APPARENT MAGNITUDE

$I = \frac{L}{4\pi R^2}$ — L: output of star; R: distance from star; I: intensity (Wm^{-2})

$m_2 - m_1 = -2.5 \log\left(\frac{I_2}{I_1}\right)$

$m = 1$ is 100× brighter/more intense than $m = 6$

$\therefore$ 2.5× brighter than $m = 2$, etc

ABSOLUTE MAGNITUDE (M)

⇒ the magnitude a star would have at 10 pc. pc ↓

$m - M = 5 \log\left(\frac{d}{10}\right)$

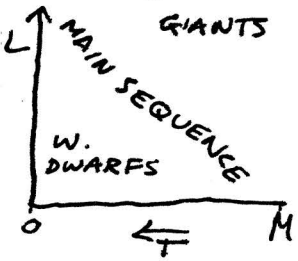
PARSEC: Parallax second: the distance at which 1 AU (mean radius of Earth's orbit) subtends 1 arcsec (1/3600°)

Stefan's Law: $L = \sigma A T^4$

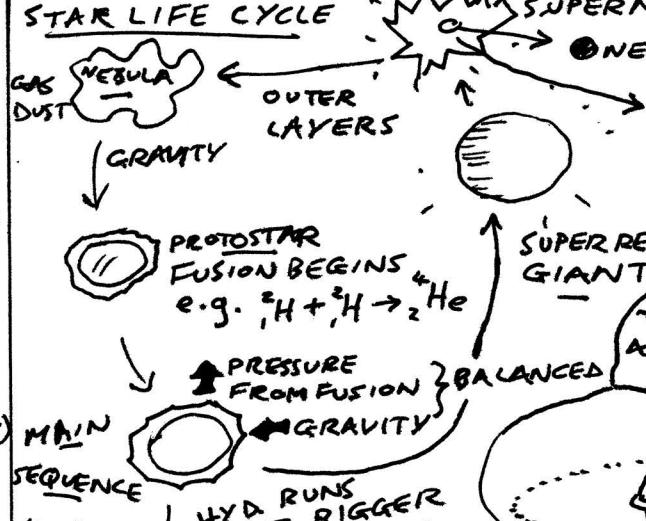
Classes:

- Oh — HOTTEST (25000–50000K)
- Be, A — H/He abs. lines
- Fine, Girl, Kiss — metal ions
- Me! — metals
- COOLEST (<3500K)

H-R diagram



STAR LIFE CYCLE



BLACK HOLES

Schwarzchild R: $R_s = \frac{2GM}{c^2}$ closer than R_s, escape → $v > c$.

EVENT HORIZON

$z = \frac{v}{c} = \frac{\Delta f}{f} = \frac{\Delta \lambda}{\lambda}$ ($v \ll c$)

If obs. line 'splits', binary stars. Relative v changes.

Hubble: v vs d

grad = H_0 constant (s^{-1})

∴ age of univ: $t_0 = \frac{1}{H_0}$

$v = H_0 d$

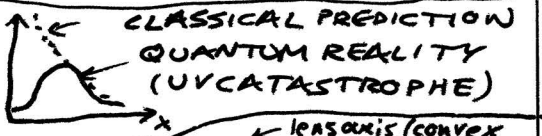
BIG BANG THEORY EVIDENCE

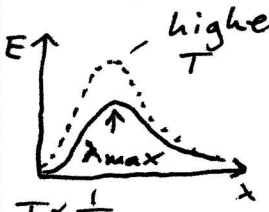
REDSHIFT: GALAXIES APPEAR RED SHIFTED (WAVELENGTHS OF LIGHT/EM 'STRETCHED'). FURTHER AWAY → FASTER. SUGGESTS THEY STARTED FROM SAME POINT.

CMBR: COSMIC MICROWAVE BACKGROUND RADIATION — EMITTED FROM DEEP SPACE - EDGE OF UNIVERSE

STILL COOLING

BLACKBODY: OBJECT THAT ABSORBS + EMITS ALL λ OF EM.





$T \propto \frac{1}{\lambda_{max}}$

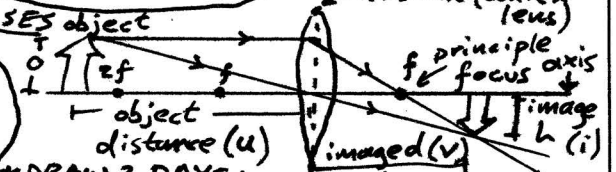
$\lambda T = 0.0029$ Wien's law

SPACE & LENSES

GEOSTATIONARY/GEOSYNCHRONOUS ORBIT. PERIOD = SAME AS PLANET'S ROTATION (24H FOR EARTH). STAYS ABOVE SAME POSITION ON EARTH. TV, COMMS. SLOW SPEED.

FAST, 'MOVES', IMAGING, WEATHER, GPS → LOW POLAR ORBIT

LENSES



* DRAW 2 RAYS:
i) PARALLEL IN, THROUGH f.
ii) STRAIGHT THROUGH CENTRE.

* IF RAYS CONVERGE, REAL IMAGE (CAN BE PROJECTED).
↳ CONCAVE LENS CAN'T.

MAGNIFICATION $M = \frac{i}{o} = \frac{v}{u}$

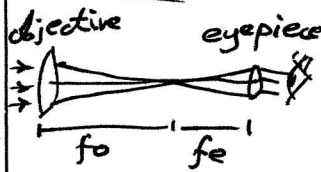
CONVEX: (ABOVE)
- if $u > 2f$: REAL, INVERTED, DIMINISHED
- if $2f > u > f$: REAL, INVERTED, MAGNIFIED
- if $u < f$: VIRTUAL, UPRIGHT, MAGNIFIED — NEED ANOTHER LENS TO PROJECT, e.g. EYE!

ORBITS/CIRCULAR MOTION

FORCE (CENTRIPETAL) IS ALWAYS 90° TO VELOCITY. CAUSES CHANGE IN DIRECTION, NOT SPEED. ACCELARATING TOWARDS CENTRE W/O GETTING CLOSER.

Telescopes:

$M = \frac{\text{aided angle}}{\text{unaided angle}}$ (small, radians)



$M = \frac{f_o}{f_e}$

Cassegrain Reflecting Telescope

(hole/small mirror are inconsequential relative to total Power received)

Gathering P $\propto A \propto d^2$ or r^2 of telescope.

Lens P: (m^{-1}) $P = \frac{1}{f}$ Dioptre

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

photons liberate electrons → trapped in 'potential wells'

← CCD sensor (CHARGE-COUPLED DEVICE)

QUANTUM EFF = $\frac{\gamma \text{ detected}}{\gamma \text{ incident}}$ (×100)

separation (rad) → Rayleigh's Criterion $\theta = \frac{\lambda}{D}$ ← diameter of telescope/aperture

No chromatic/spherical aberration, no distortion, higher resolving P, brighter. (resolution)