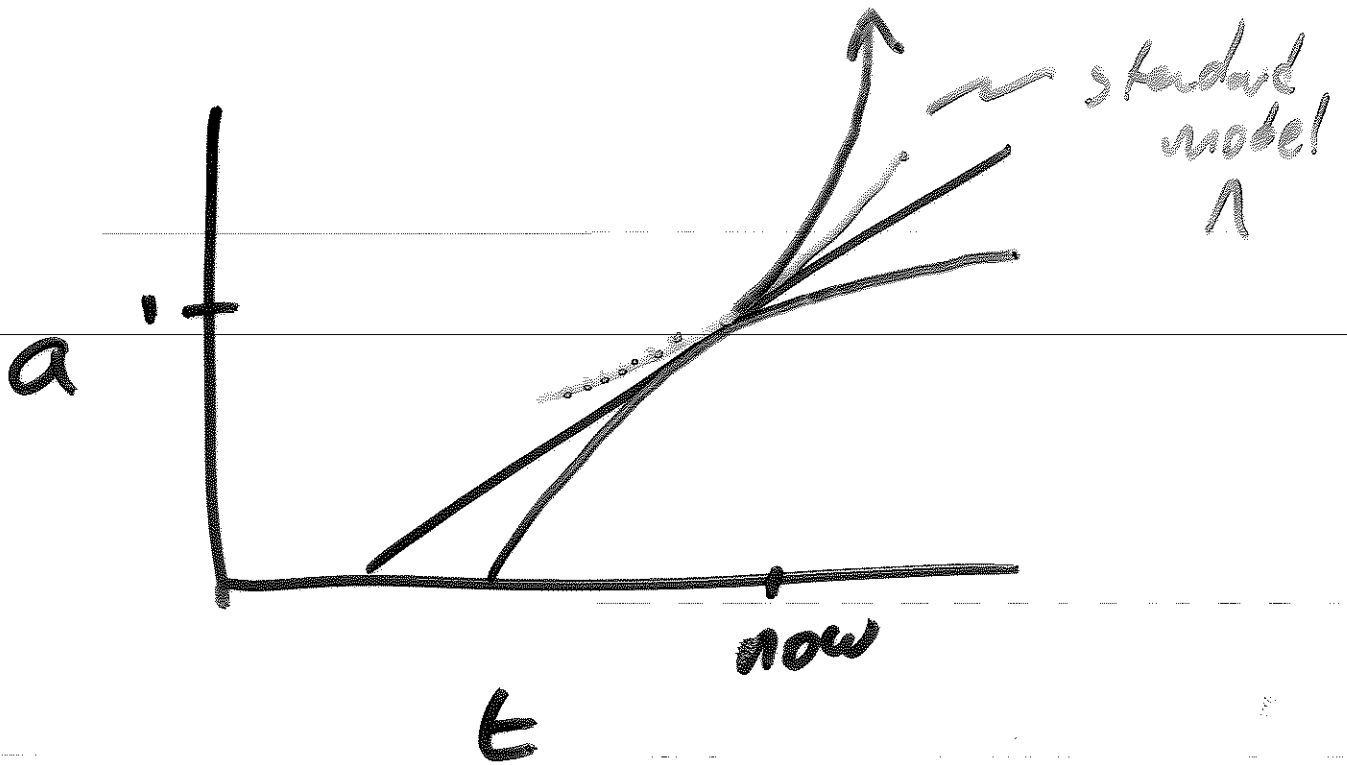


PAPER DRAFTS/OUTLINES
accepted thru Thurs. MORNING

next week: NO SECTIONS
(no s'bucks hrs either)

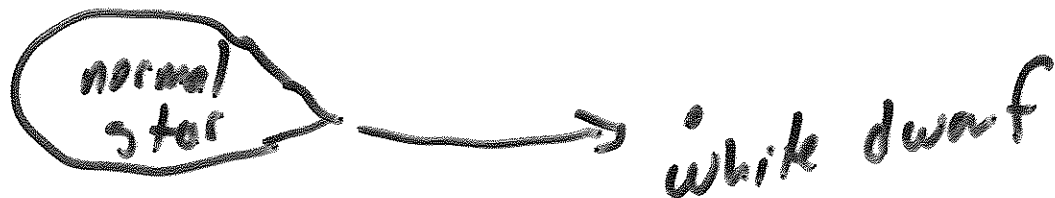
following week: DOUBLE SECTIONS
(I'll explain...)

special welcome to pre-fresh
(and come hear about
black holes at 7pm!)



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Type Ia Supernovae



white dwarf: C, O, N, Ne...

accreted material
around white dwarf

→ nuclear fusion

⇒ occasion thermonuclear
explosions of accreted
material

⇒ NOVA ⇒ C_1O , O_2

White dwarf gets more massive

"Chandrasekhar limit"

1.4 M_{\odot}

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⇒ COLLAPSE

C (other elements)

fuse \Rightarrow energy
 \hookrightarrow Fe and
leave the rest

ALL AT ONCE

"STANDARD BOMB"

always have same
amount of material
all explodes at once
always the same brightness

early 1990s:

1) HST measured Cepheids
in galaxies that had
Type Ia SN
 \rightarrow calibration

know abs. mag
grand band telescopes discovered
MANY Type Ia

Measure: all photons in some
 λ region at
some time

vary by 15-20%.

Can correct for this
measure - color
decay rate

\Rightarrow good standard candle

* Theoretical basis for
"standard candles"

* Empirical basis: after some
corrections, the nearby
ones line up well
 $< 5\%$

1998: two groups doing same things, different approaches \rightarrow same result

FABLE: Discovery of Dark Energy
MORAL: Replicating important results \rightarrow greater acceptance



\Rightarrow "Einstein's Cosmological Constant" Λ

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Energy density of Λ is constant as universe expands

for matter
 ρ_{now}

• when a was $\frac{1}{2}$ its
present amount

$\frac{1}{8}$ the volume $(\frac{1}{2})^3 = \frac{1}{8}$

Same amount of matter

$$\rho_{\text{THEN}} = \frac{M}{V} \rightarrow \text{doesn't } \overset{\text{change}}{\text{change}}$$

\hookrightarrow does change

$$= 8 \rho_{\text{now}}$$

Dark Energy Density
is CONSTANT

$\Lambda \Rightarrow$ univ. D.E. has constant density

or maybe not?

Suppose D.E. density INCREASES as Universe gets bigger

then m^3 of volume has increasing D.E.
↳ pushes universe faster
↳ size increases faster

\Rightarrow EXPONENTIAL ~~EXPANSION~~ EXPANSION

\Rightarrow "Big Rip"