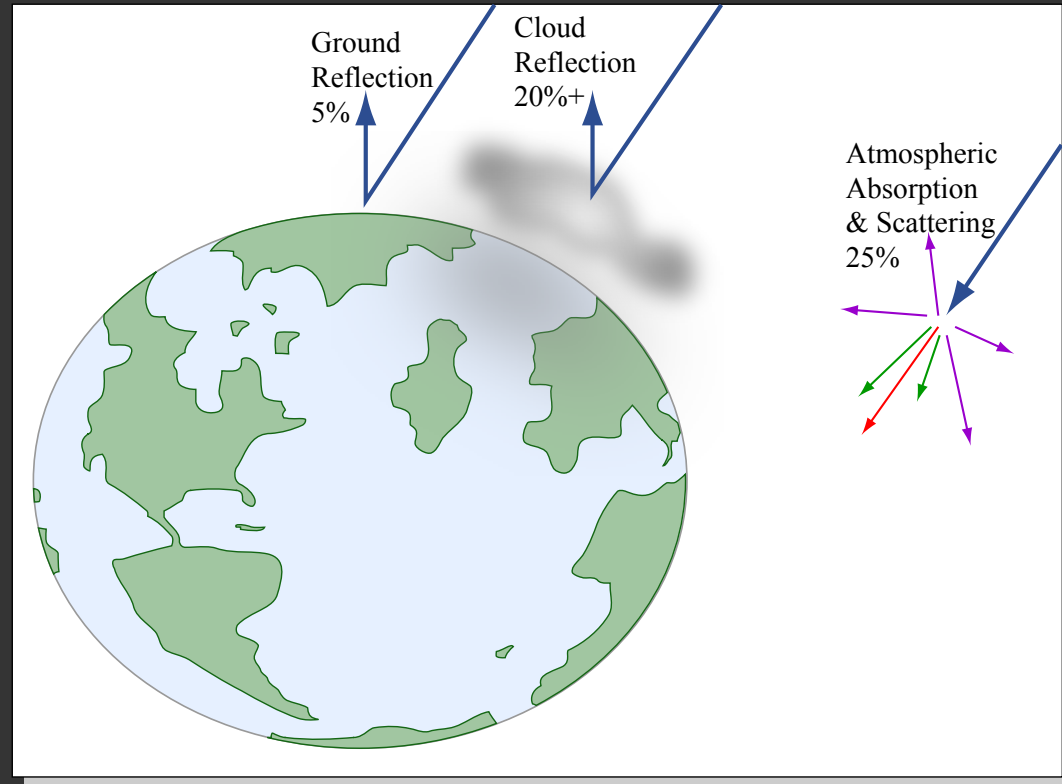
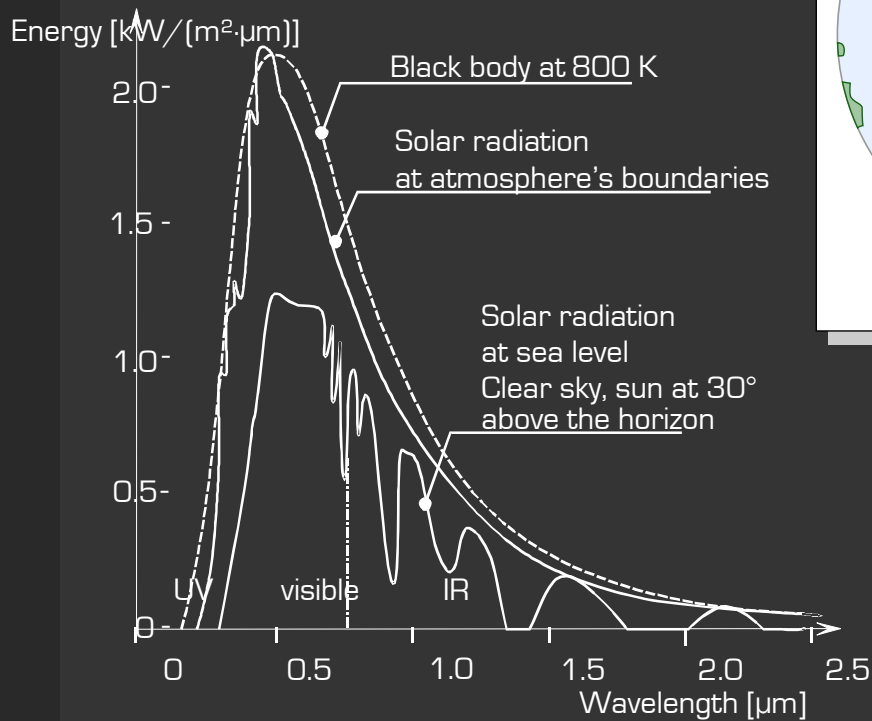


Figure by MIT OCW.



Blackbody radiation

- ▶ Radiation only dependent on T°
- ▶ Theoretical object
 - energy emitted is reabsorbed
 - maximal power radiation
- ▶ Stefan-Boltzmann law
 - radiated power per unit area = σT^4

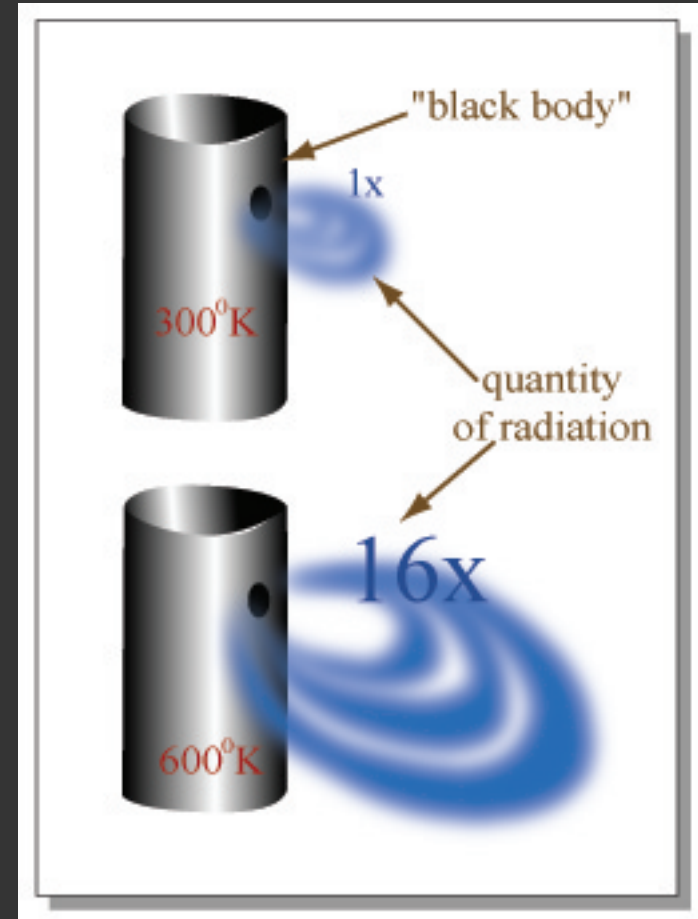
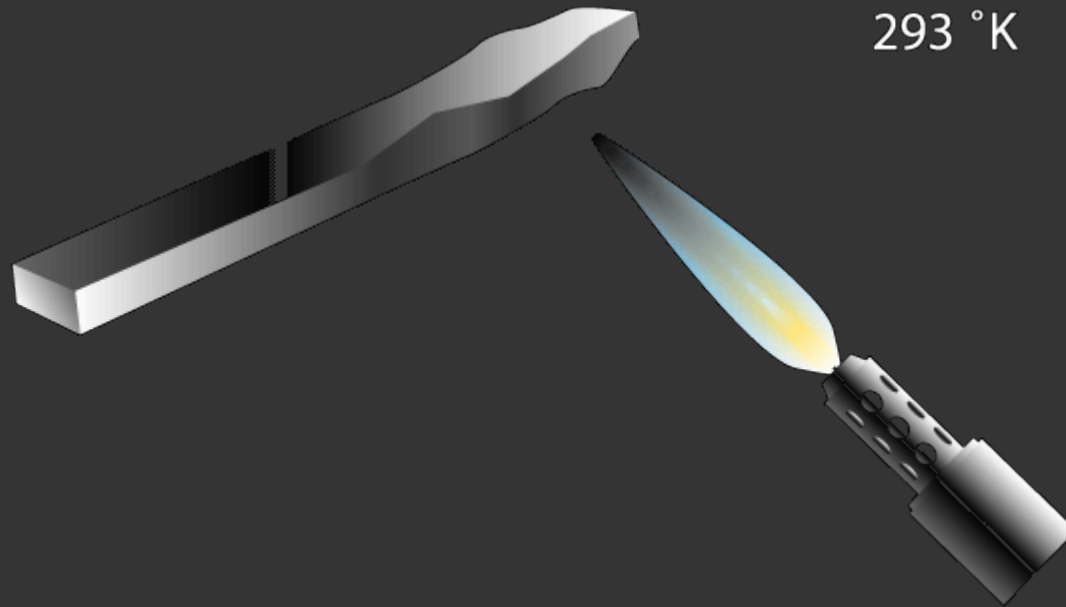


Figure by MIT OCW.

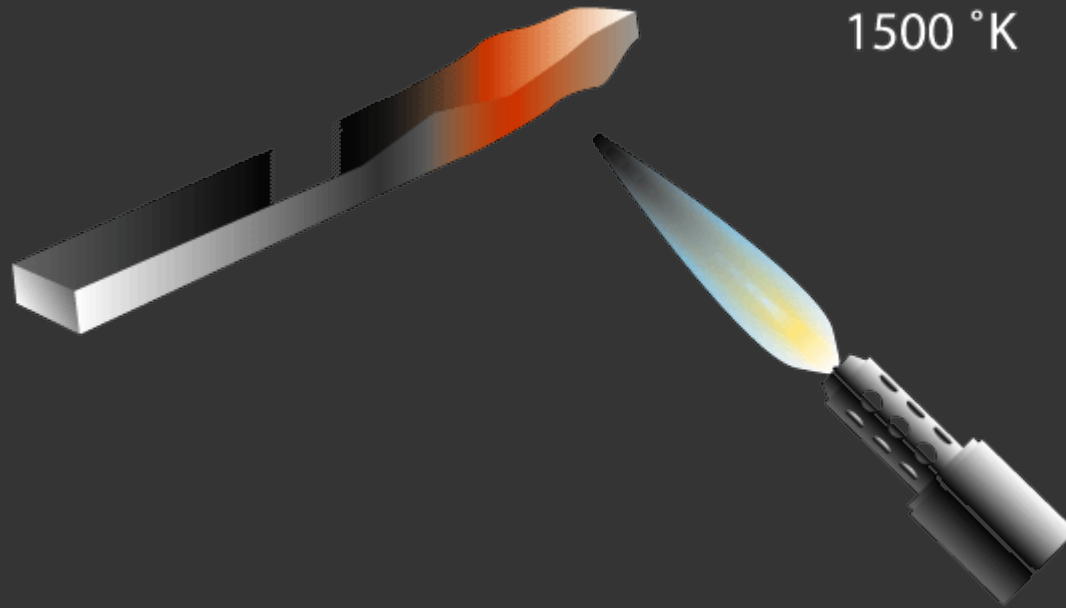
Color temperature



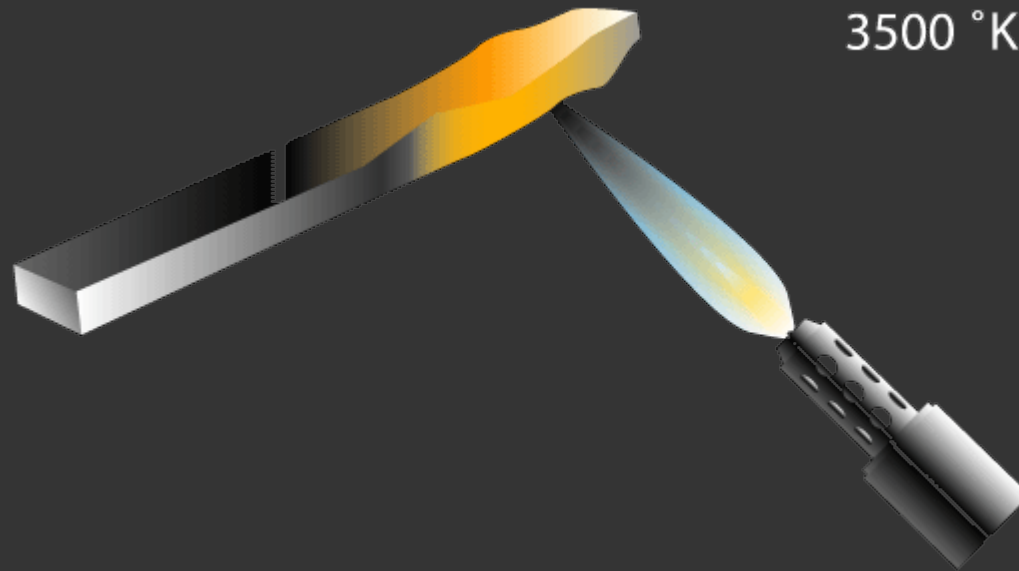
Color temperature



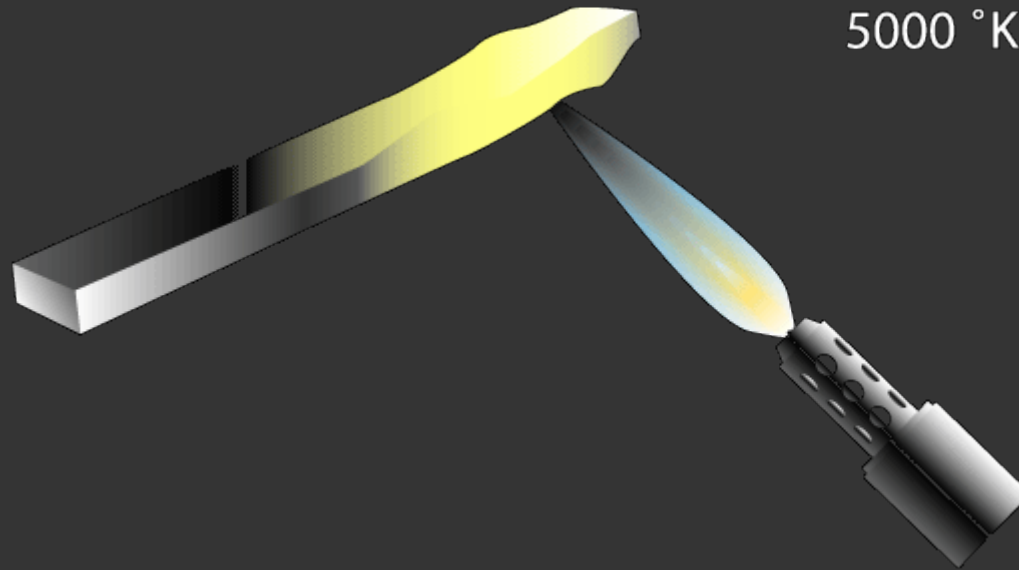
Color temperature



Color temperature

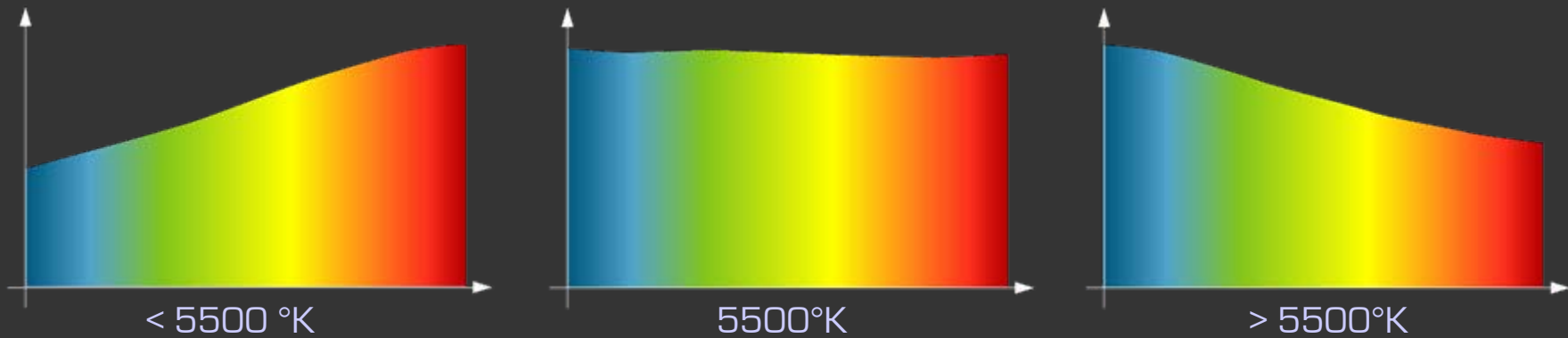


Color temperature



Color temperature

▶ Color temperature and visible emission



▶ Source requirements

- continuous spectrum
- color $T^{\circ} \approx 5500^{\circ}\text{K}$
- only fulfilled by daylight

Color temperature

► Color comfort

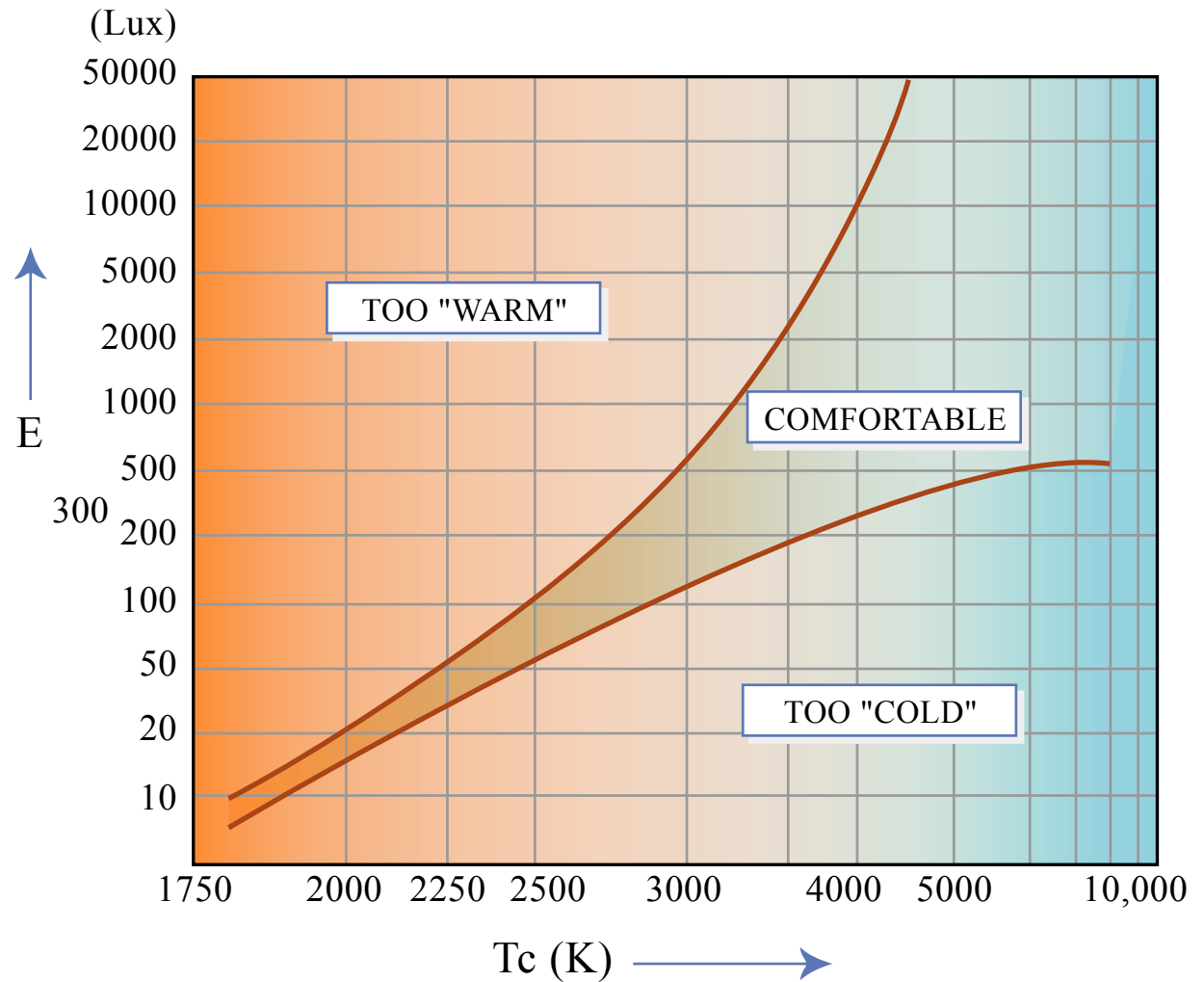


Figure by MIT OCW.

Sun course

▶ Earth's orbit

- seasons

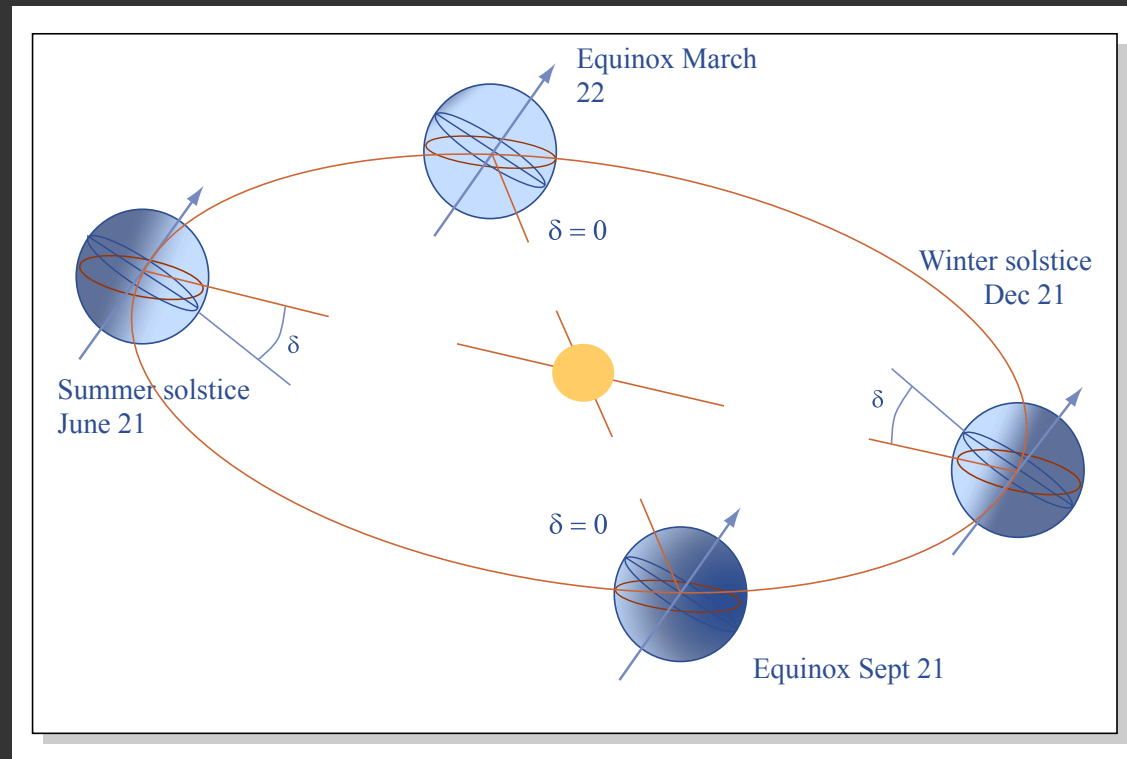


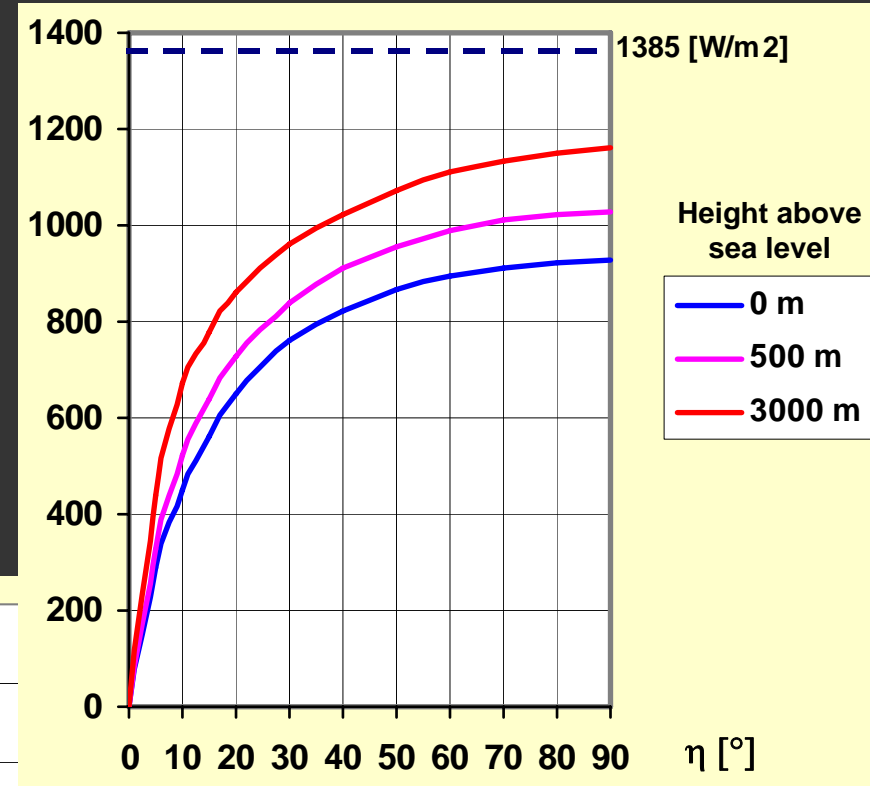
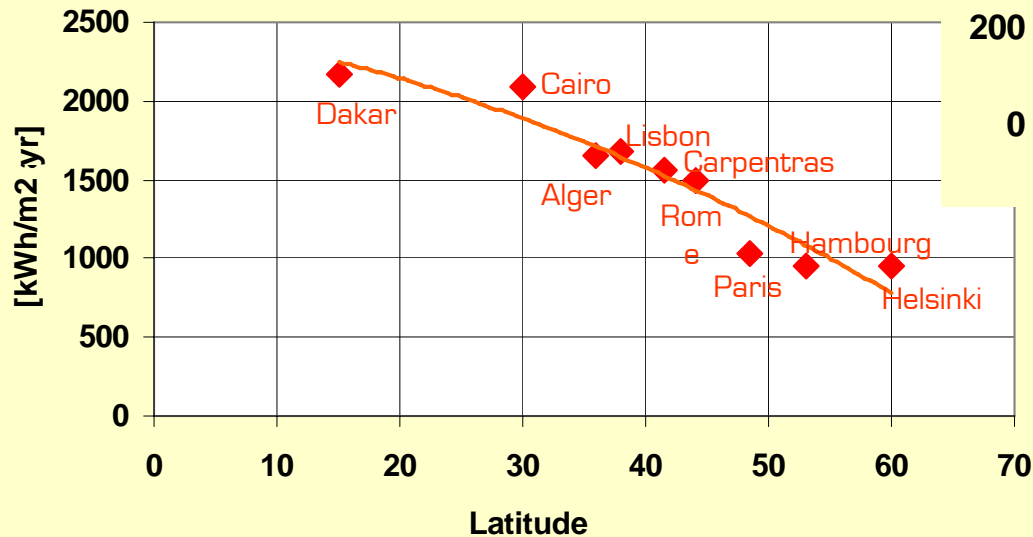
Figure by MIT OCW.

Sun course

► Earth's orbit

■ seasons

latitude and elevation's impact



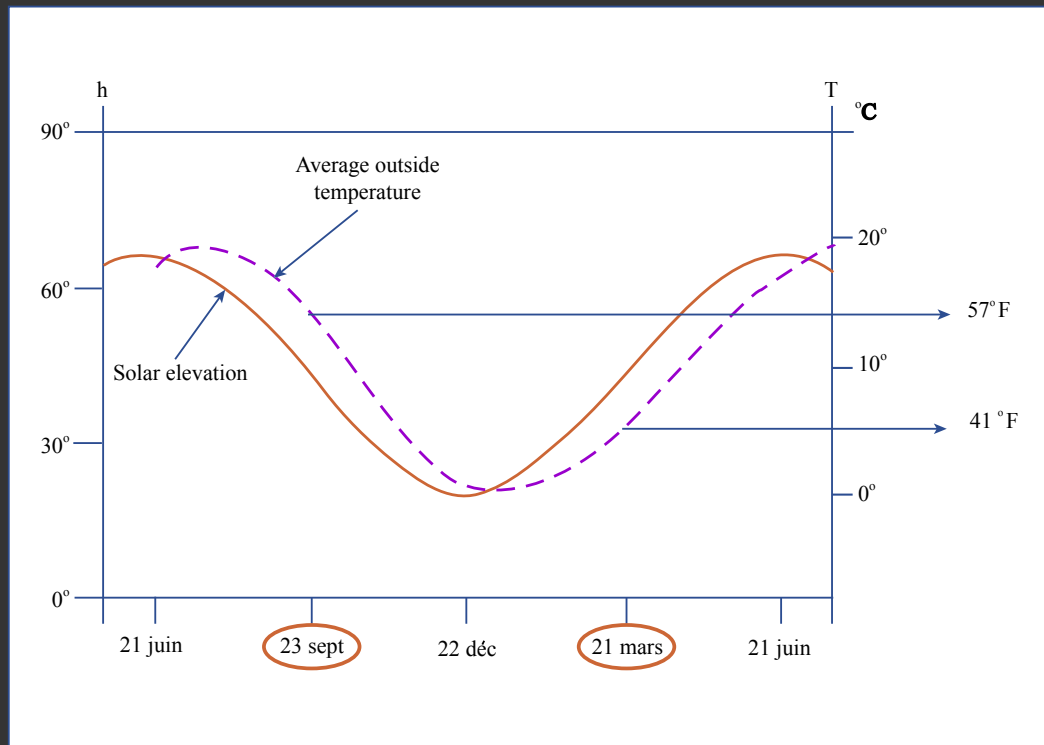
Sun course

▶ Earth's orbit

■ seasons

latitude and elevation's impact

earth's inertia



a 16°F
difference for
the same
solar elevation

Critical for solar
protections

▶ Earth's orbit

- seasons
- day
- solar time
 - speed on elliptic orbit
 - geocentric declination

$$H^{\text{solar}} = H^{\text{legal}} - \underset{[\text{min}]}{\Delta H} \dots$$

► Earth's orbit

- seasons
- day
- solar time
 - speed on elliptic orbit
 - geocentric declination
 - longitude & time zone

$$H^{\text{solar}} = H^{\text{legal}} - \underset{[\text{min}]}{\Delta H} + \underset{[\text{min}]}{4L} - \underset{[\text{min}]}{F}$$

L = longitude [°]

F = 60 x nb hours difference

with Greenwich in winter

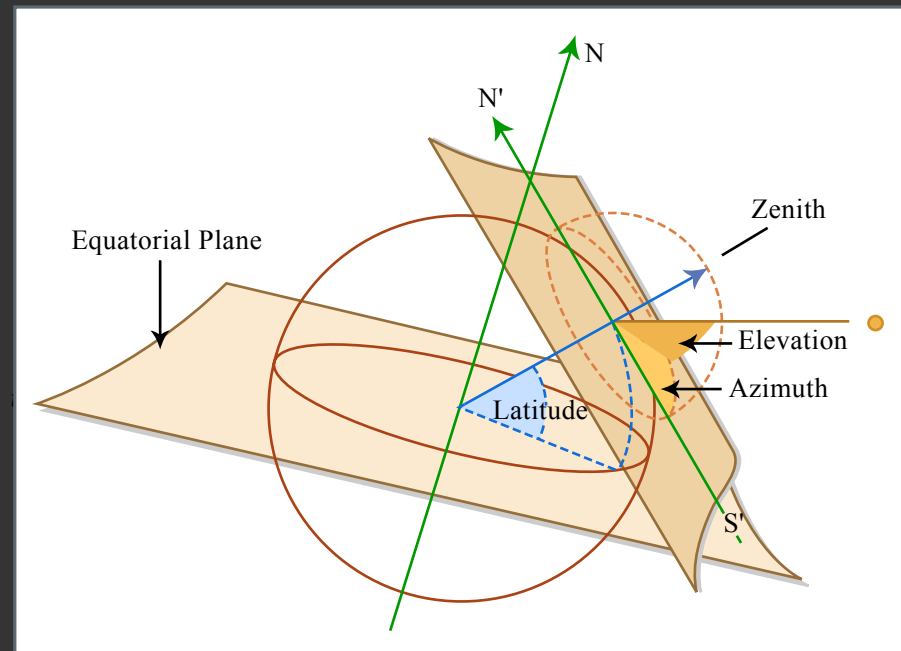
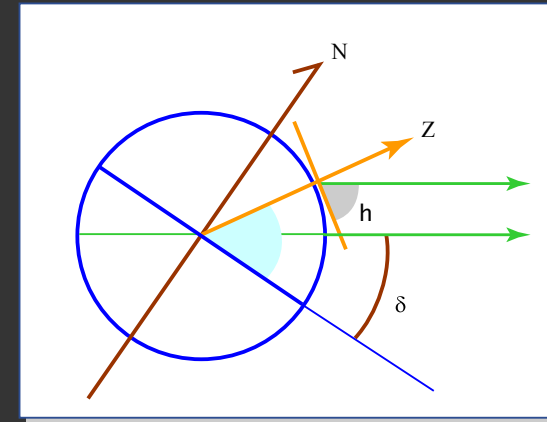
Sun charts

▶ Apparent movement of the sun

- lococentric (local) referential

elevation η ↔ latitude L
azimuth ϕ ↔ declination δ
solar time H^{solar}

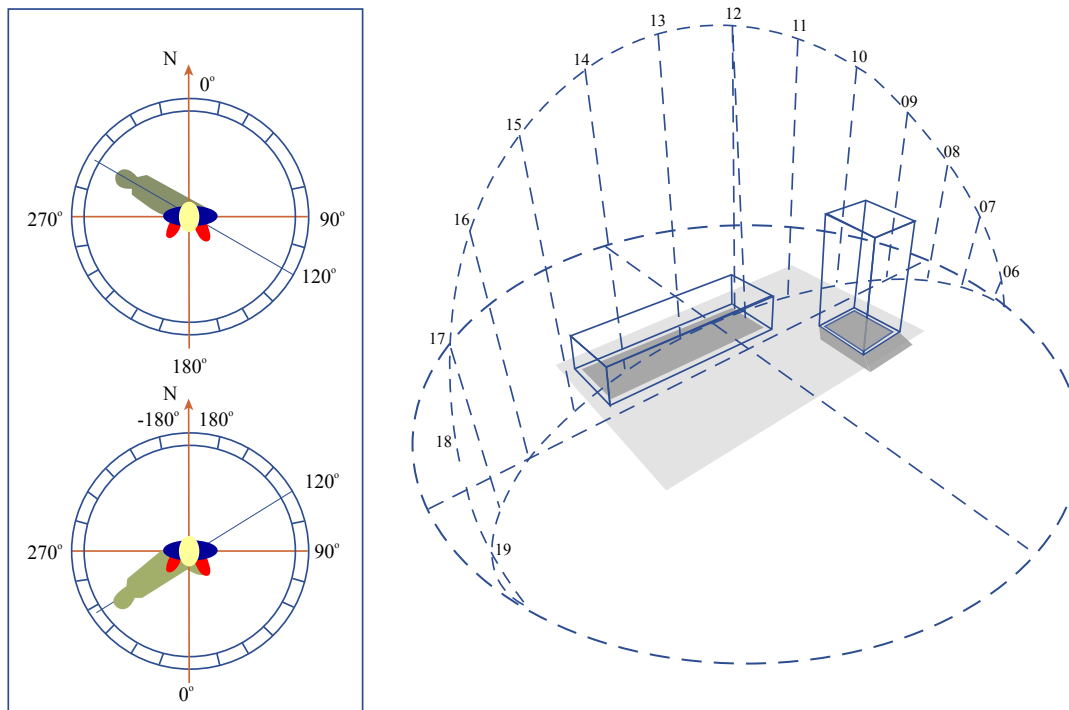
$$\eta_{\text{noon}} = 90^\circ - L + \delta$$



Sun charts

▶ Apparent movement of the sun

- lococentric (local) referential



Sun charts

► Apparent movement of the sun

- lococentric (local) referential

cylindrical projection

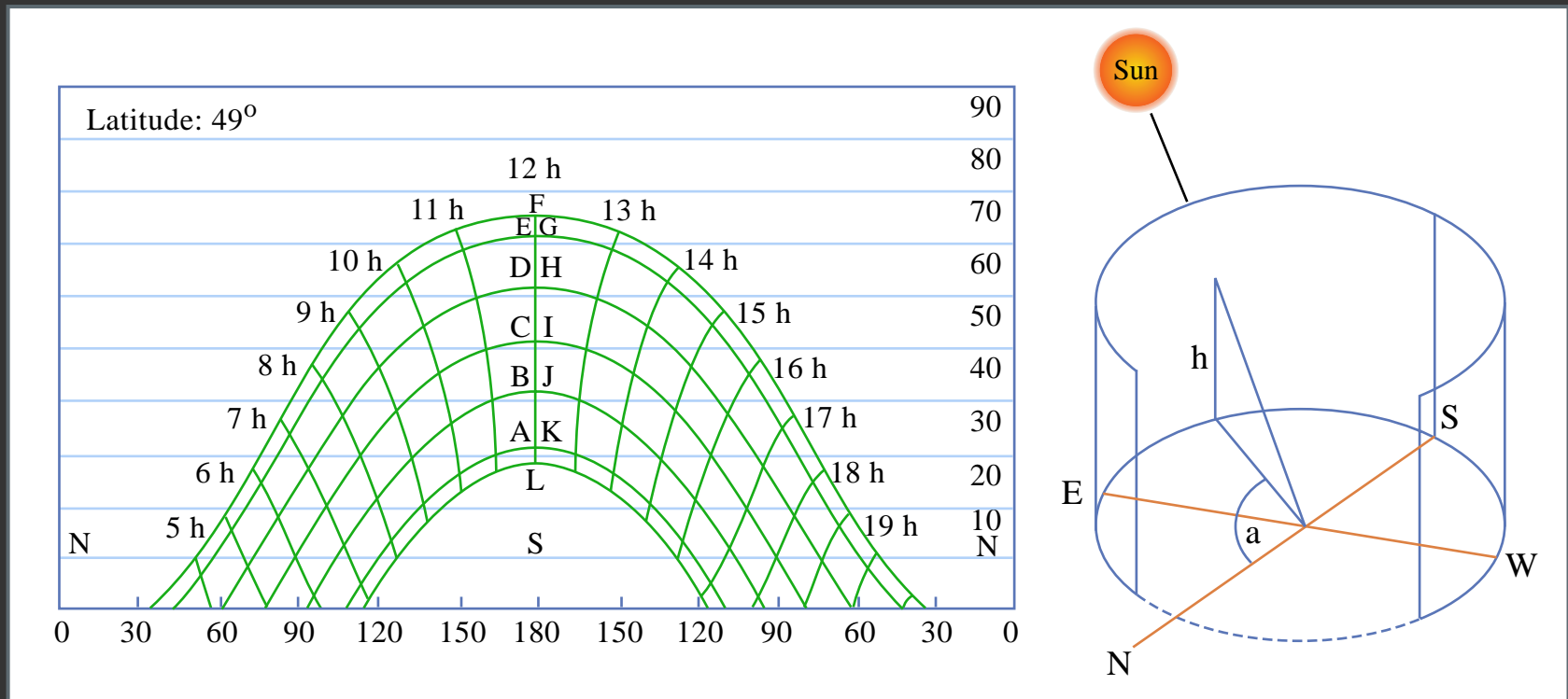


Figure by MIT OCW.

Sun charts

▶ Apparent movement of the sun

- lococentric (local) referential

cylindrical projection

stereographic projection

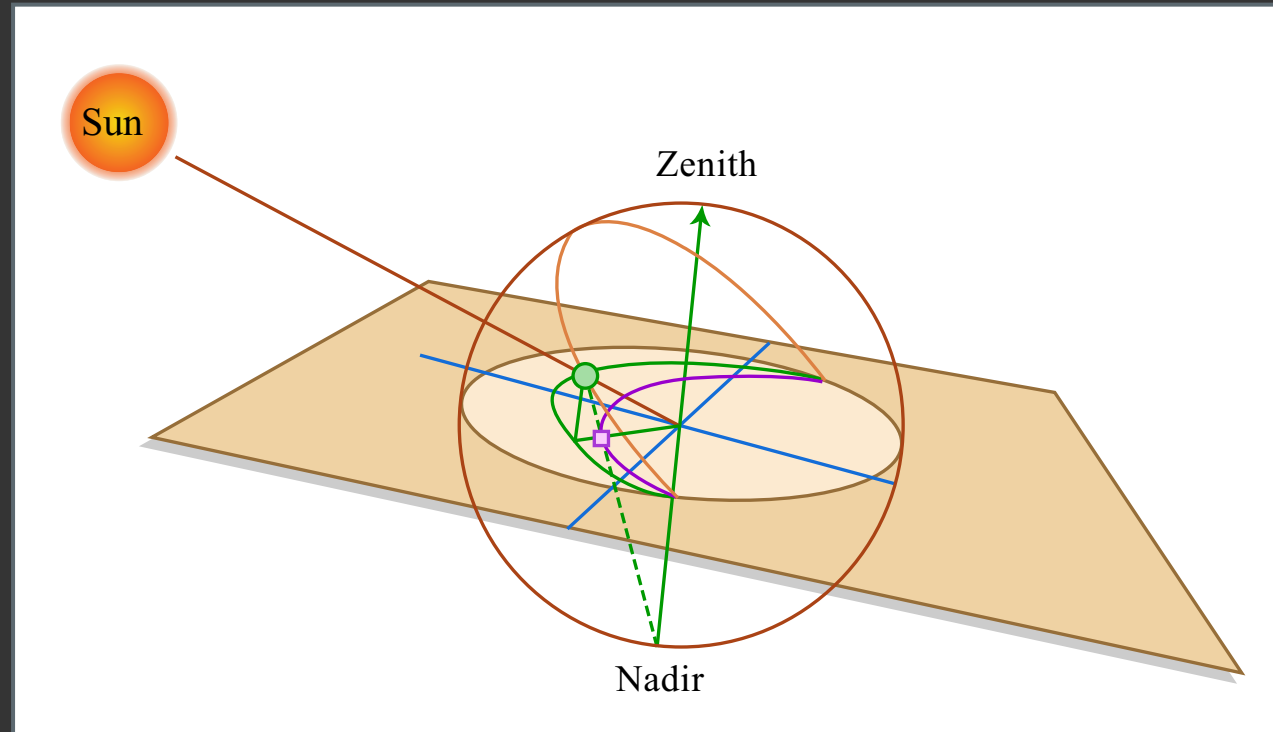


Figure by MIT OCW.

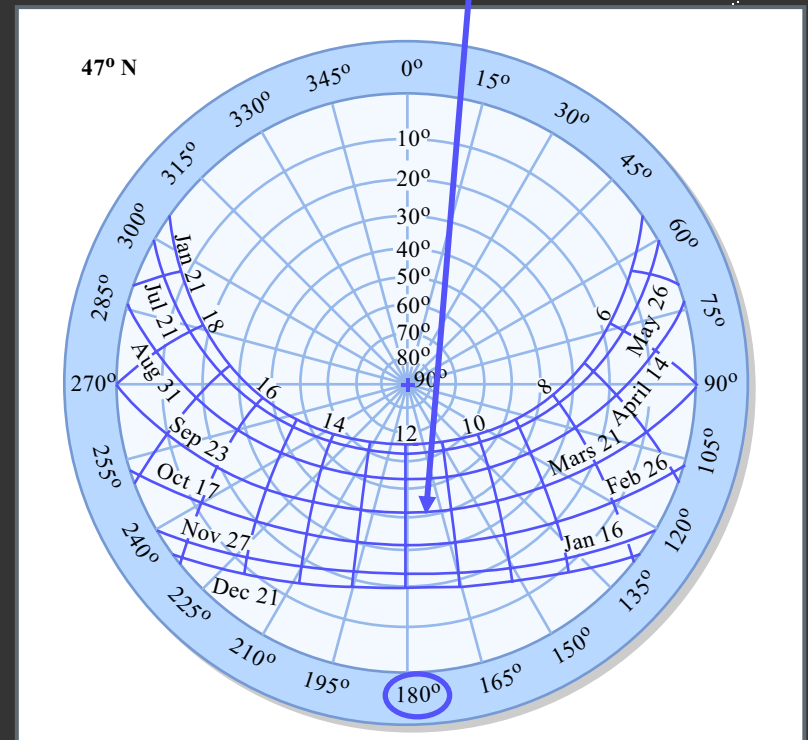
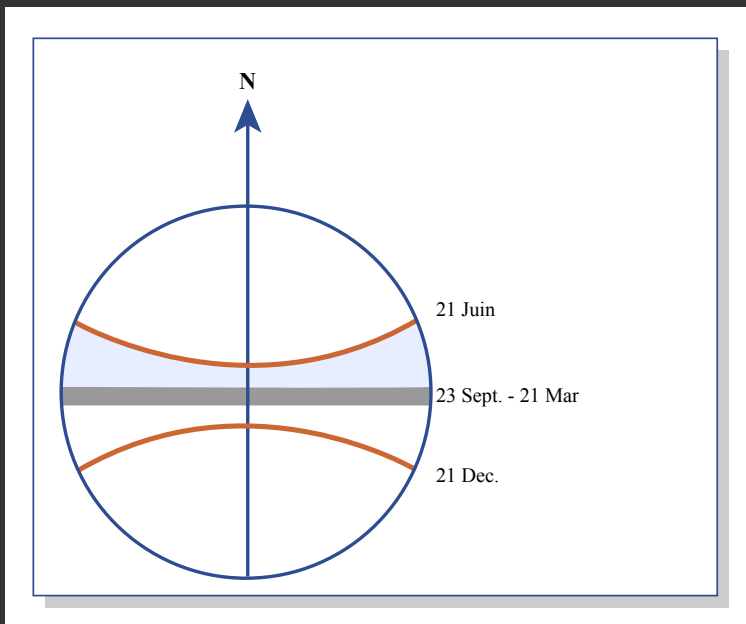
Sun charts

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cylindrical projection

stereographic projection



Sun charts

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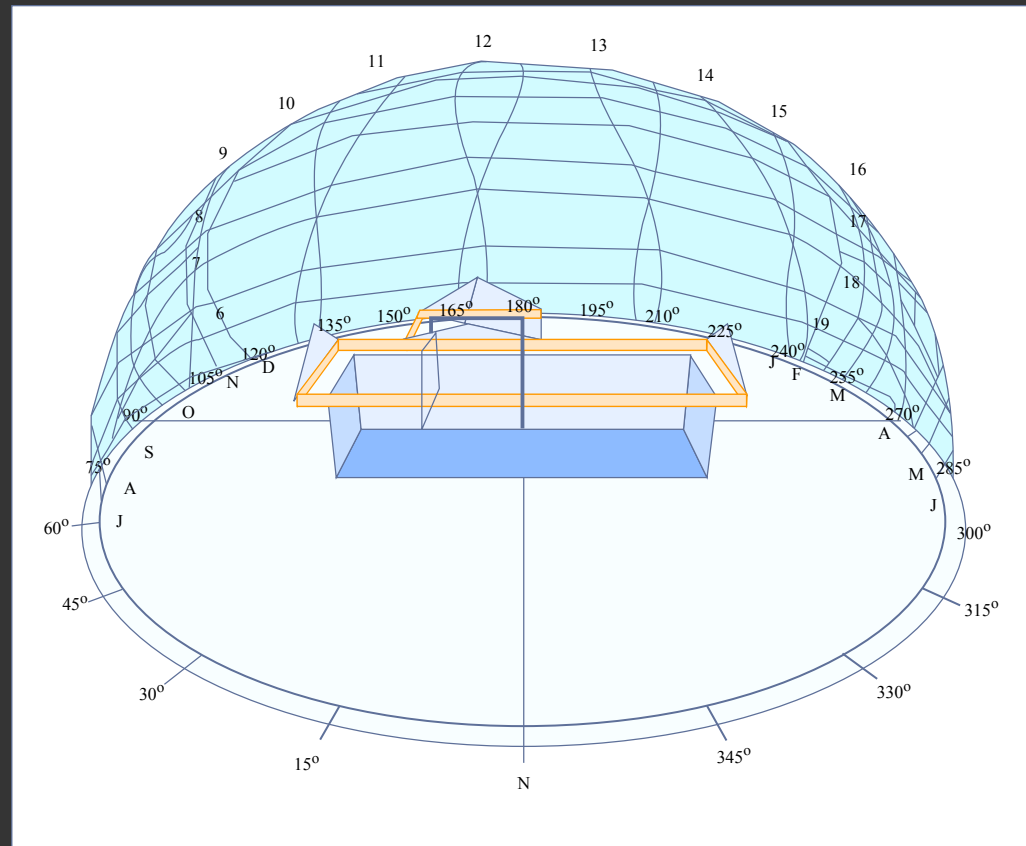


Figure by MIT OCW.

Sun charts

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cylindrical projection

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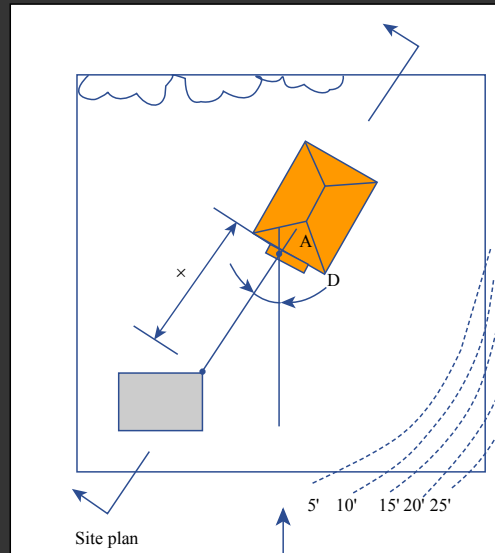
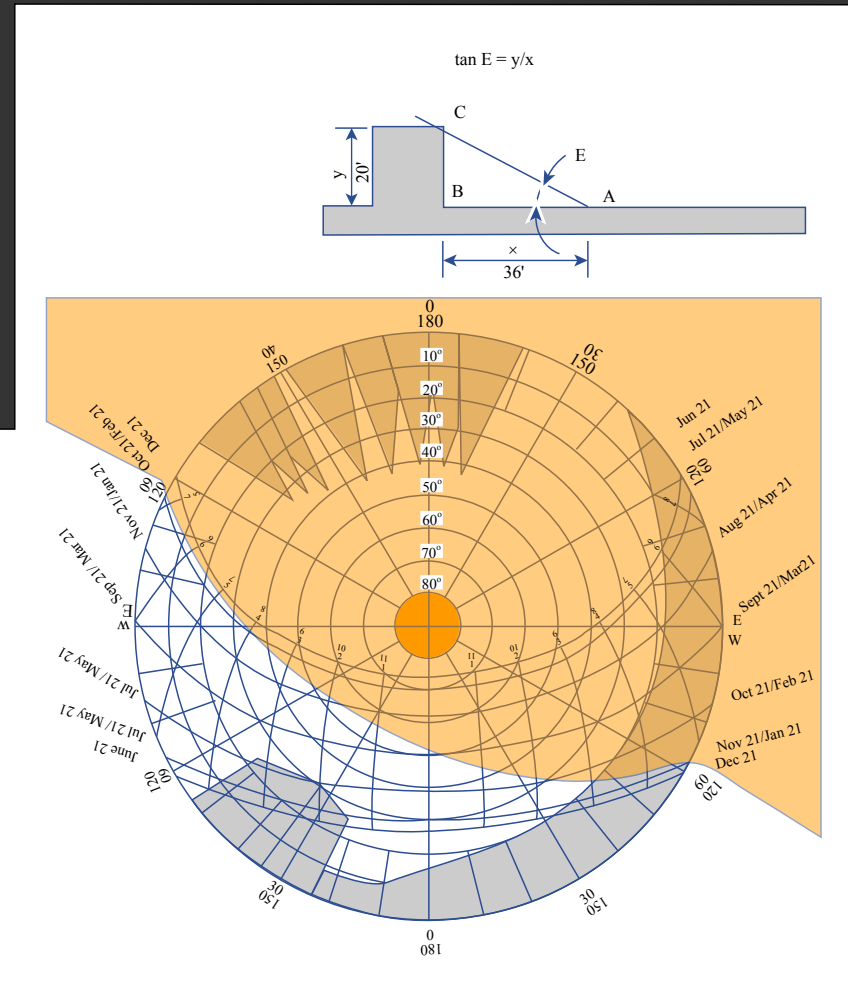


Figure by MIT OCW.



Solar radiation and sun course

► Readings relevant to lecture topics:

- "Heating Cooling Lighting" by Lechner: § 6.1 - 6.13
- "Sun Wind Light" by Brown & DeKay: § 1 - 6 in Chap 1A
- "The IESNA Lighting Handbook" by M.S. Rea (Ed.): pp. 1.1 - 1.5
- "Introduction to Architectural Science" by Szokolay: § 1.3.1