

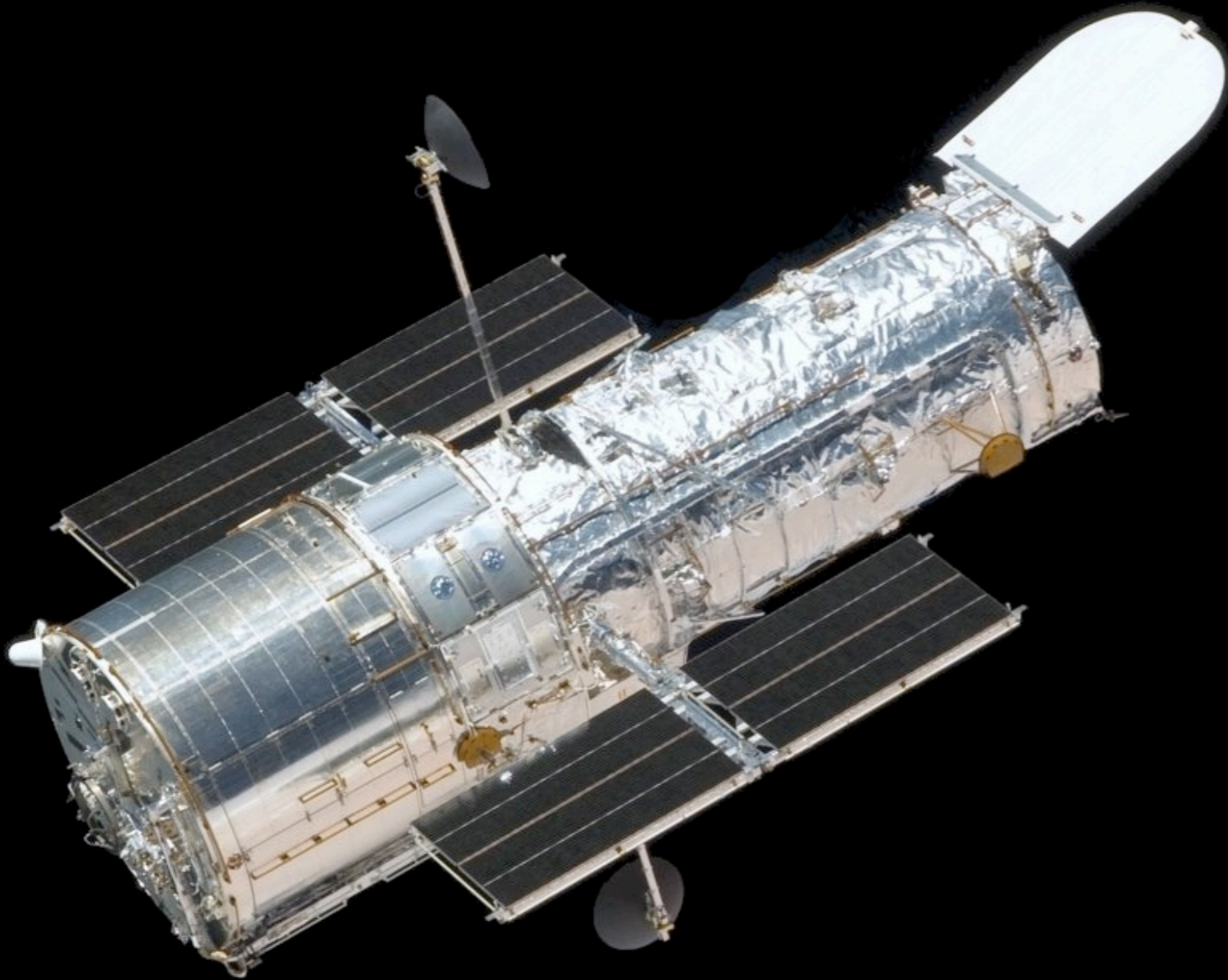
"Dark Energy" and "Dark Matter" in Friedmann Universes

Understanding modern puzzles
with physics from the 1920's

William Q. Sumner

January 16, 2012

St. Petersburg, Russia





The puzzles of Dark Energy and Dark Matter are beautifully solved using the geometry found by Friedmann in 1922.

Key Points

• Schrödinger and Sumner proved that size of atoms are directly proportional to the Friedmann radius.

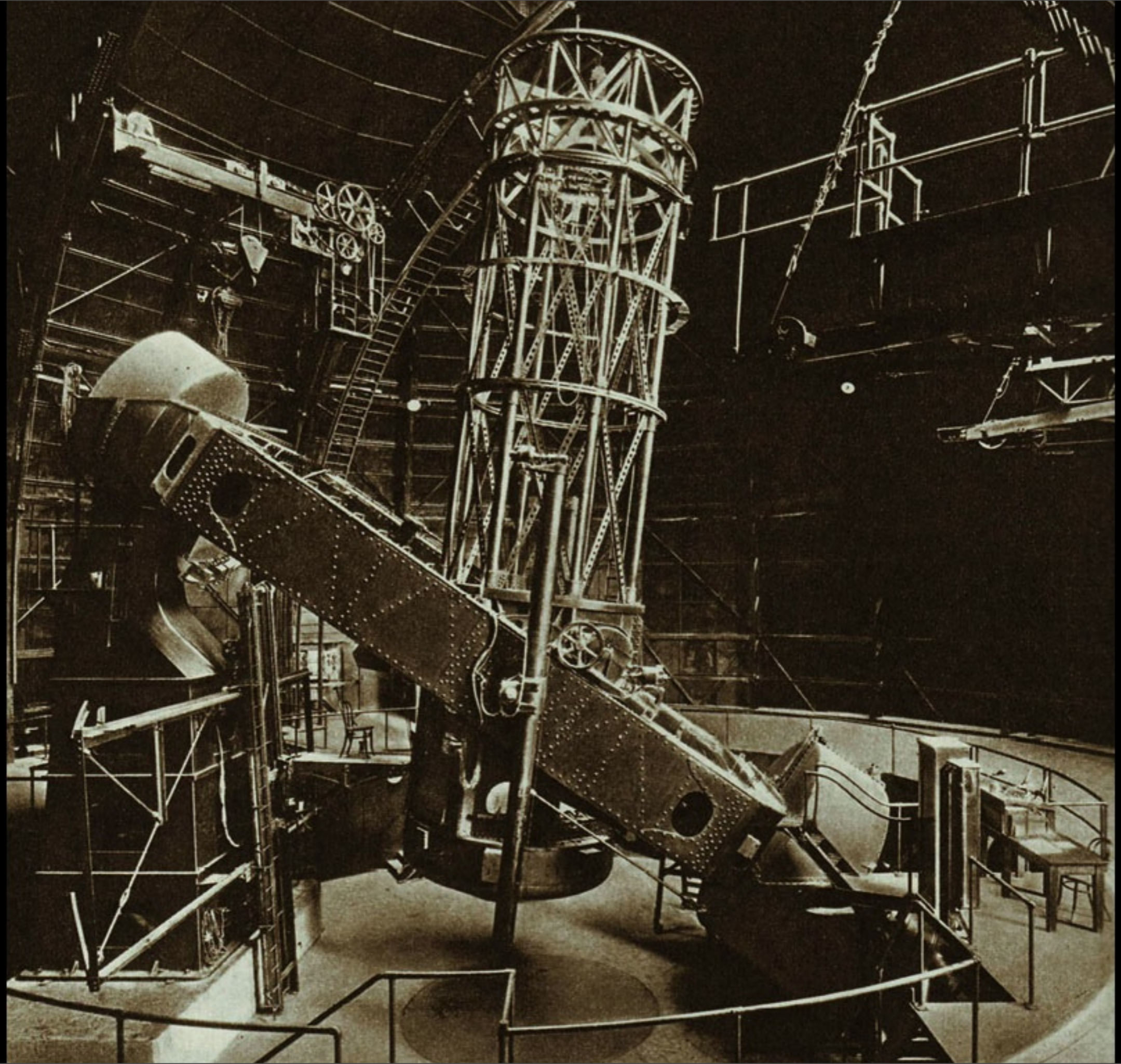
• Размер атомов меняется с течением времени! ← ЭТО КЛЮЧ!

• This changes the interpretation of Hubble redshifts. The Universe is collapsing.

• Recent accelerating redshift measurements dramatically confirm this reasoning. No “Dark Energy” is needed to explain redshift data.

• The Universe is more than 1300 billion years old and will end in about 9.8 billion years.

• Most “Dark Matter” likely consists of burned-out stars.



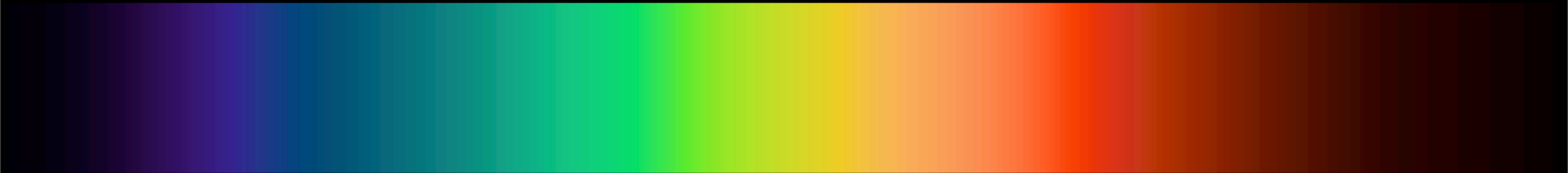


Edwin
Hubble



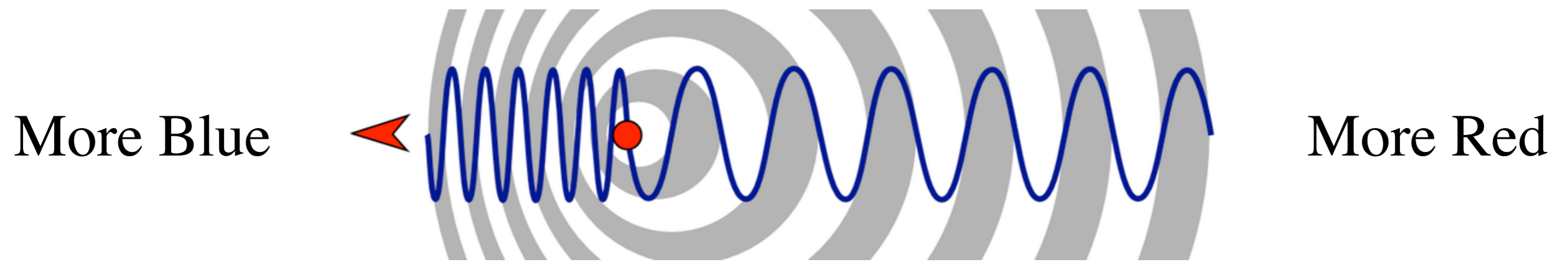


Earth



Nebula





Hubble redshifts were explained as Doppler shifts caused by nebular velocities away from the earth.

A RELATION BETWEEN DISTANCE AND RADIAL VELOCITY AMONG EXTRA-GALACTIC NEBULAE

BY EDWIN HUBBLE

MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

Communicated January 17, 1929

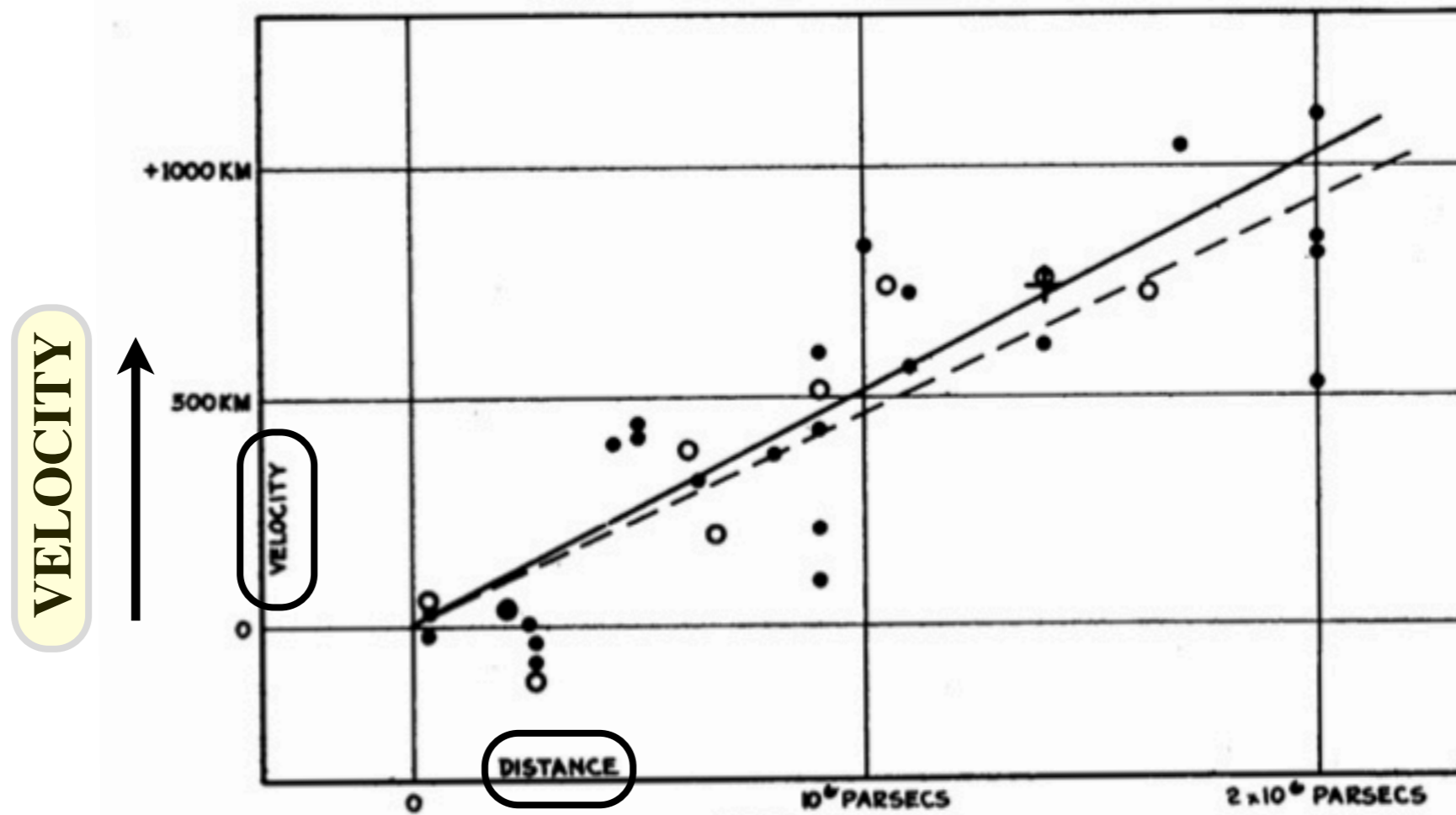
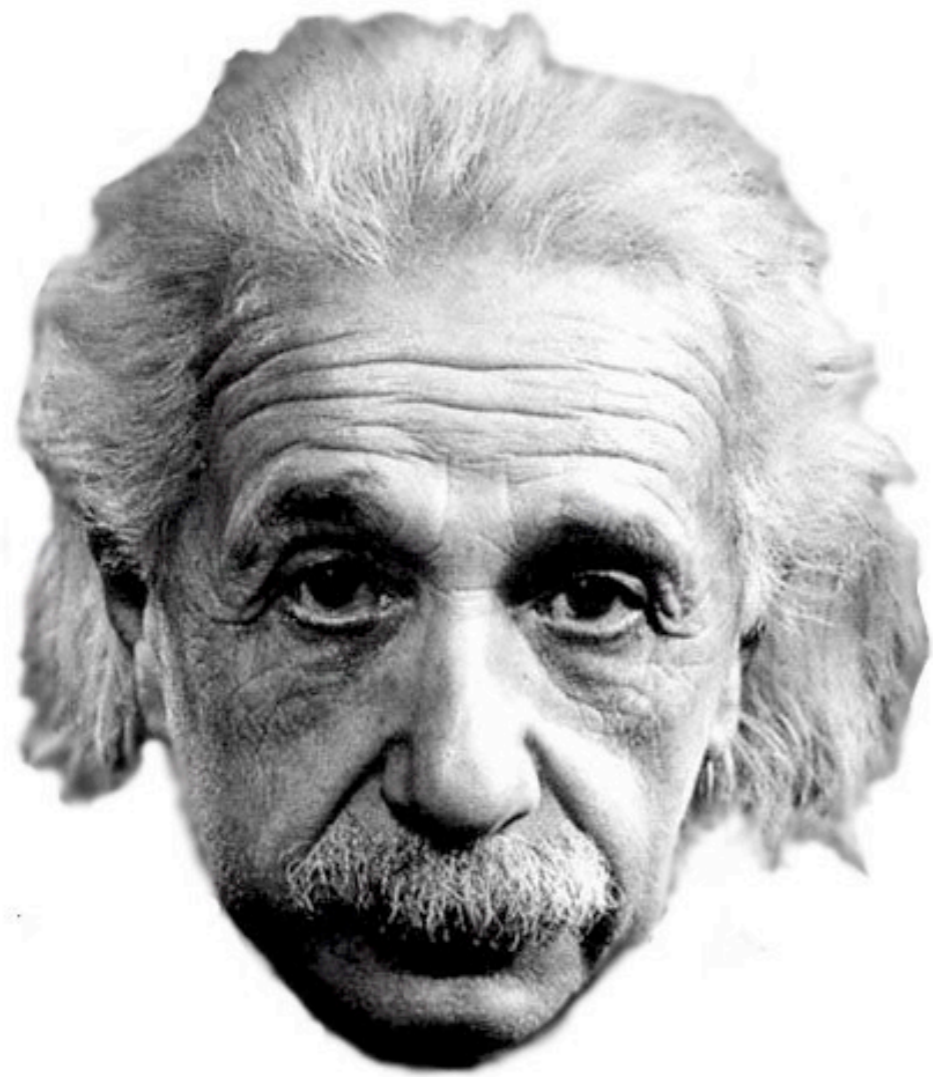


FIGURE 1

DISTANCE



Albert Einstein

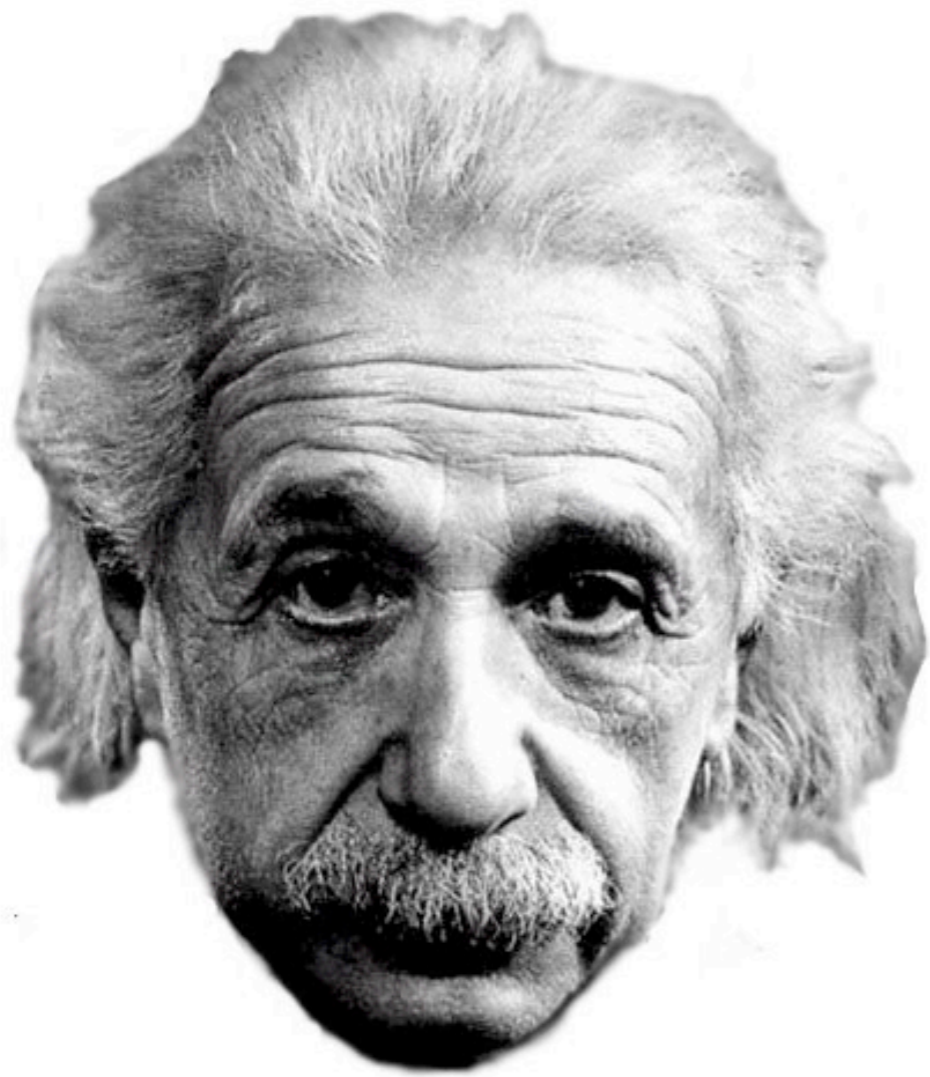
1916.

Nr 7.

ANNALEN DER PHYSIK.

VIERTE FOLGE. BAND 49.

1. *Die Grundlage
der allgemeinen Relativitätstheorie;*
von *A. Einstein.*



$$G^{\alpha\beta} = 8\pi T^{\alpha\beta}$$



Über die Krümmung des Raumes.

Von **A. Friedman** in Petersburg.

Mit einer Abbildung. (Eingegangen am 29. Juni 1922.)

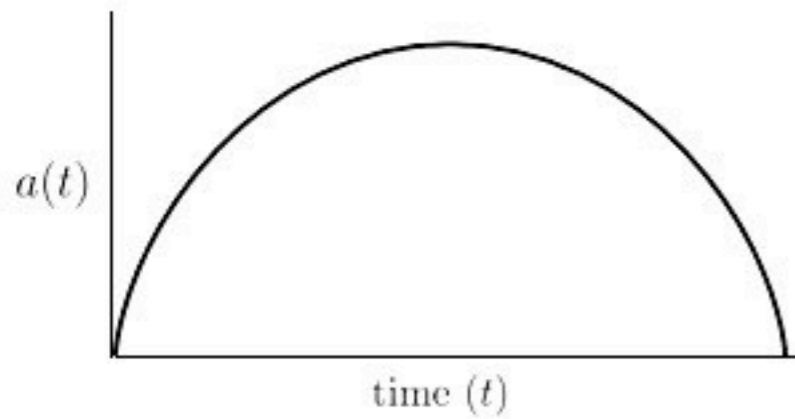
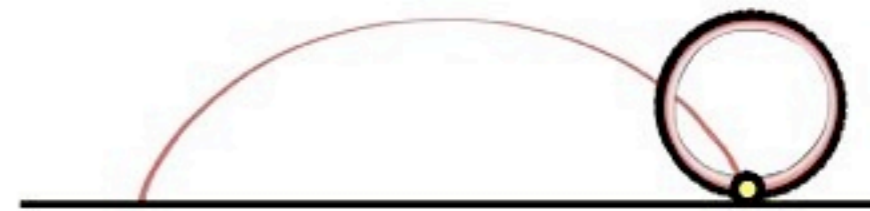
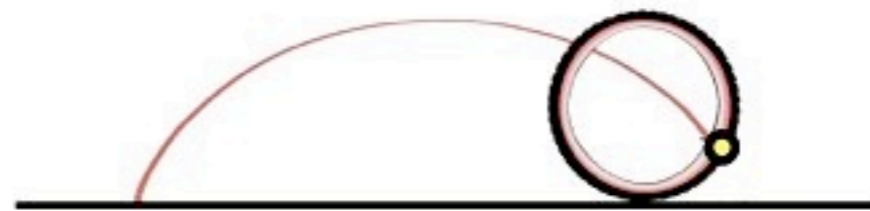
Alexandr Friedmann



$$G^{\alpha\beta} = 8\pi T^{\alpha\beta}$$

Isotropic & homogeneous
“dust”

$$ds^2 = c^2 dt^2 - a^2(t) \left[\frac{dr^2}{(1-r^2)} + r^2 (d\vartheta^2 + \sin^2\vartheta d\varphi^2) \right]$$



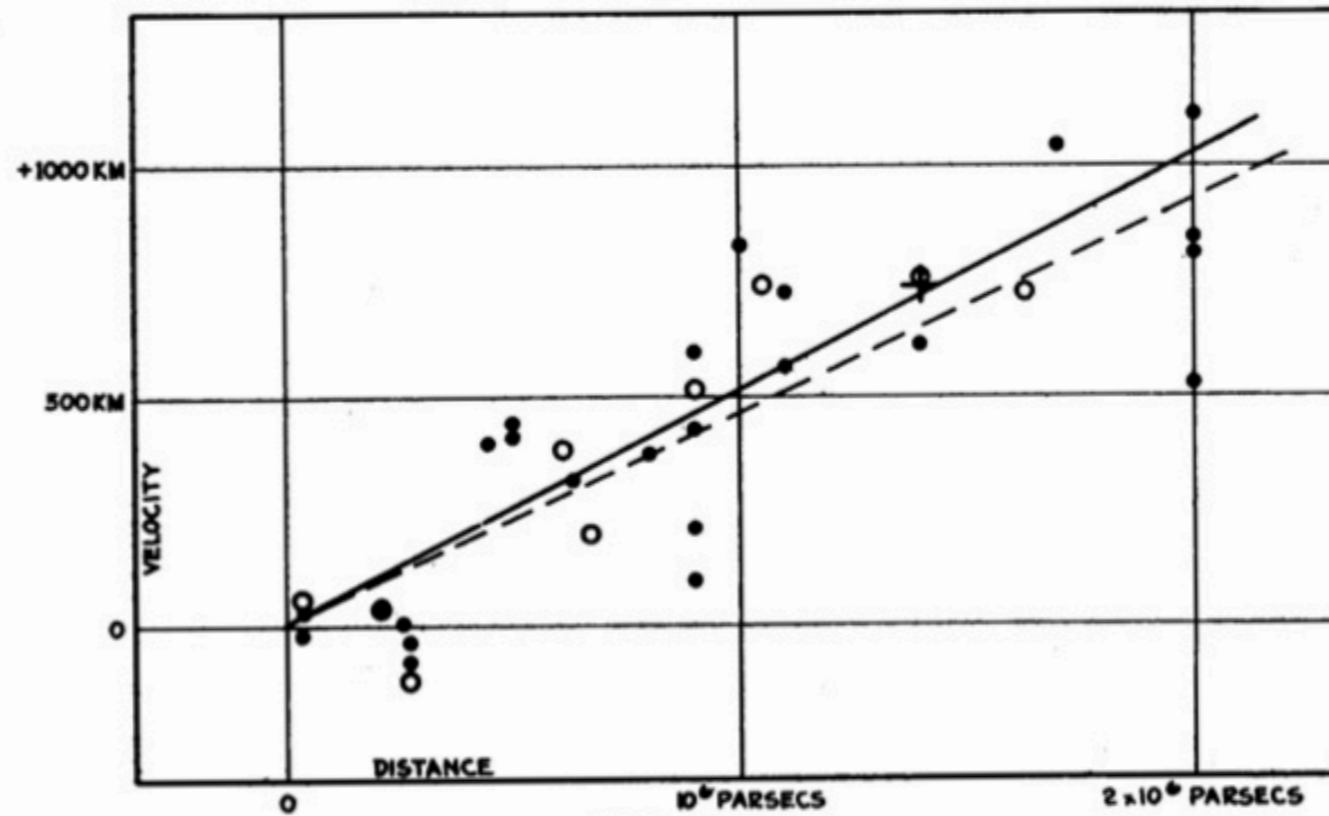
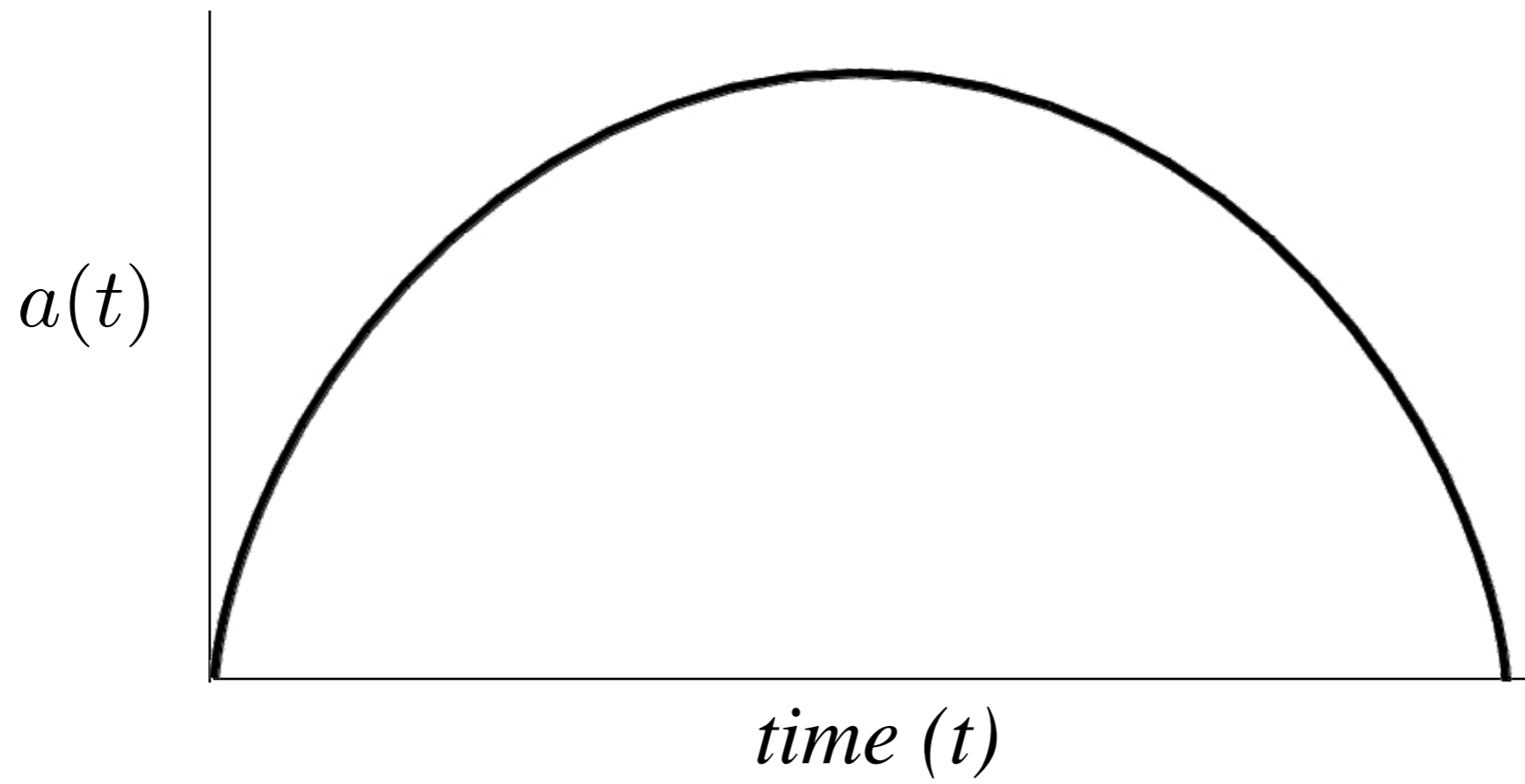
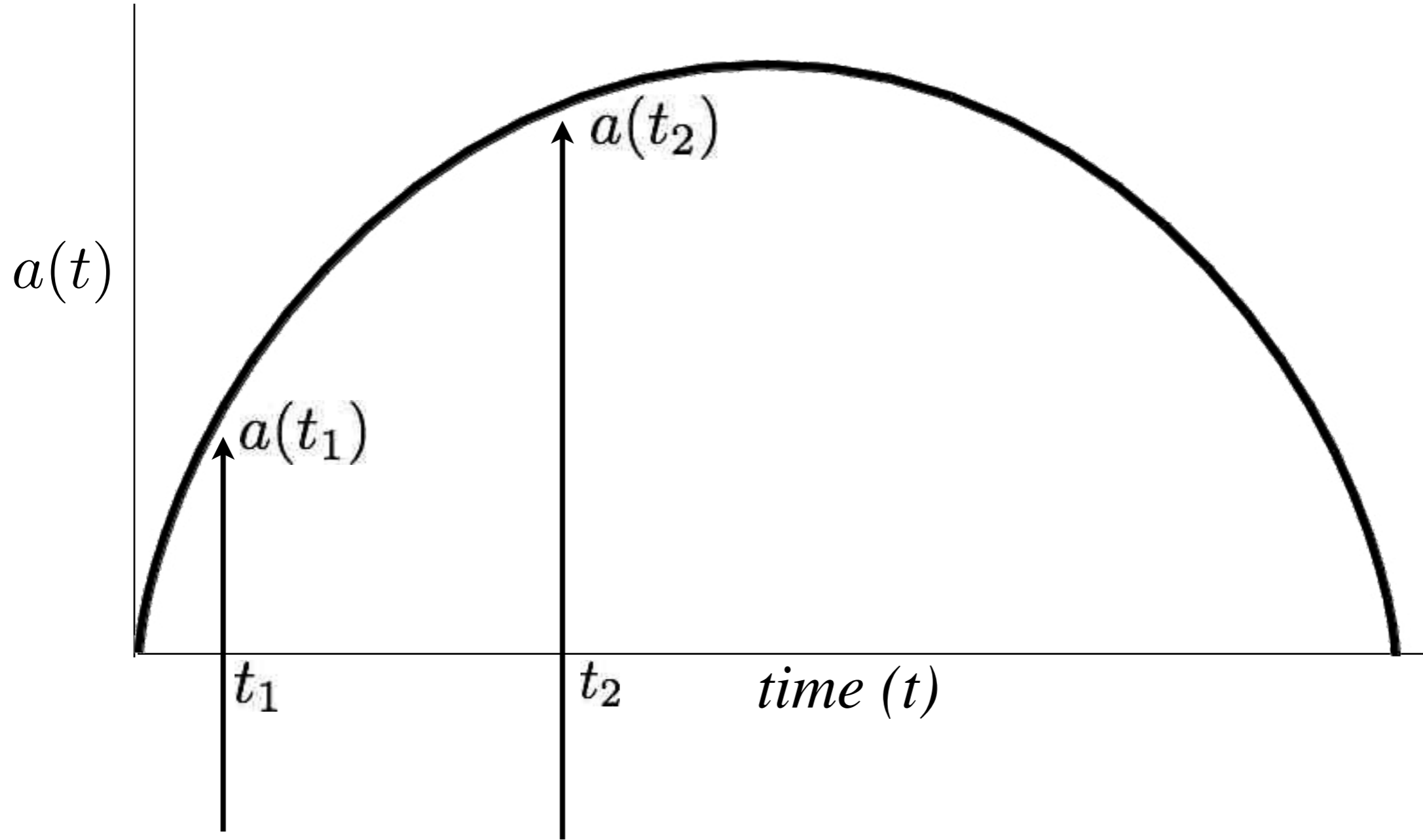
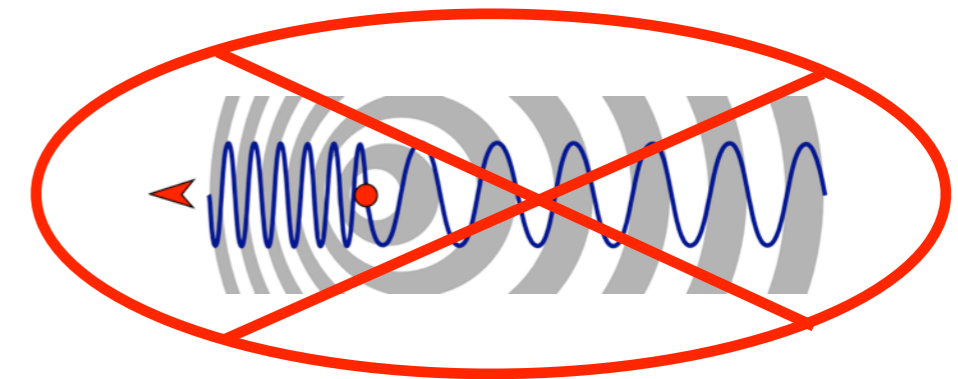
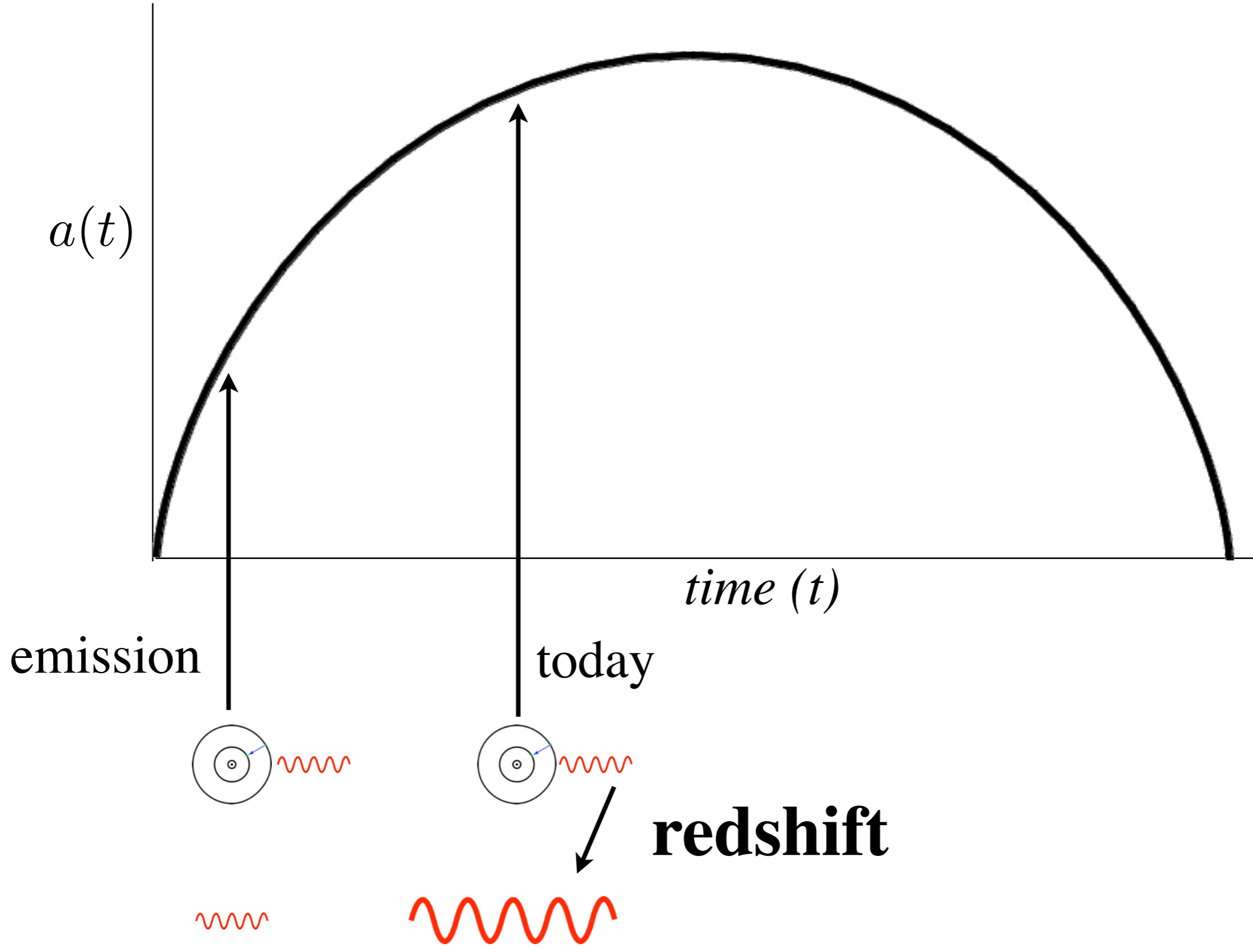


FIGURE 1



$$\frac{\lambda(t_1)}{\lambda(t_2)} = \frac{a(t_1)}{a(t_2)}$$



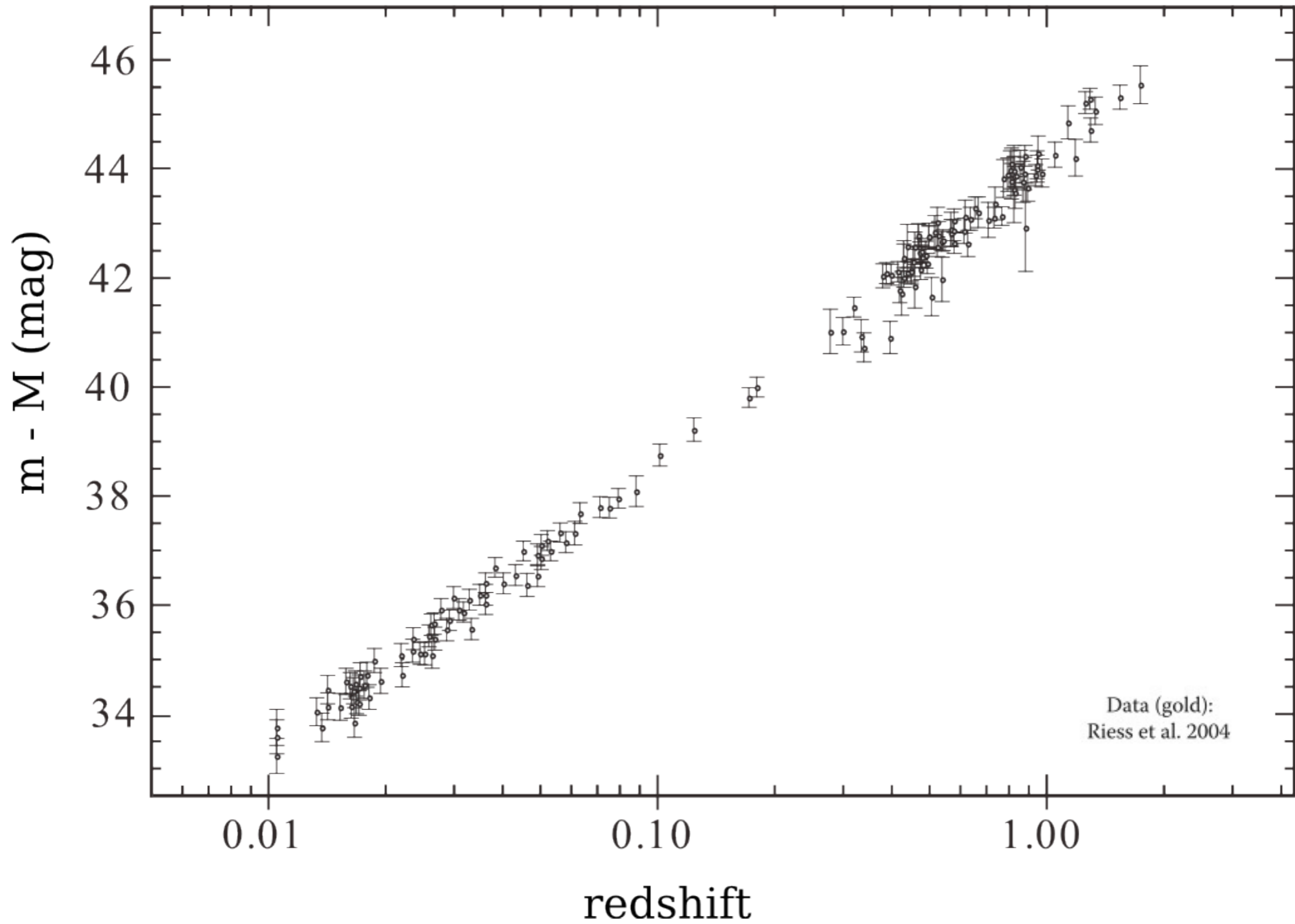


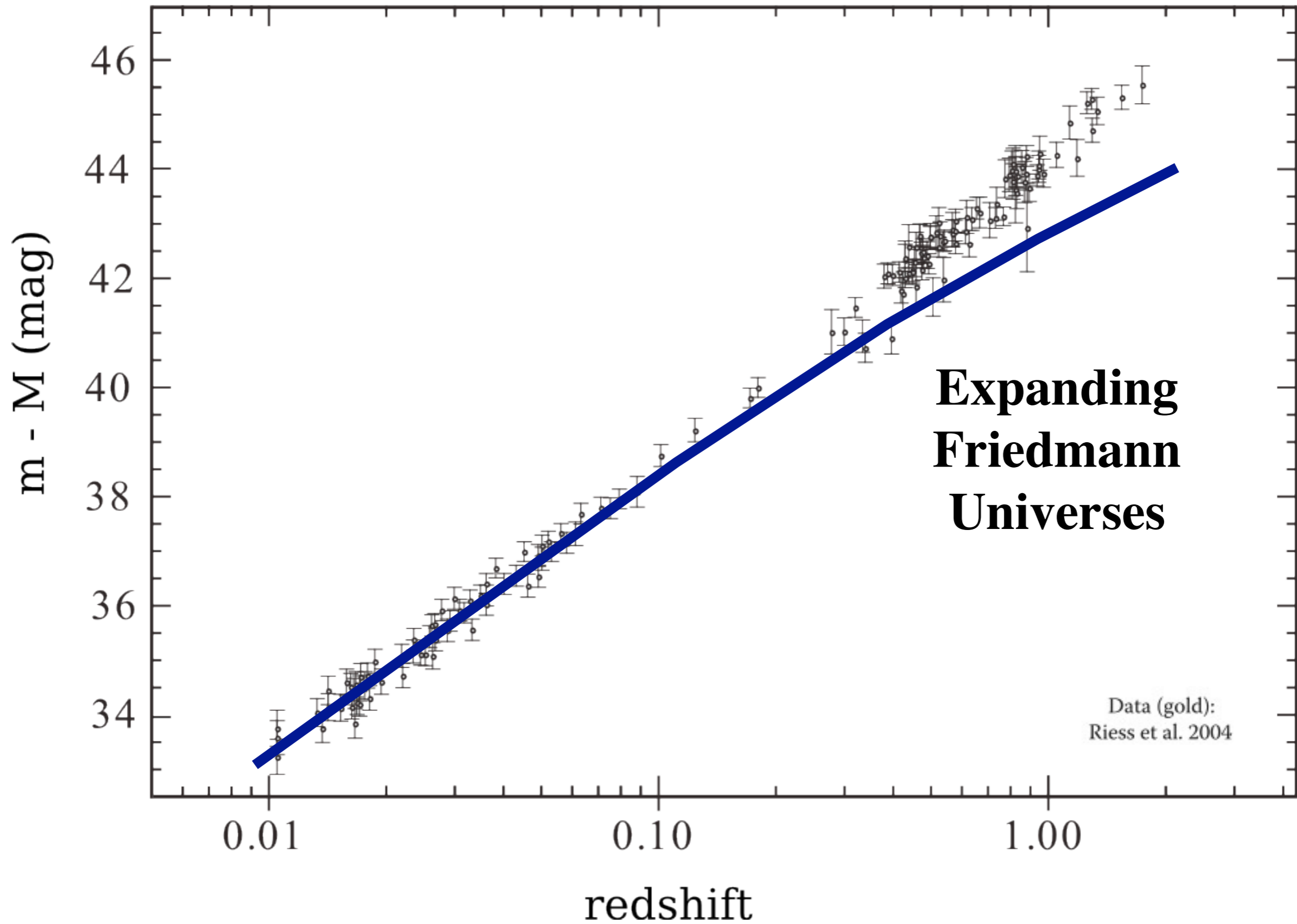


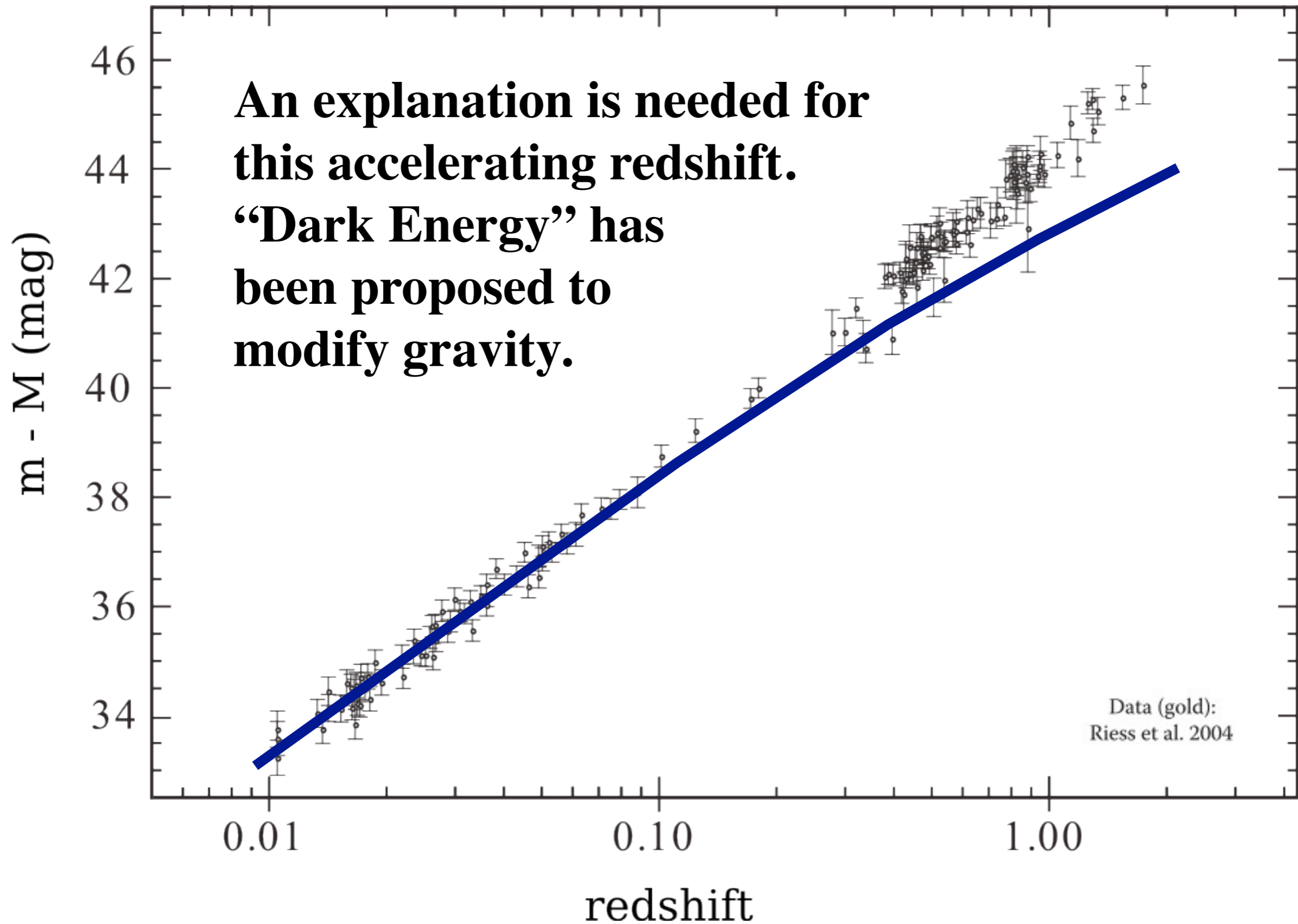




SN 2011dh









THE PROPER VIBRATIONS
OF THE EXPANDING UNIVERSE

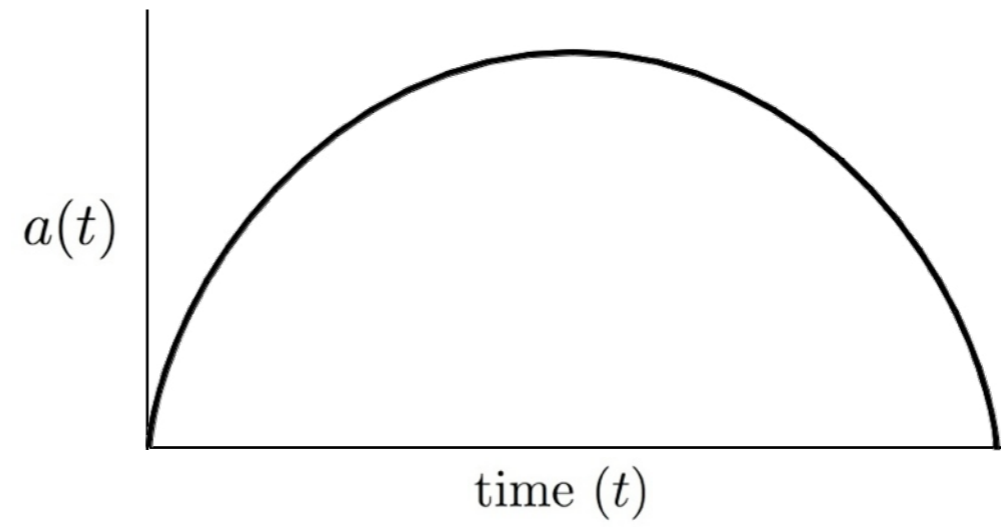
by ERWIN SCHRÖDINGER

Schrödinger, E. 1939, Physica, 6, 899

Erwin Schrödinger



$$G^{\alpha\beta} = 8\pi T^{\alpha\beta}$$





Zur Schrödingerschen Wellenmechanik.

Von V. Fock in Leningrad.

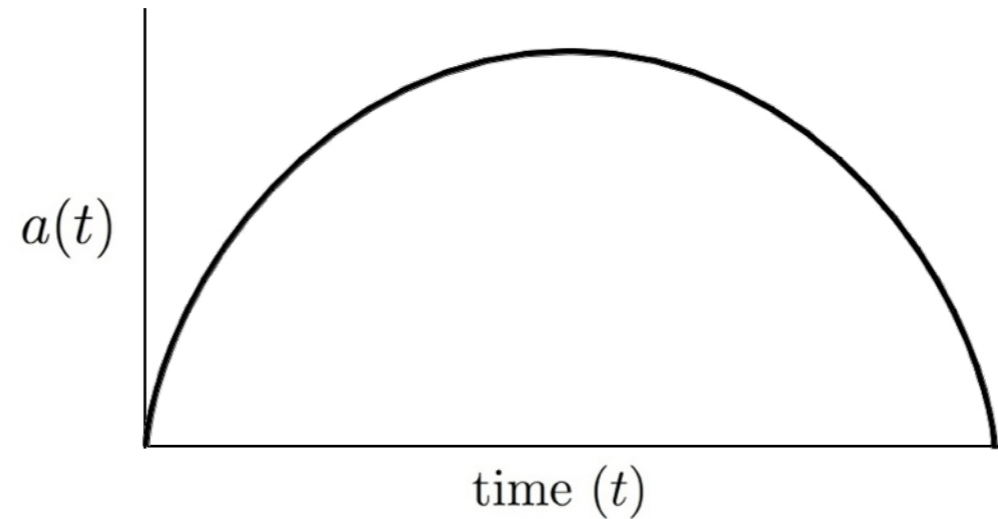
(Eingegangen am 11. Juni 1926.)

Vladimir Fock

$$\frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^\alpha} \left[\sqrt{-g} g^{\alpha\beta} \frac{\partial \psi}{\partial x^\beta} \right] + \mu^2 \psi = 0$$



$$G^{\alpha\beta} = 8\pi T^{\alpha\beta}$$



$$\frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^\alpha} \left[\sqrt{-g} g^{\alpha\beta} \frac{\partial \psi}{\partial x^\beta} \right] + \mu^2 \psi = 0$$

What are the basis functions
for ψ ?



THE PROPER VIBRATIONS OF THE EXPANDING UNIVERSE

by ERWIN SCHRÖDINGER

§ 1. *Introduction and summary.* Wave mechanics imposes an a priori reason for assuming space to be closed; for then and only then are its proper modes discontinuous and provide an adequate description of the observed atomicity of matter and light.

• • •

For light: when referred to the customary *co-moving* coordinates, an *arbitrary* wave process exhibits essentially the same succession of states as without expansion. Briefly, the wave function shares the general dilatation. Hence all wave lengths increase proportionally to the radius of curvature. — The time rate of events is slowed down.

• • •

For the material particle the broad results are these: a strictly monochromatic process (i.e. a proper vibration) again shares the

— 899 —

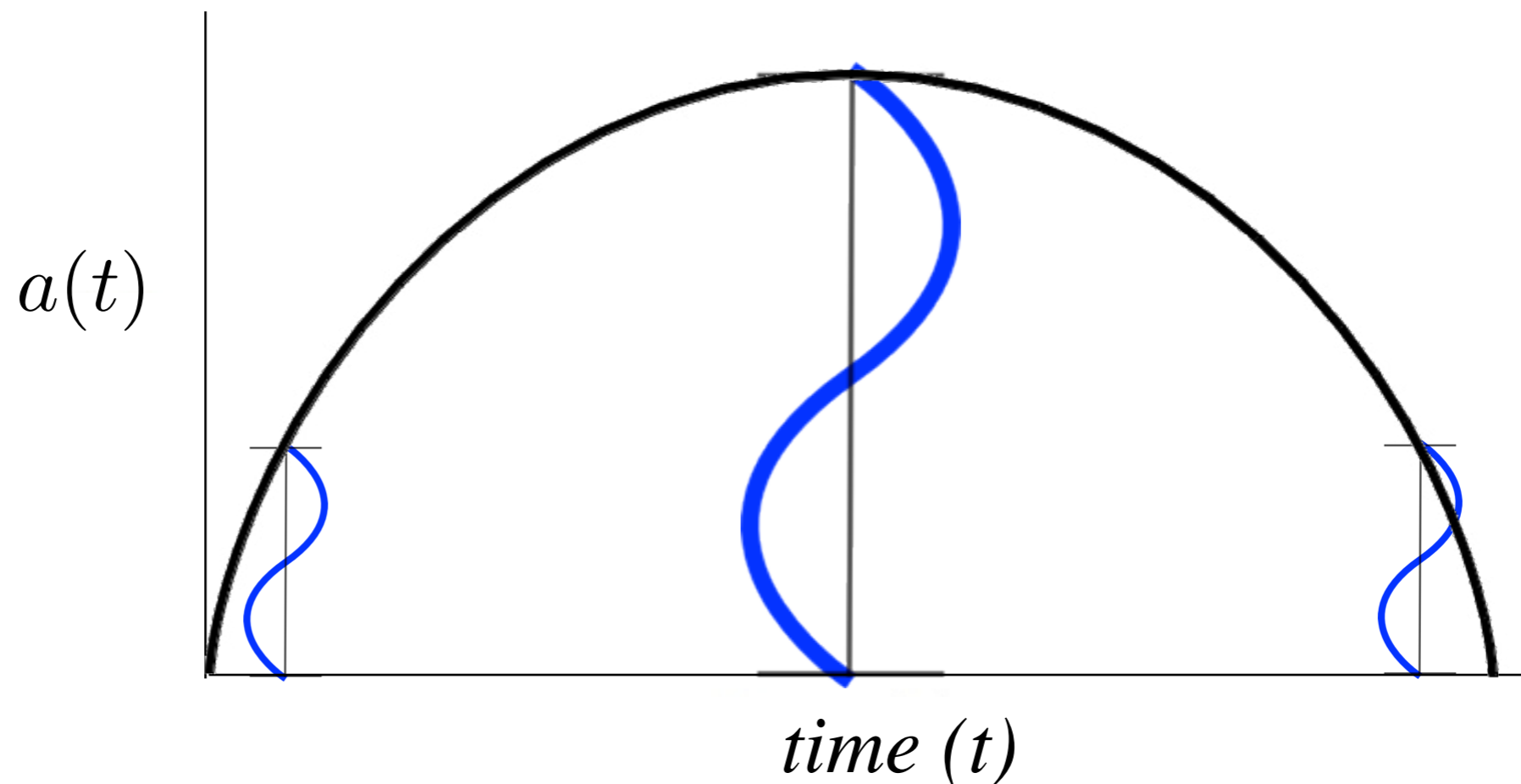
common dilatation, so that its wave length λ is proportional to R , as before.

Schrödinger, E. 1939, *Physica*, 6, 899



“In an expanding space all momenta decrease . . . This simple law has an even simpler interpretation in wave mechanics: all wavelengths, being inversely proportional to the momenta, simply expand with space.”

Erwin Schrödinger



Astronomers assume that light changes exactly as Schrödinger showed but they ignore the changes in atomic size. This is wrong. The wavelengths of both atoms and photons change.

Астрономы согласны с Шрёдингером, что размер волны фотонов изменяется, но они игнорируют изменения размера атомов. Это неверно. Длина волн фотонов и атомов изменяется одновременно.

ON THE VARIATION OF VACUUM PERMITTIVITY IN FRIEDMANN UNIVERSES

WILLIAM Q. SUMNER
Box 588, Kittitas, WA 98934

Received 1993 March 31; accepted 1994 January 14

THE ASTROPHYSICAL JOURNAL, 429:491–498, 1994 July 10

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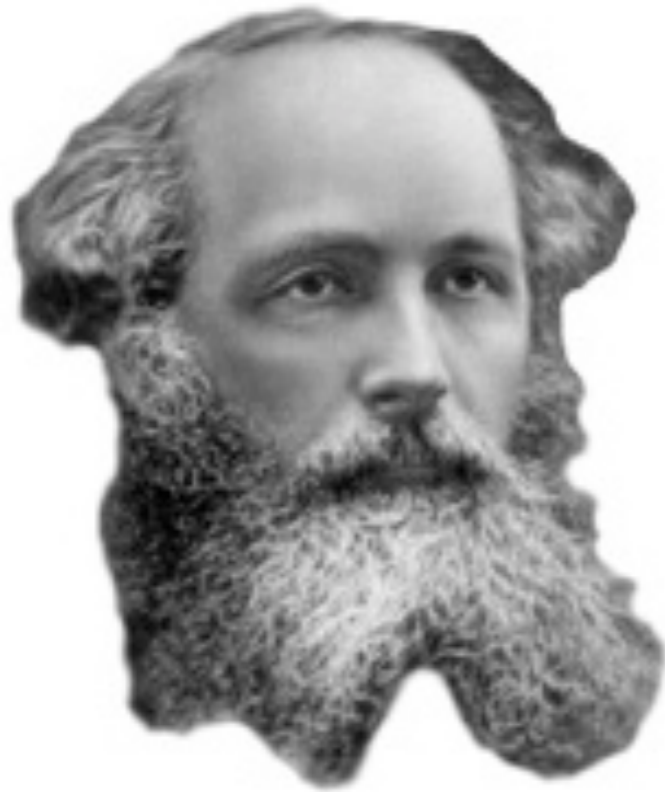
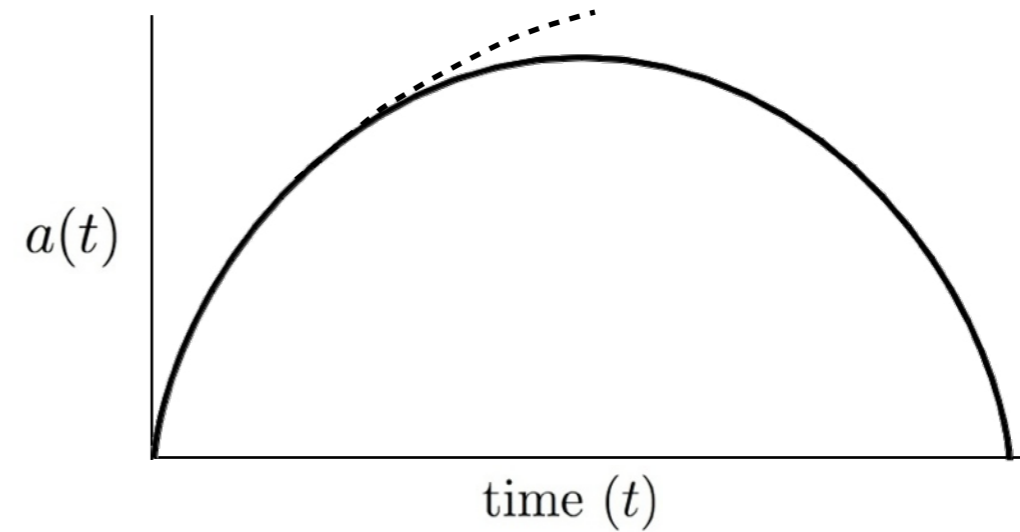


William Sumner

(Same result as Schrödinger)



$$G^{\alpha\beta} = 8\pi T^{\alpha\beta}$$



$$T^{\mu\nu} = \varepsilon_0 \left(-g^{\nu\beta} F^{\mu\alpha} F_{\beta\alpha} + \frac{1}{4} g^{\mu\nu} F^{\alpha\beta} F_{\alpha\beta} \right)$$

$$(\varepsilon_0 F^{\alpha\beta})_{;\beta} = J^\alpha$$

$$\vec{F} = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2 \hat{r}}{r^2}$$

James Clerk Maxwell

THE ASTROPHYSICAL JOURNAL, 429:491–498, 1994 July 10

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ON THE VARIATION OF VACUUM PERMITTIVITY IN FRIEDMANN UNIVERSES

WILLIAM Q. SUMNER

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ABSTRACT

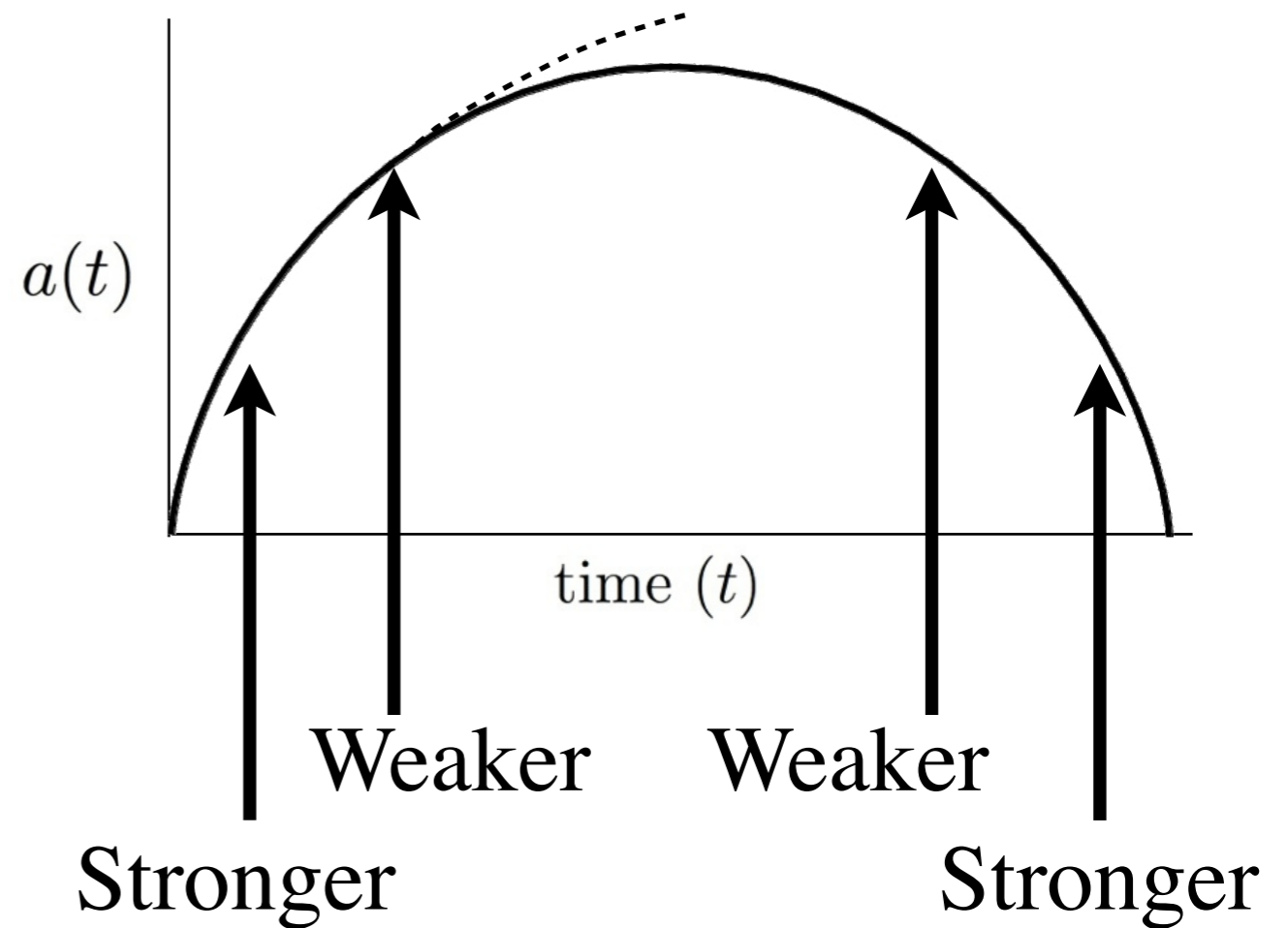
Vacuum permittivity, the measure of strength of electric fields in a vacuum, is a function of the spacetime geometry of Einstein's general relativity. This dependence on geometry was noted over 40 years ago by C. Møller (1952) and has remarkable consequences. Variation in vacuum permittivity breaks the equivalence of physical measurements and mathematical coordinates postulated by Einstein. Physical lengths, as measured by a rigid rod, and physical times, as measured by an atomic clock, are not equivalent to the mathematical lengths and times of general relativity. This changes some concepts of space and time, invalidates stronger interpretations of the principle of equivalence, and requires that care be exercised in interpreting the speed of light. The laws of physics must be carefully used to understand the essential relationships between mathematical spacetime and physical measurements.

For Friedmann universes, vacuum permittivity is directly proportional to the Friedmann radius and is therefore a function of time. As the size of the universe evolves, the changing strength of the electrical force between charges shifts atomic energy levels, changing the wavelengths of emitted light. This shift in photon emission due to the evolution of electrical attraction in the atom is twice as large as evolutionary photon shift. Considered together, atomic and photon evolution reverse the interpretation of Hubble redshift to imply that the Friedmann universe is presently collapsing.

Subject headings: cosmology: theory

**Vacuum permittivity is proportional to the
Friedmann radius** $\epsilon_0(t) \propto a(t)$

$$\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2 \hat{r}}{r^2}$$



Atomic Sizes Change

Bohr radius $a_o(t) = \frac{\epsilon_0(t) h^2}{\pi m_e e^2}$

And $\epsilon_0(t) \propto a(t)$

$$\frac{a_o(t_1)}{a_o(t_2)} = \frac{a(t_1)}{a(t_2)}$$

Atomic Energy Levels Change

$$\lambda_e = \frac{h}{\Delta E} = \frac{8\varepsilon_0^2 h^3}{me^4} \left(\frac{n_1^2 n_2^2}{n_1^2 - n_2^2} \right)$$

$$\frac{\lambda_e(t_1)}{\lambda_e(t_2)} = \frac{a^2(t_1)}{a^2(t_2)}$$

Photons change exactly Like Schrödinger found

$$\frac{\lambda(t_1)}{\lambda(t_2)} = \frac{a(t_1)}{a(t_2)}$$

Именно поэтому красное
смещение переворачивается

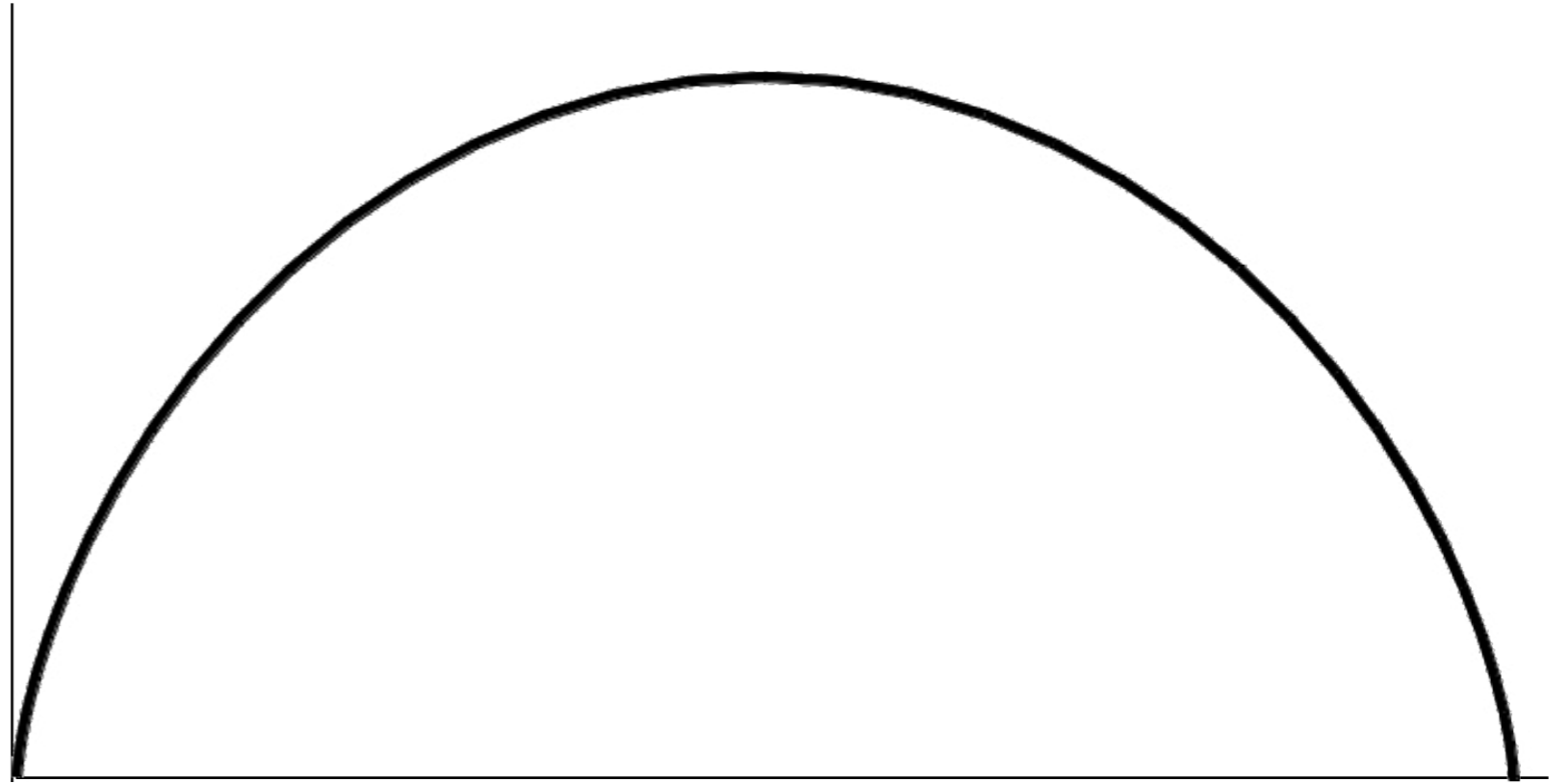
But for atomic emissions

$$\frac{\lambda_e(t_1)}{\lambda_e(t_2)} = \frac{a^2(t_1)}{a^2(t_2)}$$

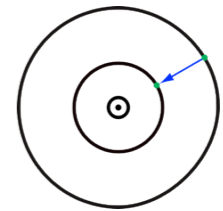
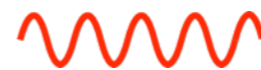
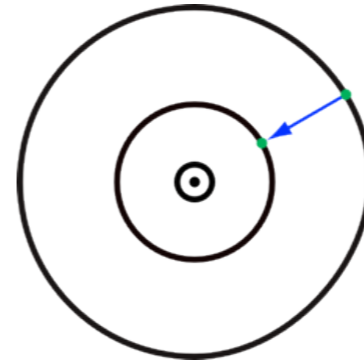
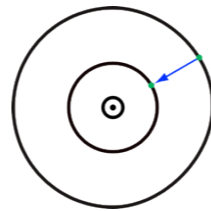


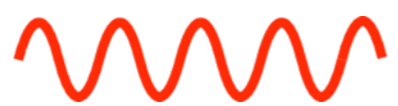
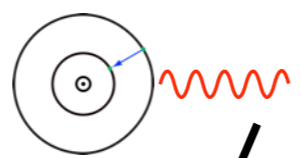
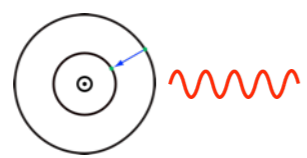
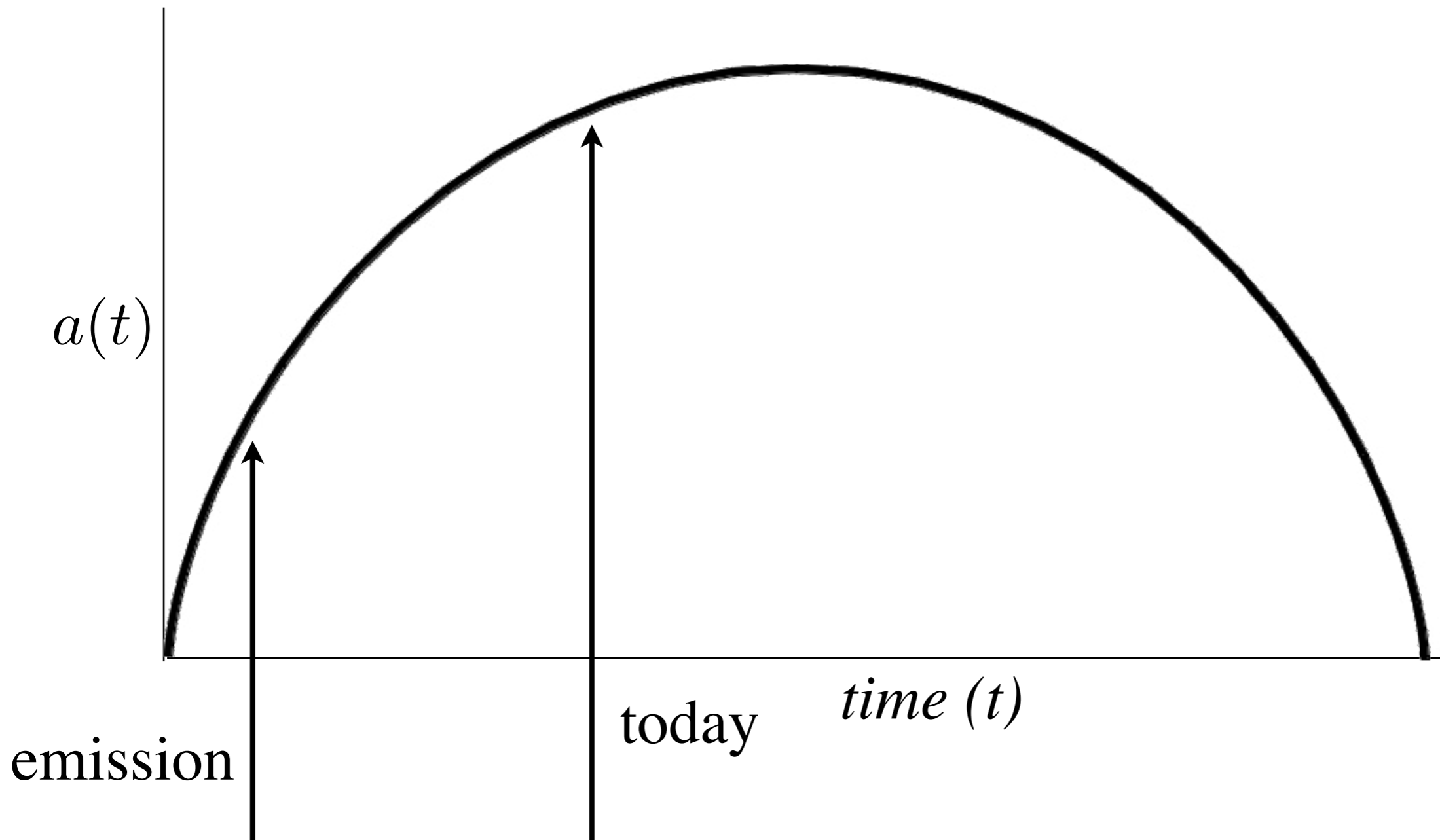


$a(t)$



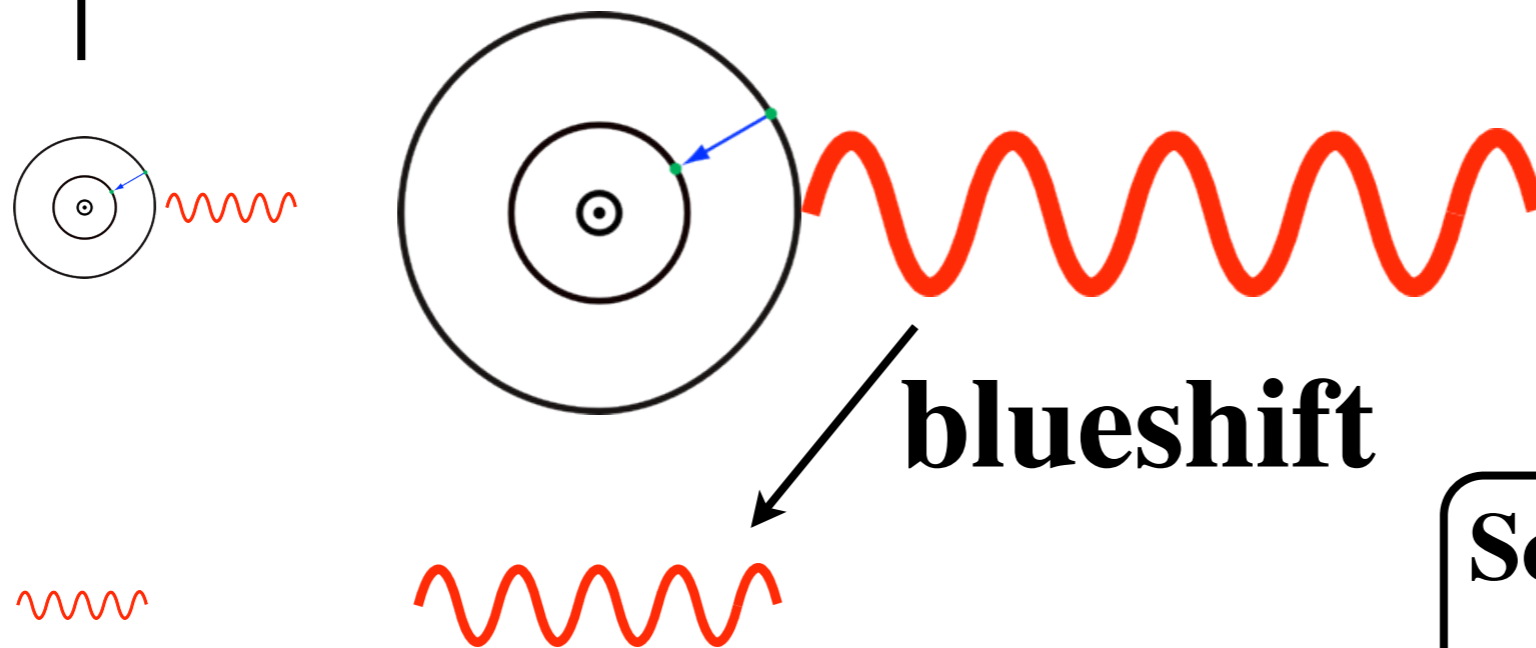
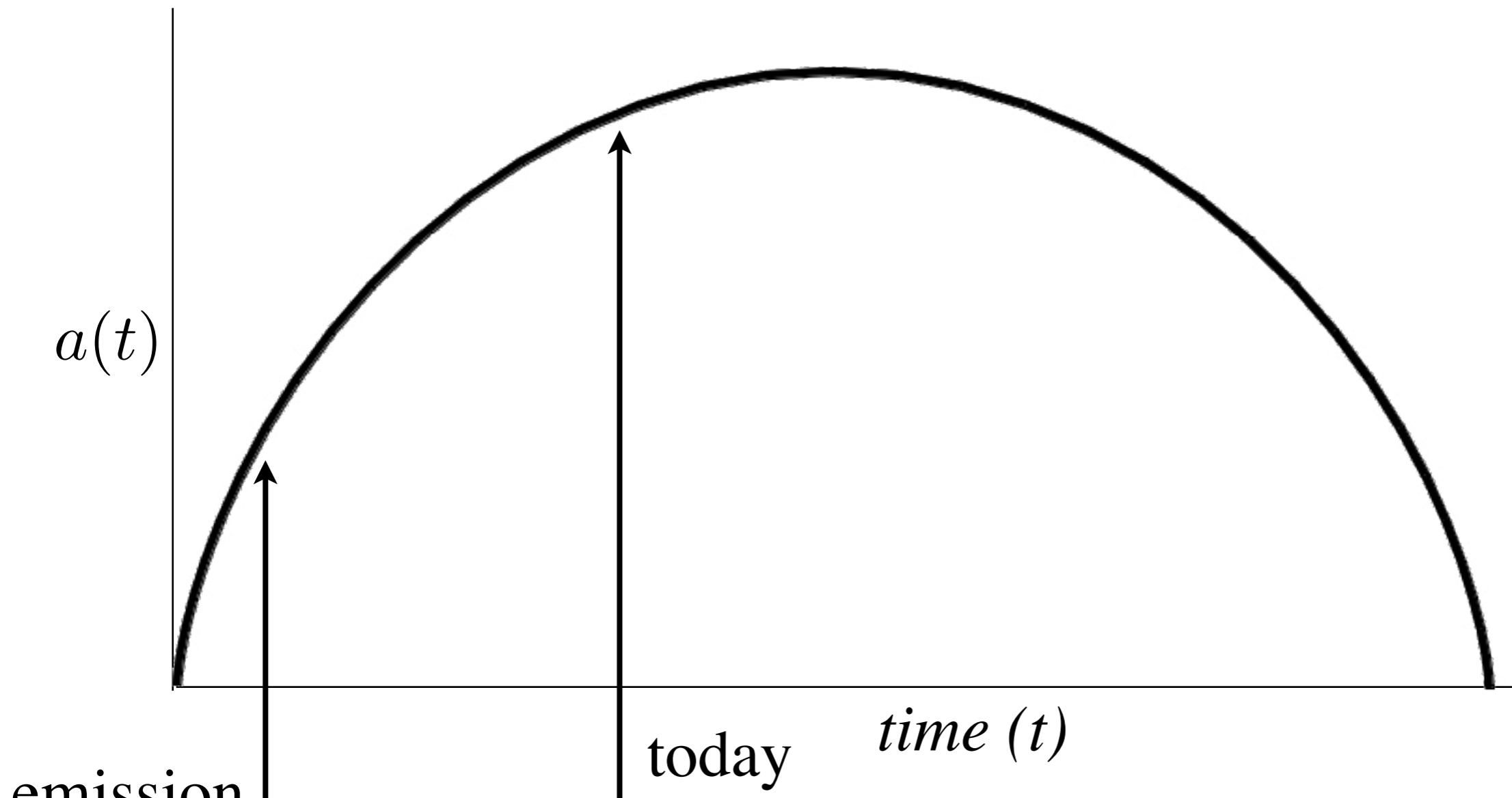
$time (t)$



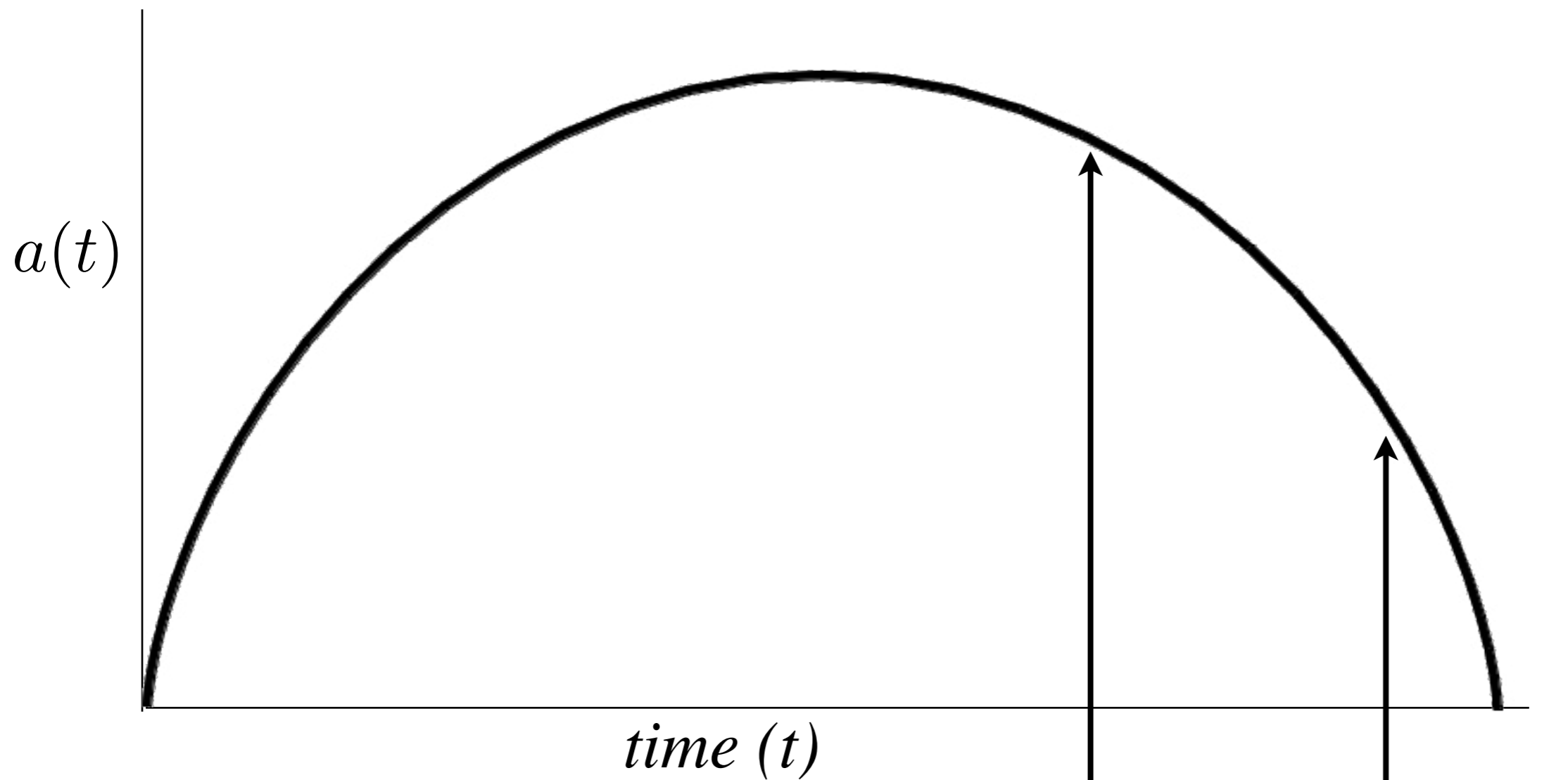


redshift

Conventional Interpretation

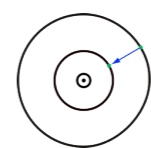
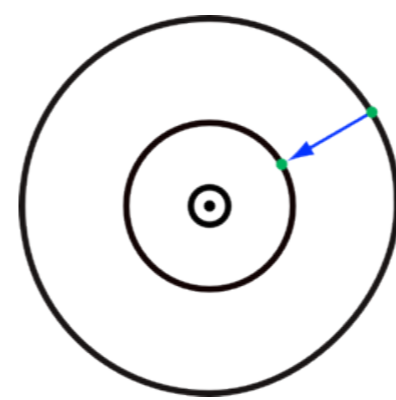


**Schrödinger/Sumner
Interpretation**

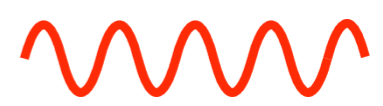


emission

today

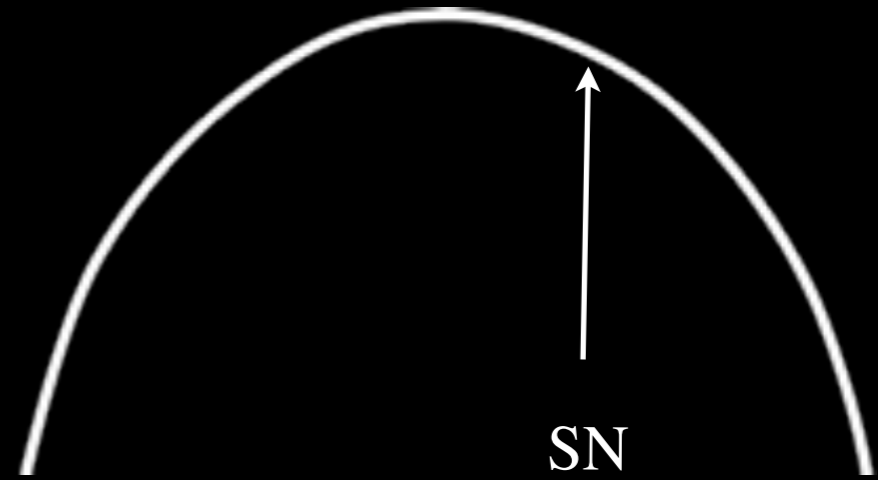
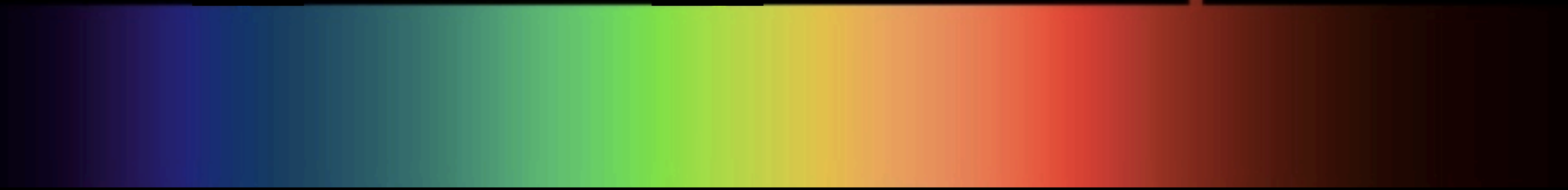


redshift



**Schrödinger/Sumner
Interpretation**

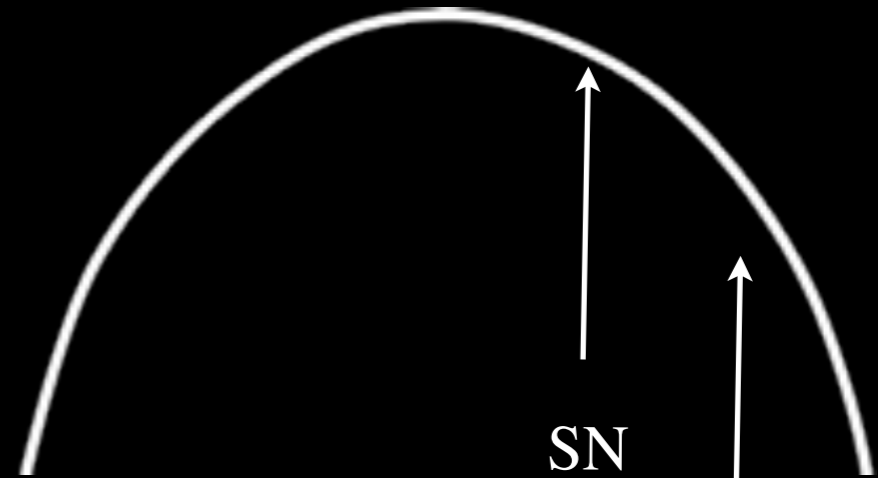
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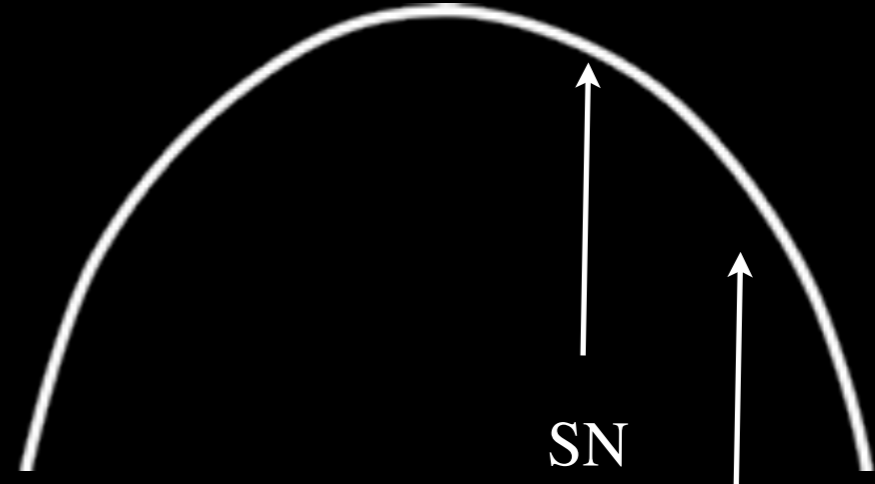
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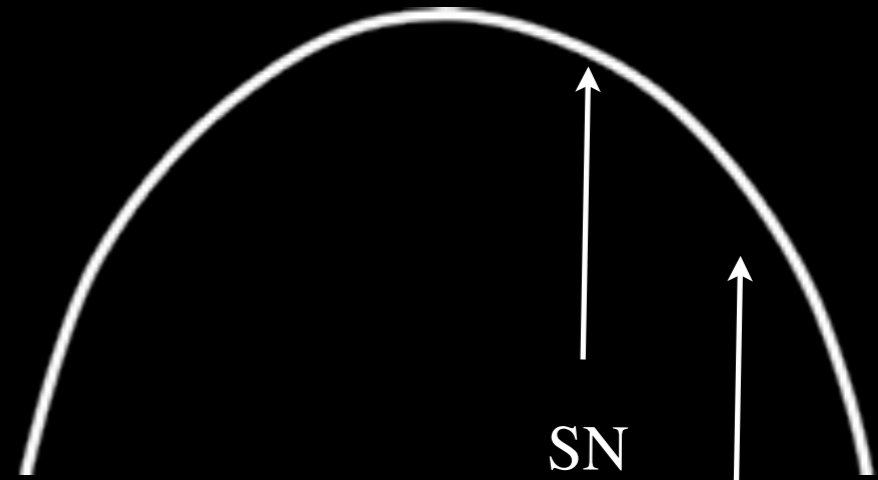
Today

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Redshift



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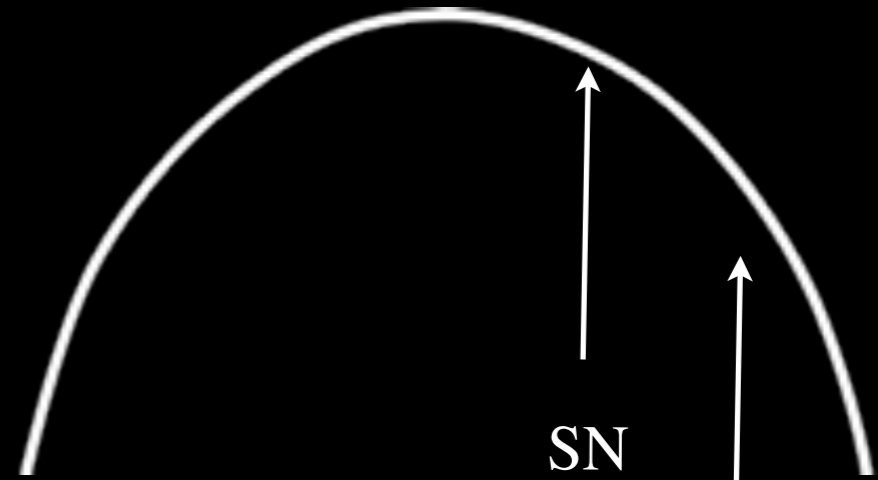
SN Today

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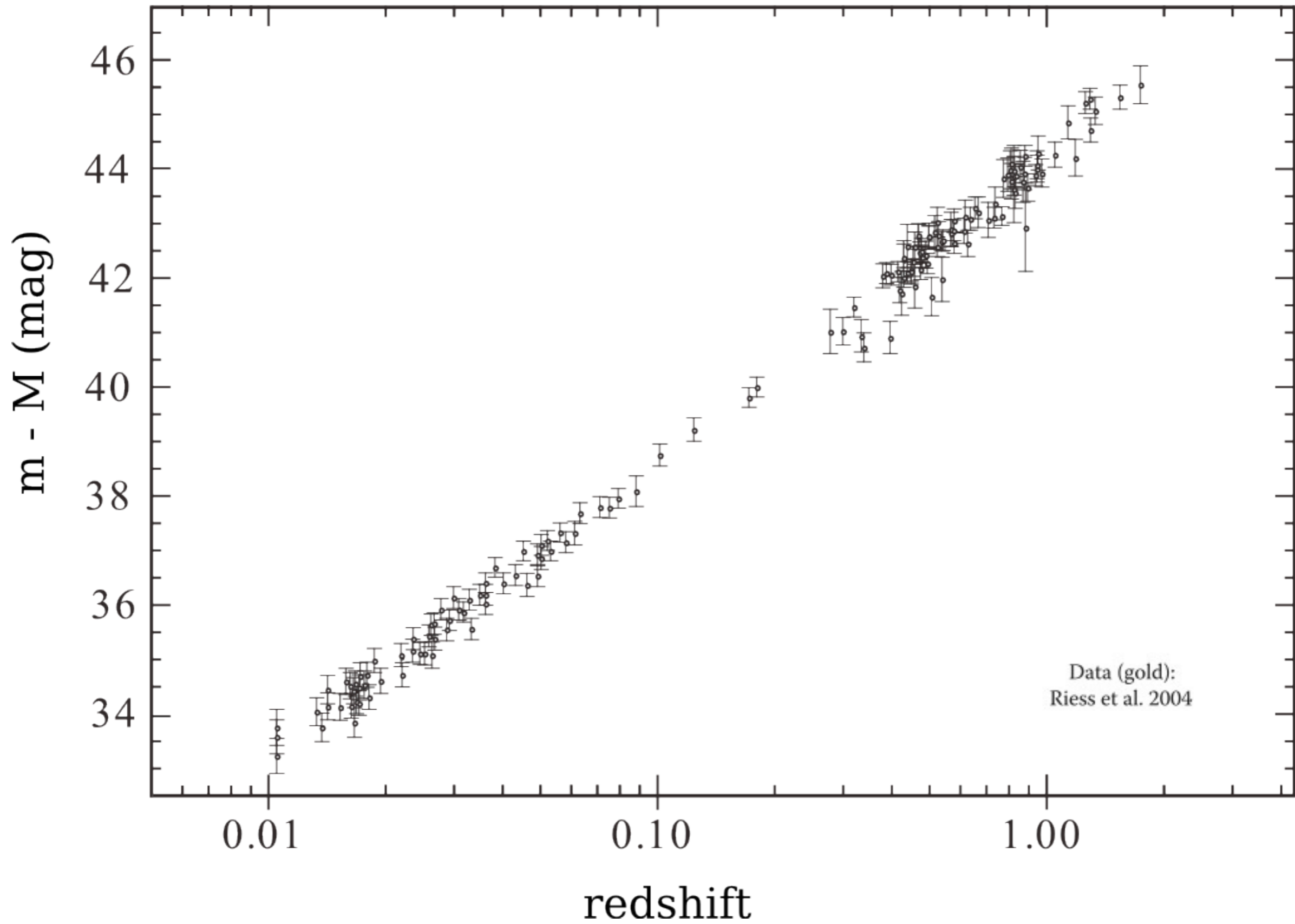
Redshift



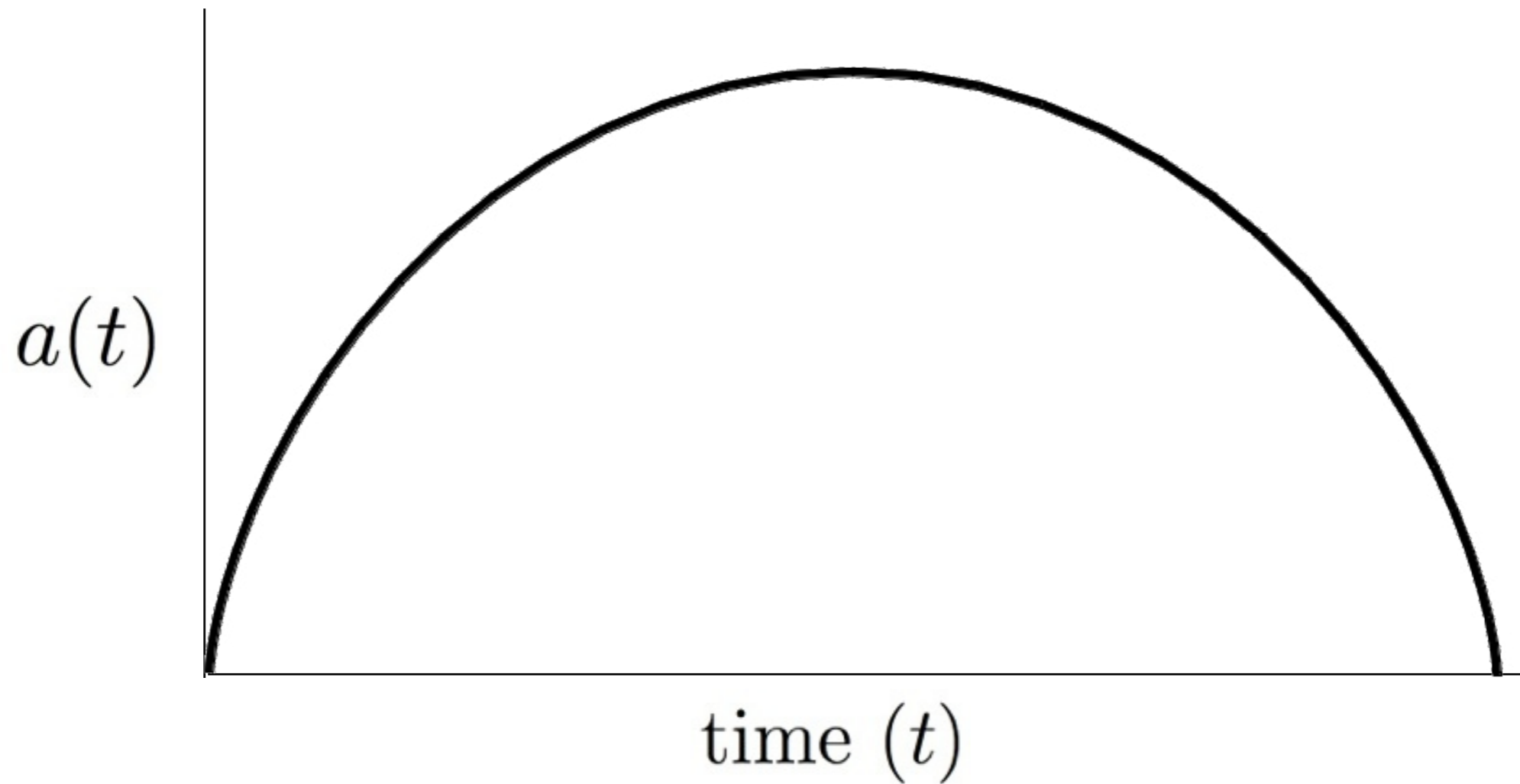
Redshift means collapse



Today



Calculate Redshift for a Collapsing Friedmann Universe



- Define redshift $k = \frac{\lambda_{obs}(t_0) - \lambda_e(t_0)}{\lambda_e(t_0)}, \quad k = \frac{a(t_1)}{a(t_0)} - 1$

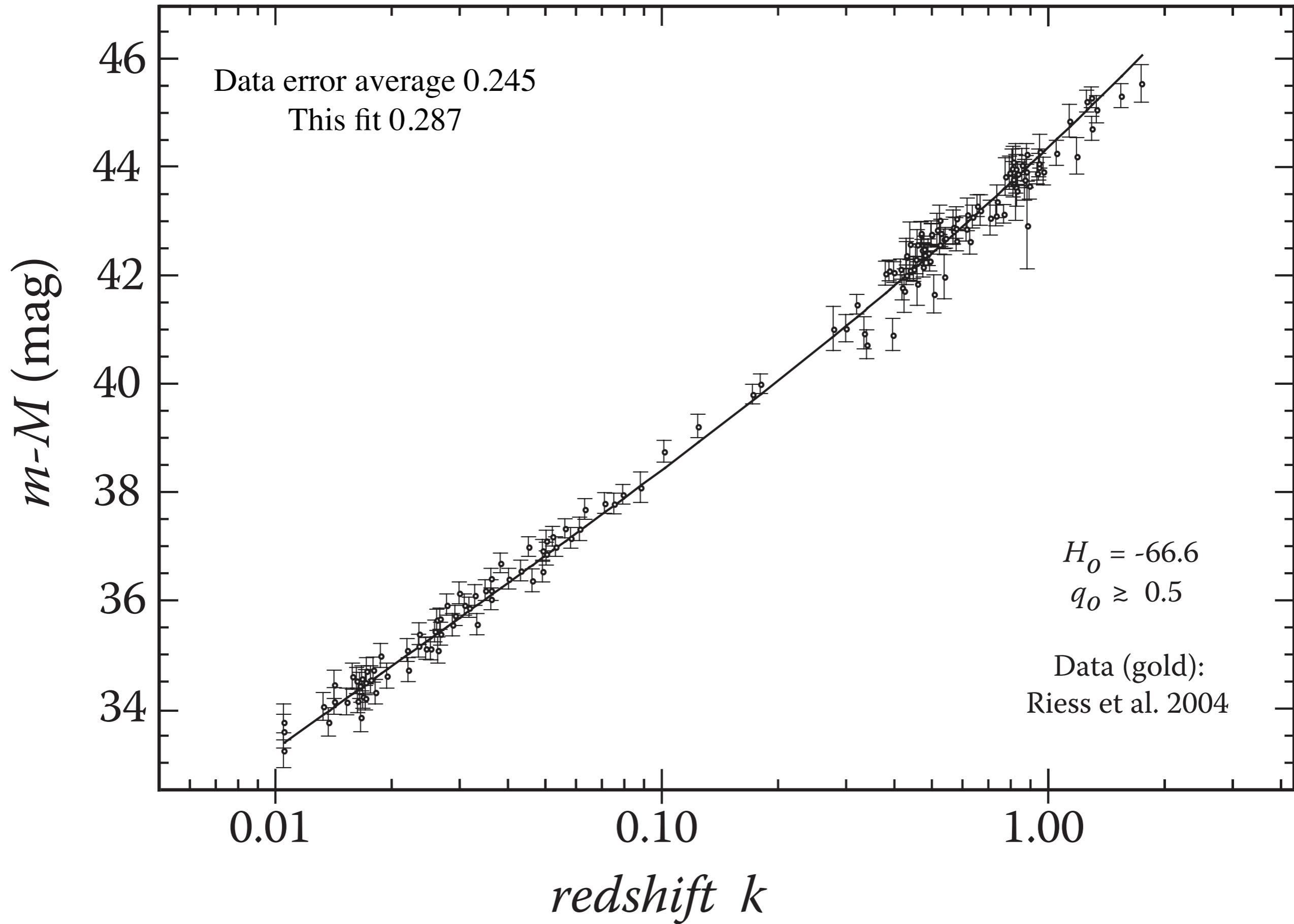
- Characterize the Friedmann curve using the Hubble constant, H_0 , and the deceleration parameter, q_0 .

- Derive from Friedmann solution
$$D_L = \left(\frac{-c}{H_0} \right) \frac{(1+k)}{q_0} \left\{ \left[k - \frac{(1+k)(1-q_0)}{q_0} \right] + \frac{(1-q_0)}{(2q_0-1)^{1/2}} \left\{ 1 - \left[k - \frac{(1+k)(1-q_0)}{q_0} \right]^2 \right\}^{1/2} \right\}.$$

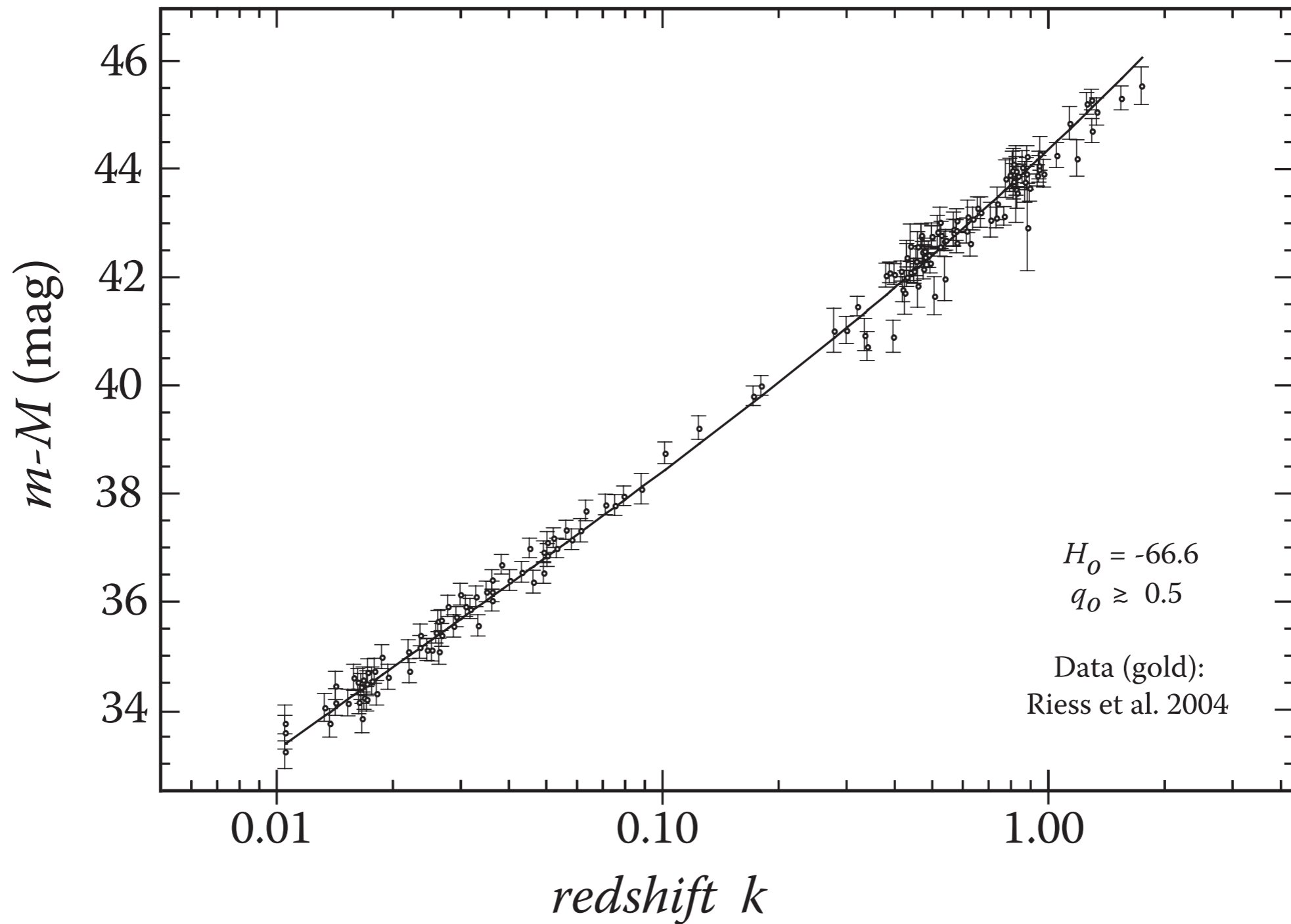
- Vary H_0 and q_0 for best fit for supernova brightness, $m - M$, and redshifts, k , using

$$m - M = 5 \log_{10} \left(\frac{D_L}{10 \text{ parsecs}} \right).$$

Details: arXiv:astro-ph/0008386v1

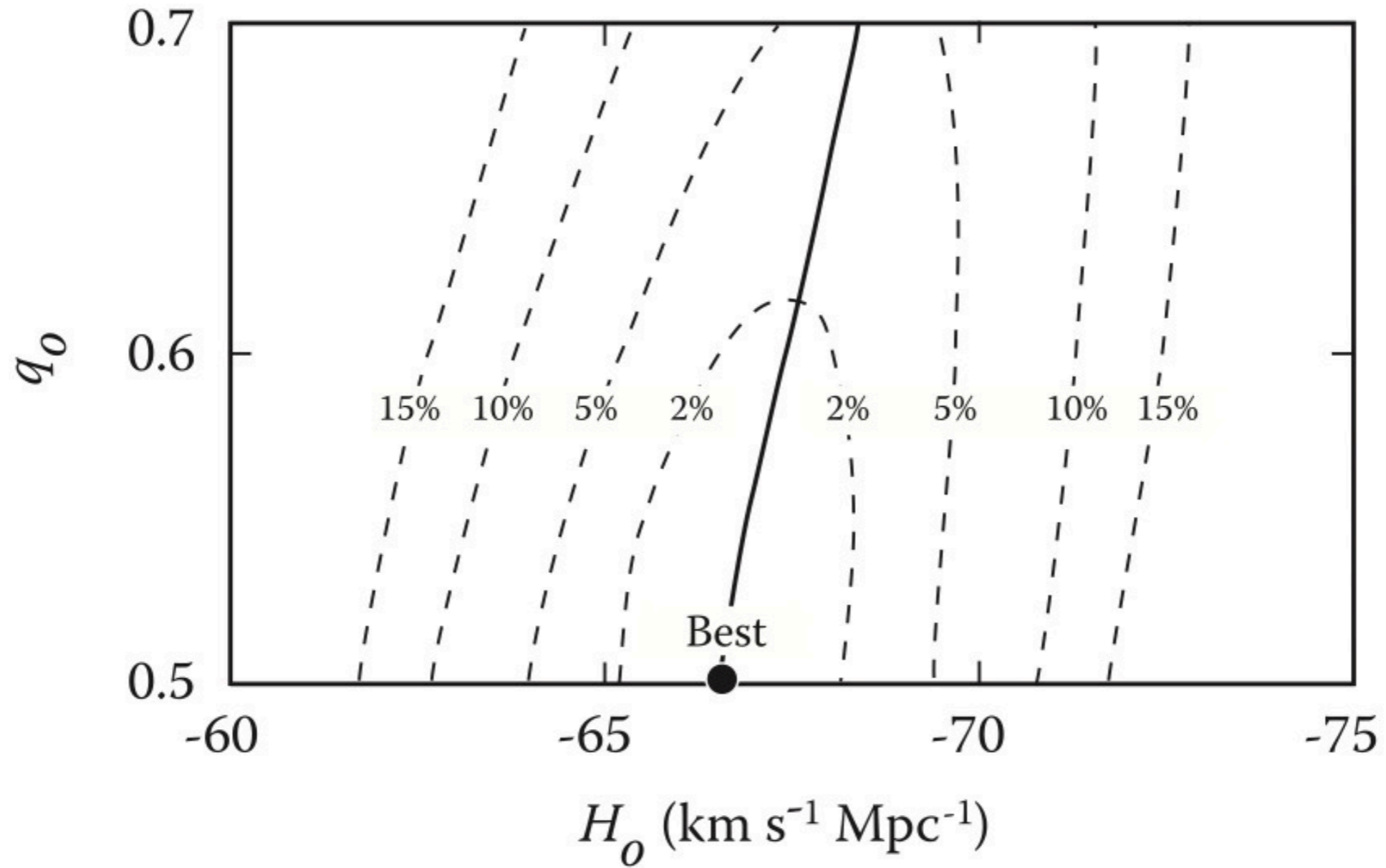


Details: arXiv:astro-ph/0503161v1

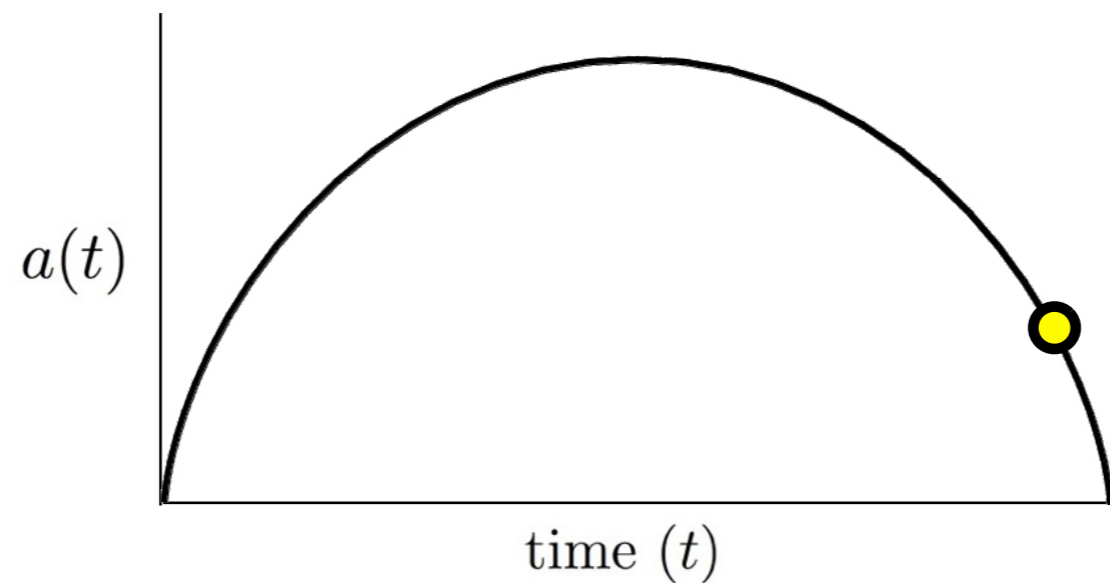
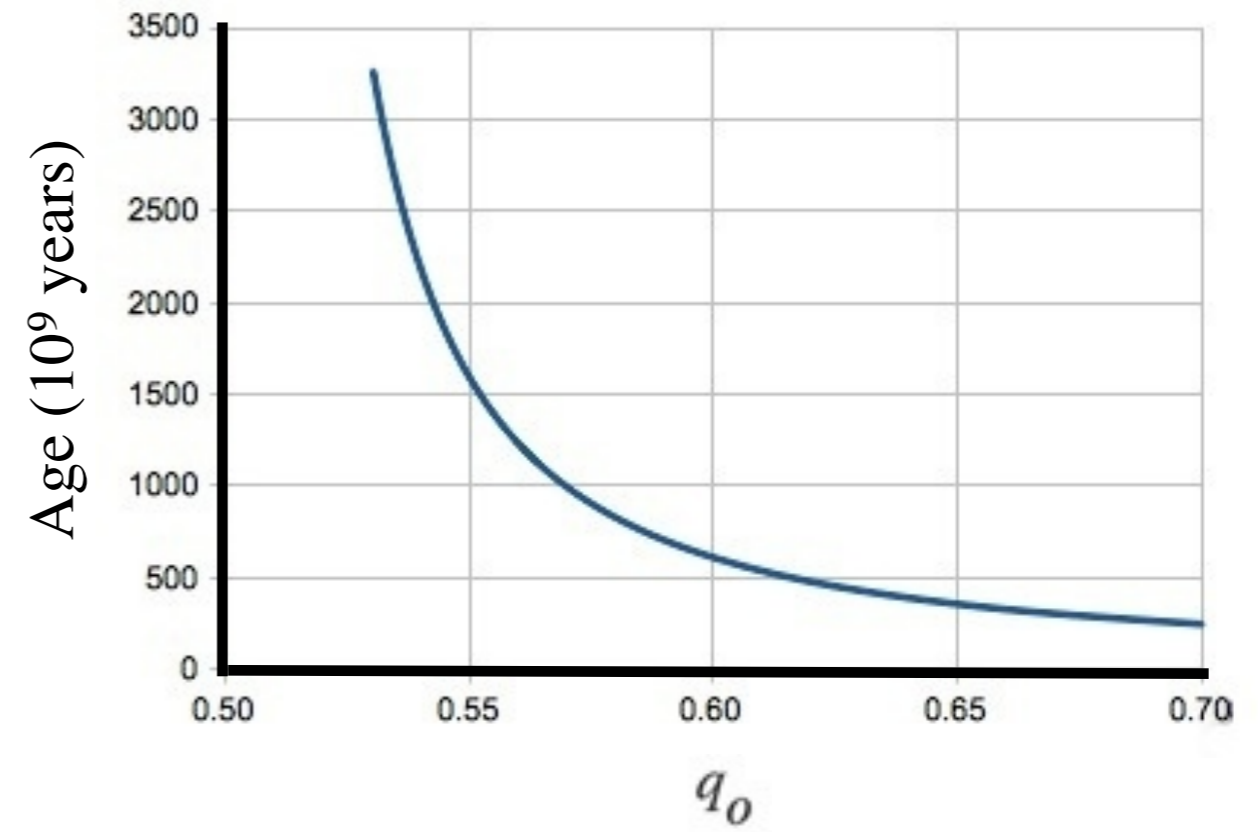
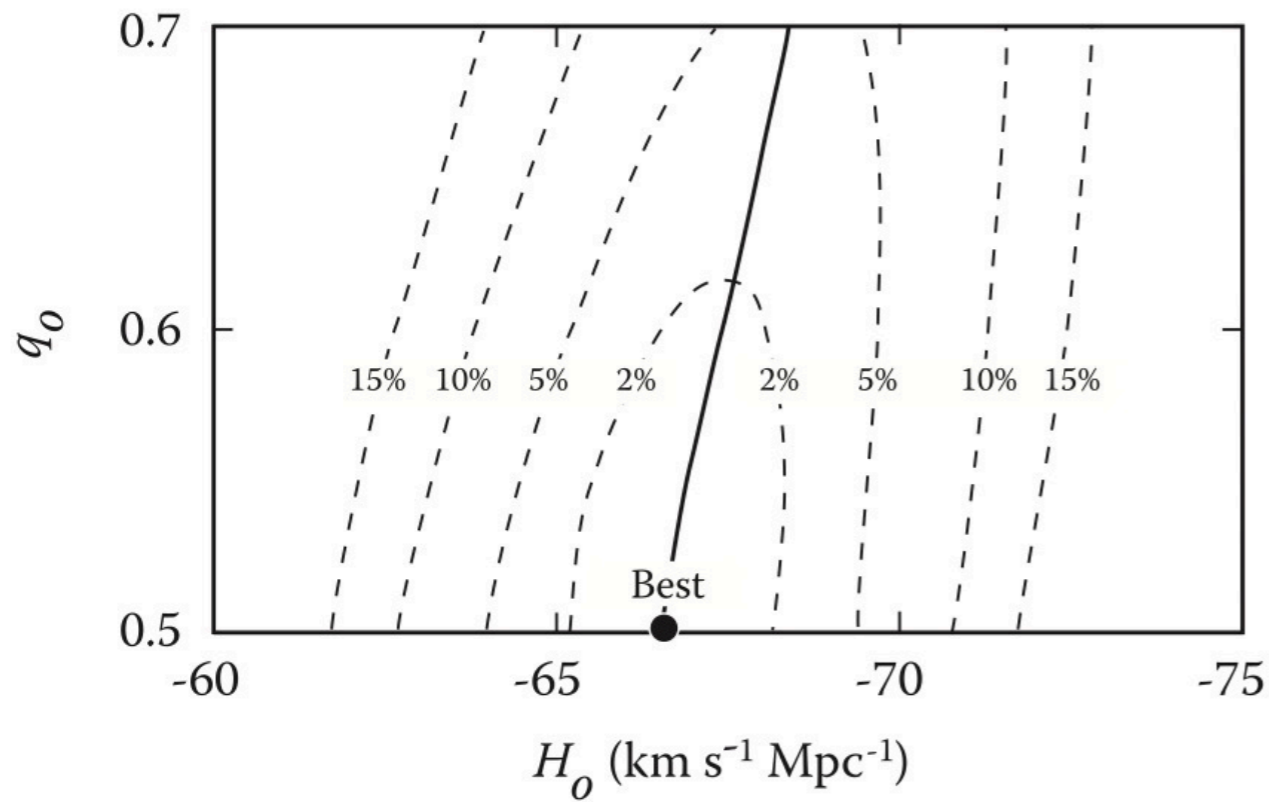


“Dark Energy” is not needed to explain accelerating redshift

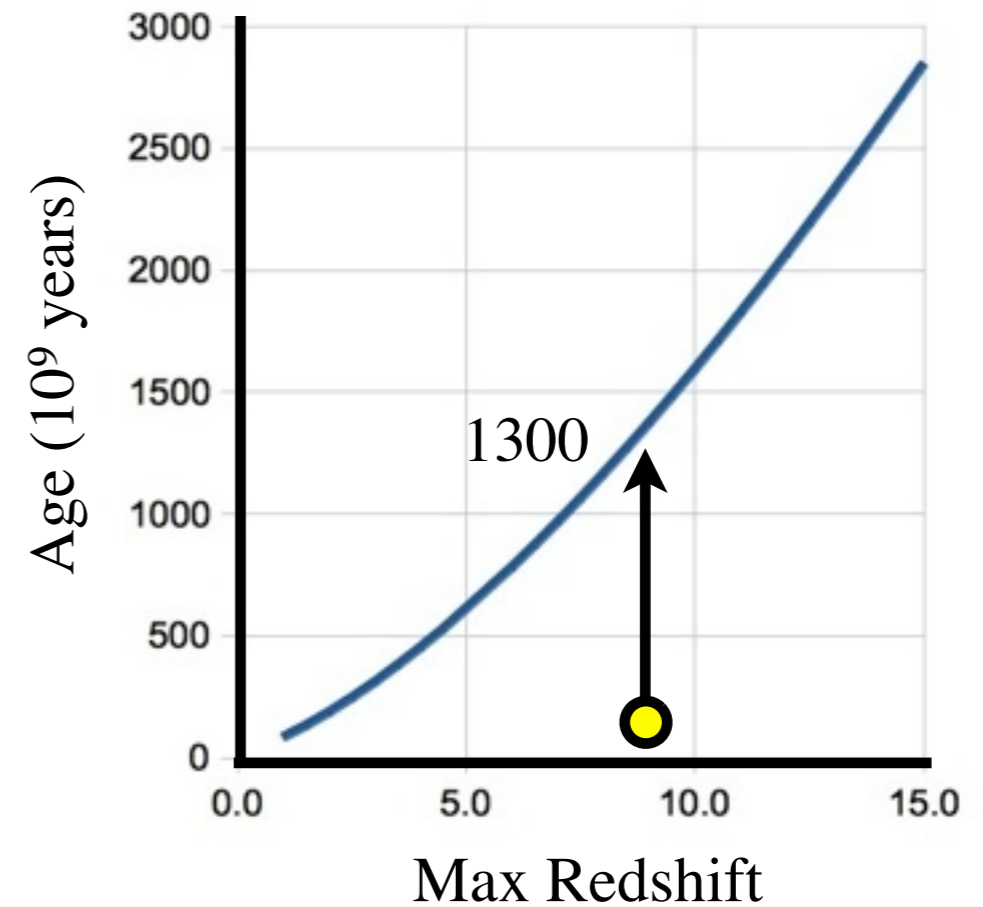
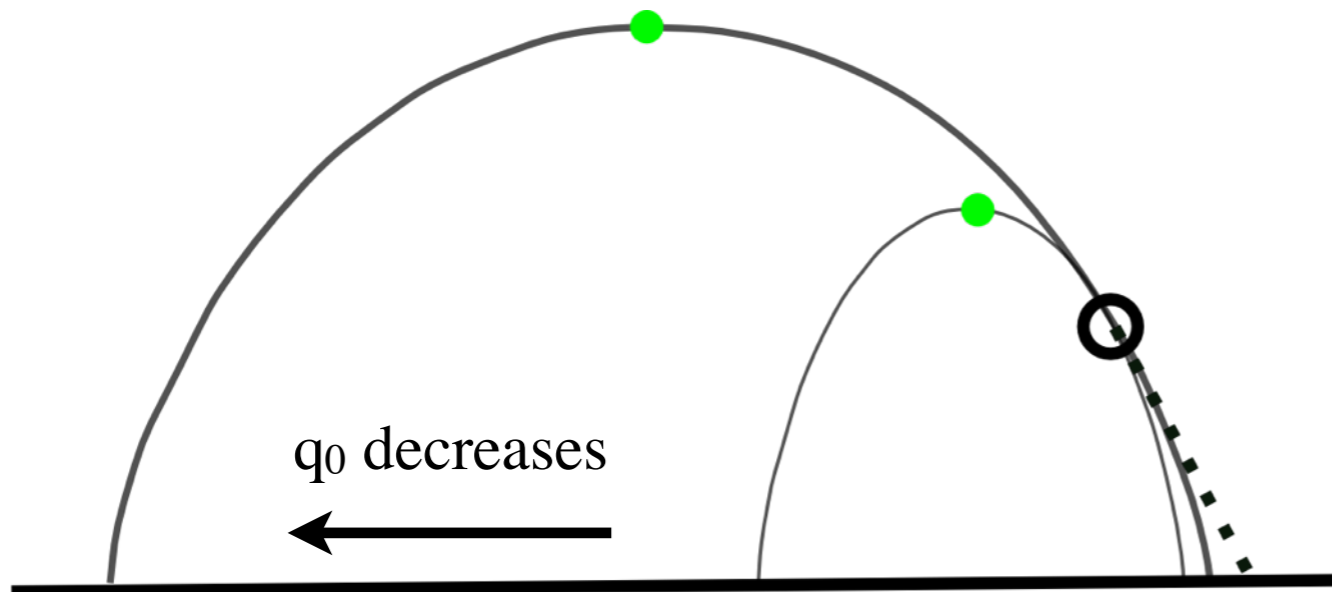
The Universe Is Nearly Flat ($q_0 \sim 1/2$)



Estimating the Age of the Universe

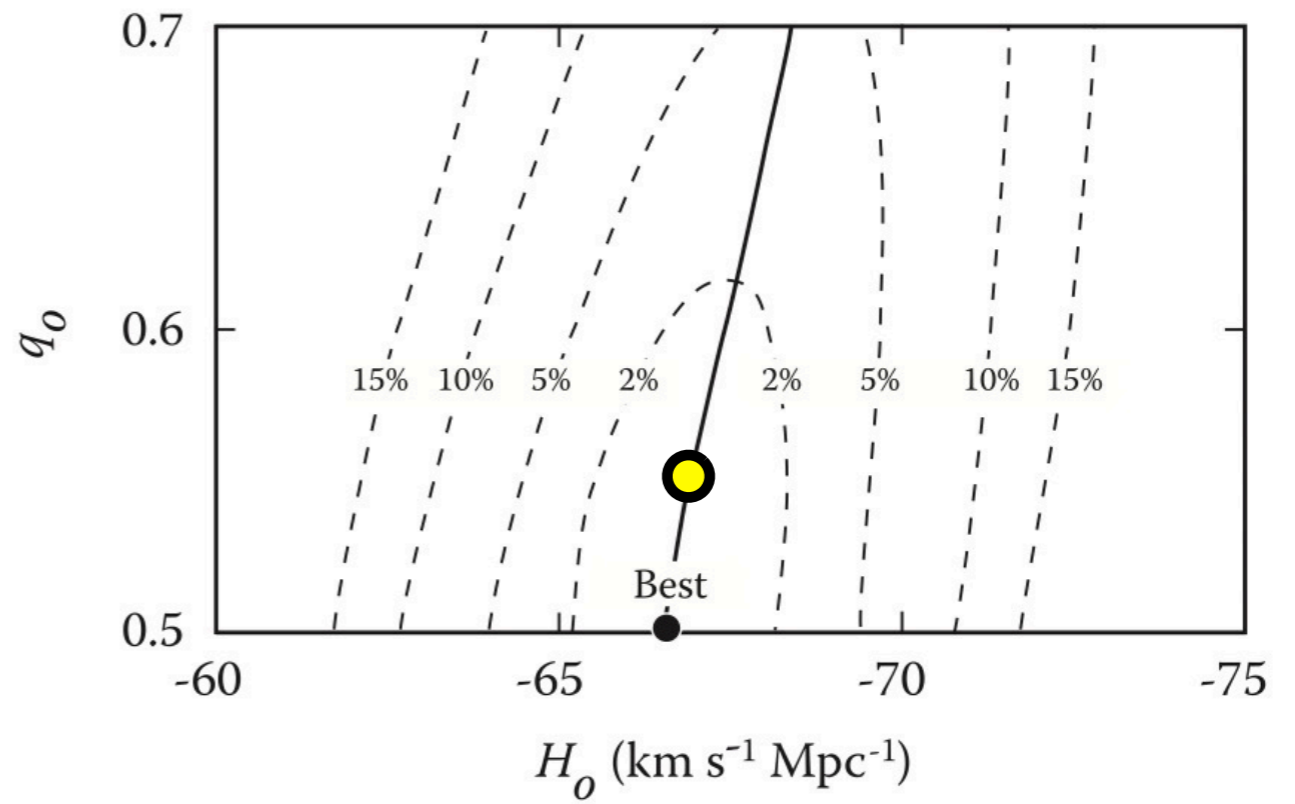
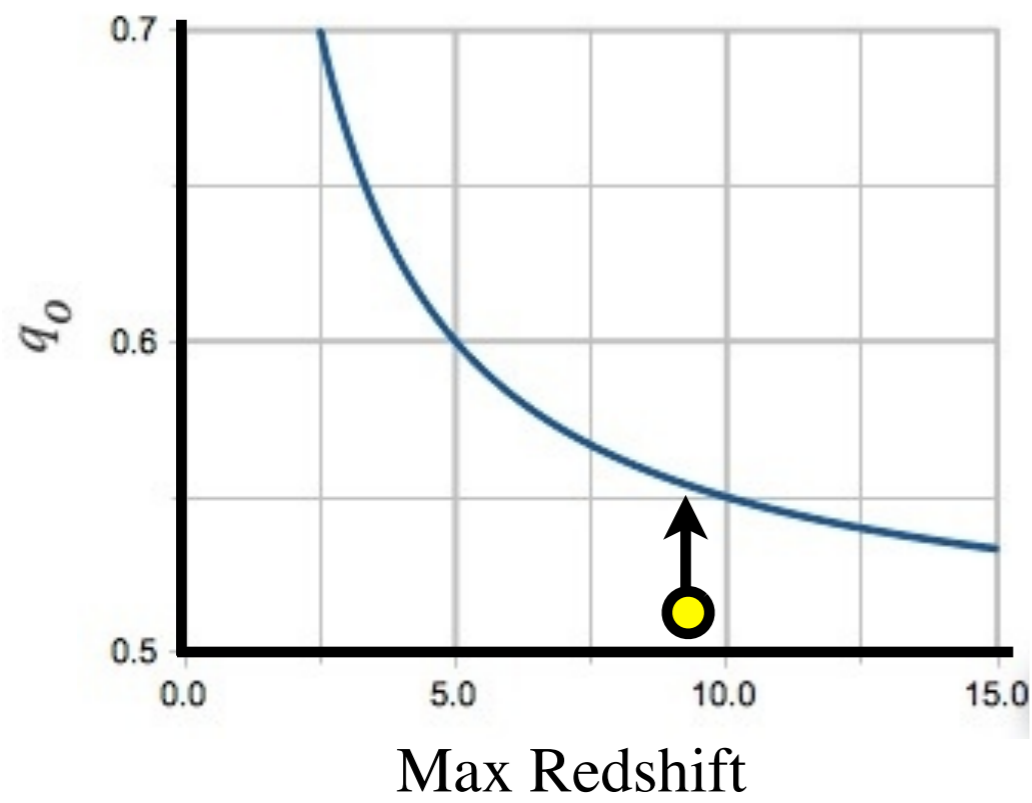


Estimating minimum age by using the maximum observed redshift



Details: [arXiv:astro-ph/0403012](https://arxiv.org/abs/astro-ph/0403012) v1

● 8.6 maximum redshift

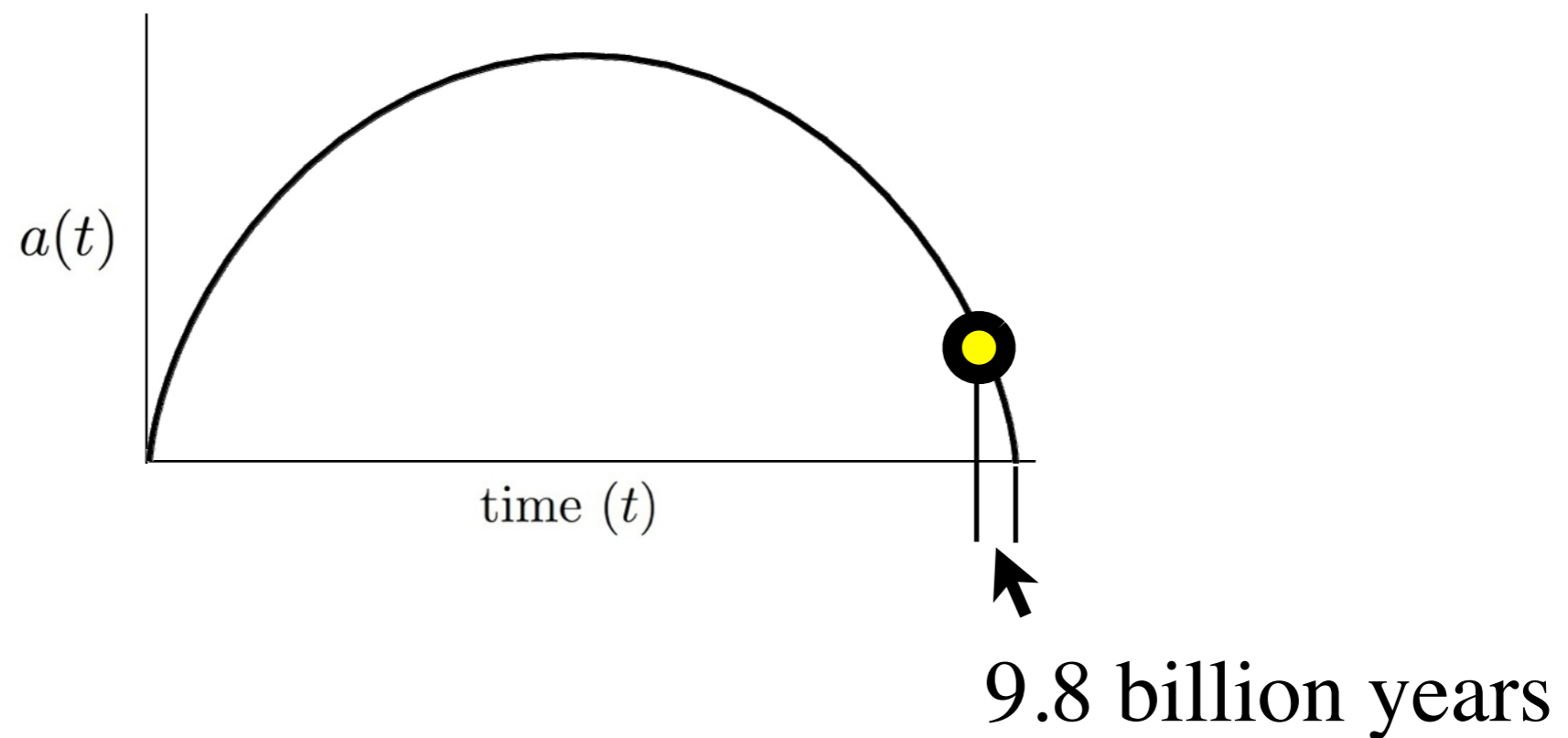


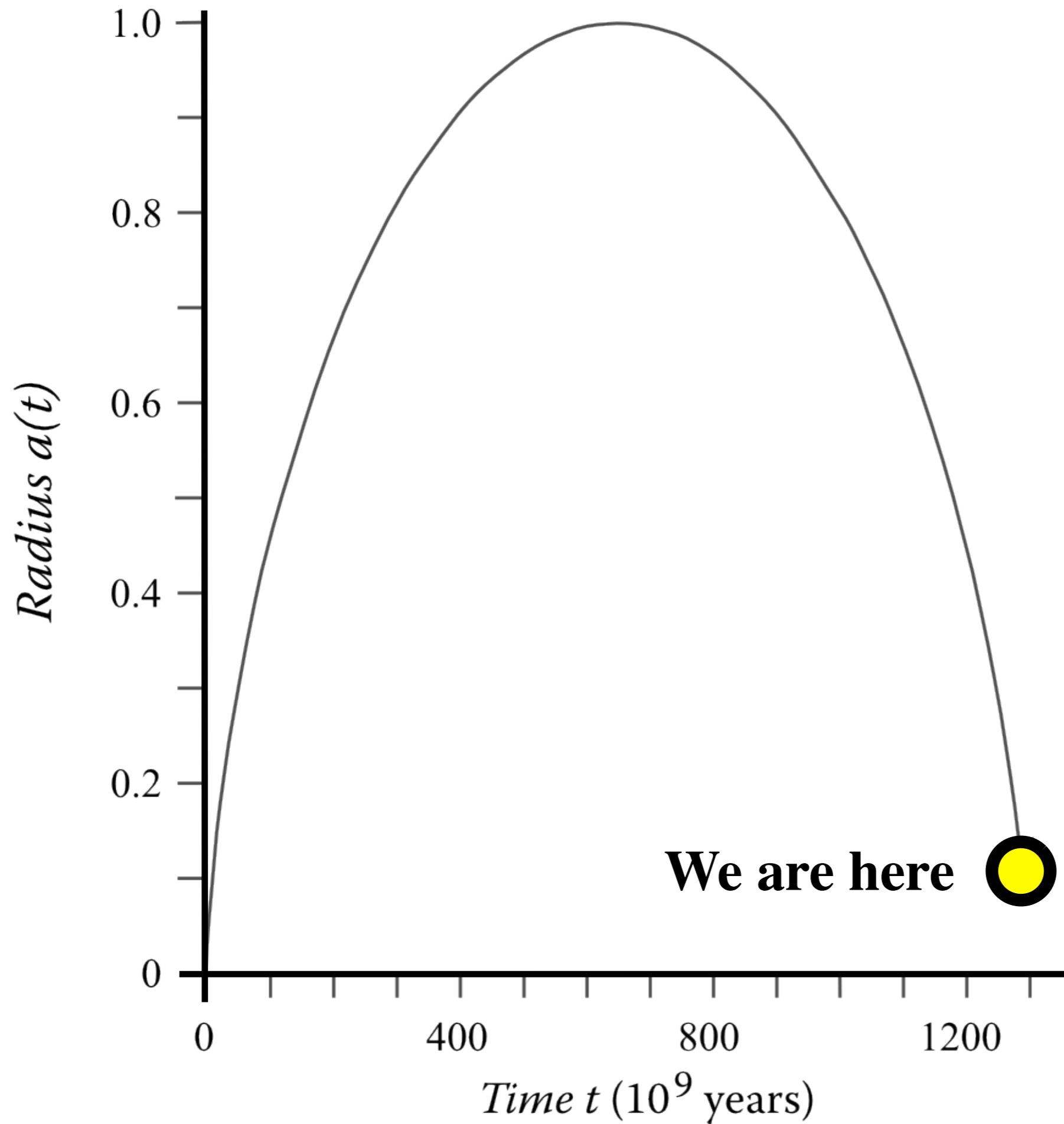
Details: arXiv:astro-ph/0403012 v1

● 8.6 maximum redshift

Time Until Collapse

For the time until collapse, $2/3 \times |H_0|^{-1}$ is a good estimate when q_0 is near 0.5. For $H_0 = -66.6 \text{ km s}^{-1} \text{ Mpc}^{-1}$, this is 9.8 billion years.





Time to collapse is
~9.8 billion years

“Dark Matter”

**is mass that neither emits
nor scatters electromagnetic radiation.**

**It cannot be directly detected
by optical or radio astronomy.**

There is ‘Dark Matter’

- The closed Friedmann Universe requires much more matter than has been directly observed.

There is “Dark Matter”

- The closed Friedmann Universe requires much more matter than has been directly observed.
- Many astronomical studies indicate there is much more matter than has been directly observed.

There is “Dark Matter”

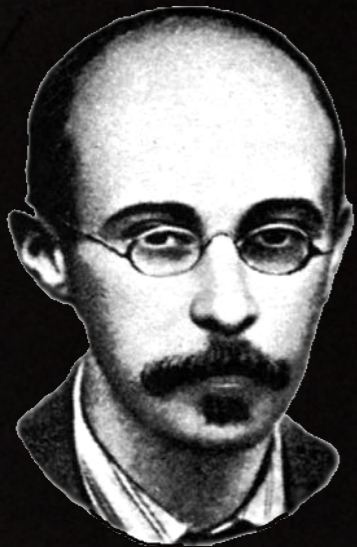
- The closed Friedmann Universe requires much more matter than has been directly observed.
- Many astronomical studies indicate there is much more matter than has been directly observed.
 - Motions of clusters of galaxies.
 - Rotational speeds of galaxies.
 - Gravitational lensing.
 - Temperature distributions of hot gases.

A Simple Explanation of “Dark Matter”

- The universe is at least 1300 billion years old.
 - The lifetime of our sun, an average star, is estimated to be of the order of 10 billion years.
 - Stars began forming soon after the Big Bang. Those and most stars from the following 1300+ billion years have gone dark.
 - This leads to the hypothesis that
- Most “Dark Matter” likely consists of burned-out stars.

Summary

- Schrödinger and Sumner have shown that the wavelengths of photons and atoms are directly proportional to the Friedmann radius.
- The evolution of atoms changes the interpretation of Hubble redshift. Redshift is characteristic of a collapsing Universe.
- Recent redshift measurements provide dramatic confirmation of this reasoning. No “Dark Energy” is needed to explain redshift data.
- The Universe is more than 1300 billion years old and will end in about 9.8 billion years.
- Considering the age of the universe, most "Dark Matter" likely consists of burned-out stars.



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