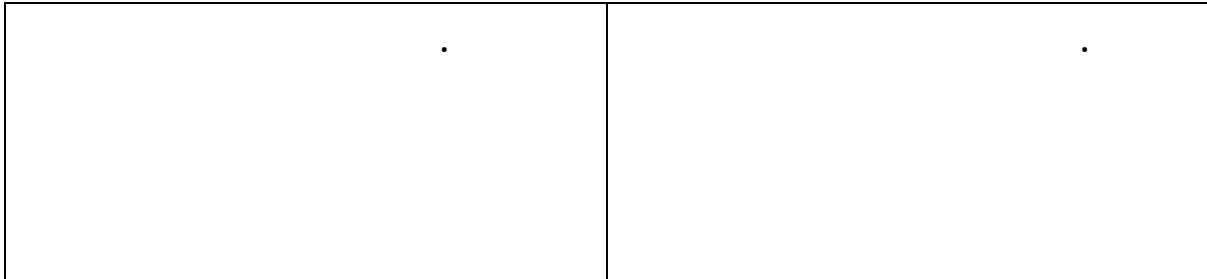


The Universe with Theory of Relativity



"Historical View"

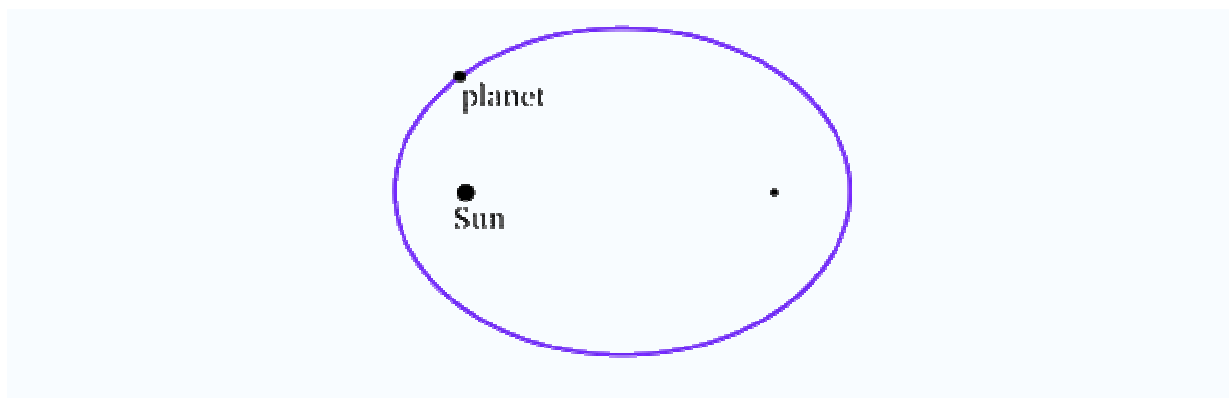
"Era before Einstein"

(1630-1571)

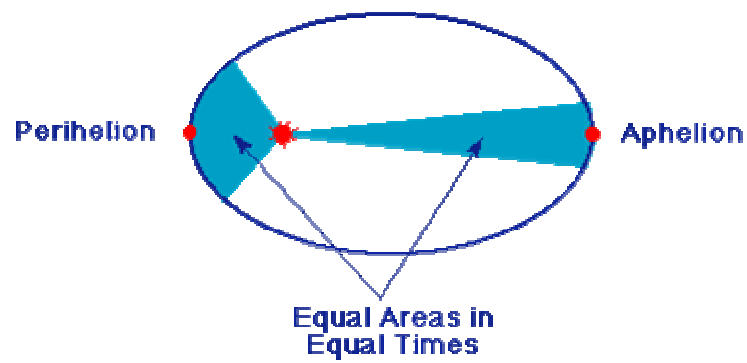
:

"Elliptic path"

-0



-0

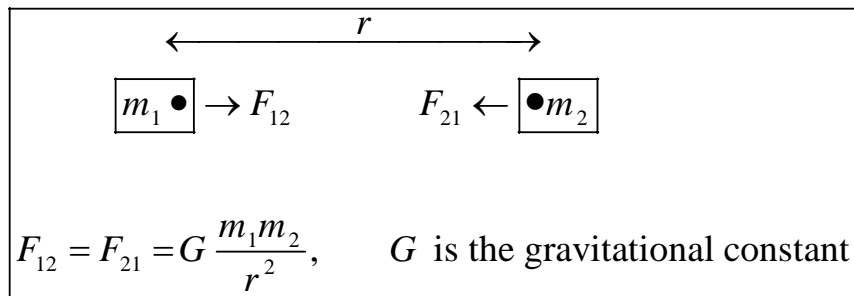


-2

	() ()	()	
	88	5.8×10^7	Mercury
	220	1.07×10^8	Venus
	376		Earth
	12×376	7.73×10^8	
	29.5×376	1.425×10^9	Saturn
	166×376	4.8×10^9	

:

:"



() Gravita

:

-3

-4

$$\vec{F} = m \vec{a}$$

\vec{a}

m

\vec{F}

-5

:

-

-

-

\mathbf{v} m

(Localized)

$$\dots K = \frac{\mathbf{p}^2}{2m}$$

$$\mathbf{p} = m \mathbf{v}$$

.(Distinguishable)

$$c = v\lambda$$

$$v \quad \lambda$$

(Non-Localized)

()

:

(Black body radiation)	-3
(Photoelectric phenomena)	-4
(Principle of atomic theory)	-5
(Compton scattering)	-6
(Diffraction of particles)	-7
(Michelson-Morely experiment) *	-8
(Orbit precession of Mercury)	-9

5 1

."(Quantum mechanics) "

$$\lambda = h / p$$

-

.

p

6

.

.

-

*

(H. A. Lorentz)

(Edward Fitzgerald)

"Theory of relativity "

"Special theory of relativity"

1905

:()
-1
:()
-2

m_o

:

"m "

u

$$m = \frac{m_o}{\sqrt{1 - \left(\frac{u}{c}\right)^2}}$$

c

(Length contraction)

(Proper length)

" u "

" L_o "

:

" L "

$$L = L_o \sqrt{1 - \left(\frac{u}{c}\right)^2}$$

c

" Δt "

(Time dilation)

:

" Δt_o "

" u "

$$\Delta t = \frac{\Delta t_o}{\sqrt{1 - \left(\frac{u}{c}\right)^2}}$$

"Twin paradox"

"Clock paradox"

:

$$E = mc^2$$

(c) (m) (E)

"He"

"H"

" Δm "

"General theory of relativity "

1915

(+)

:(Principle of equivalence)

-1

m_i

$$\vec{F} = m_i \vec{a}$$

m_g

$$\vec{F}_g = m_g \vec{g}$$

$$m_i \frac{d^2x}{dt^2} = m_g g$$

$$\boxed{\frac{d^2x}{dt^2} = g}$$

()

$g \equiv a$:

()

:(Principle of covariance)

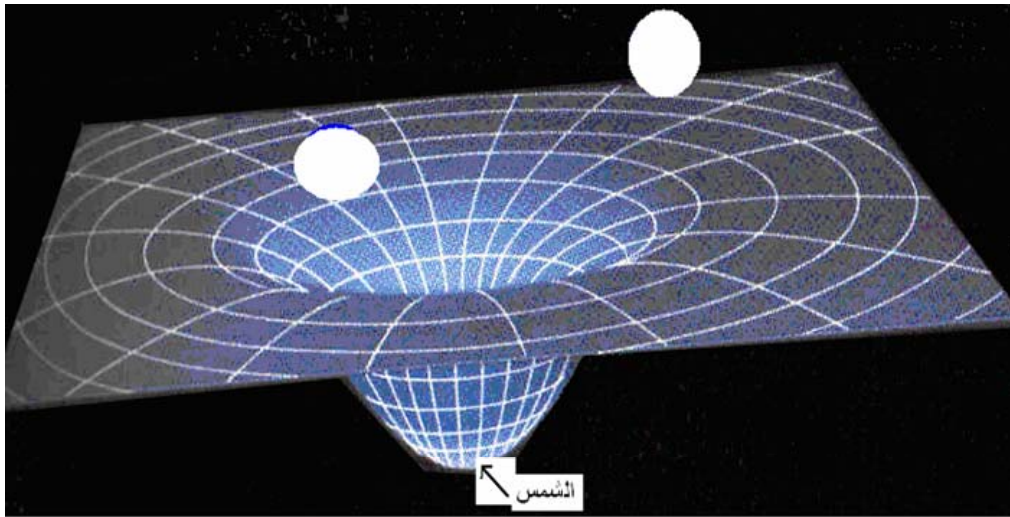
-2

(Tensor calculus)

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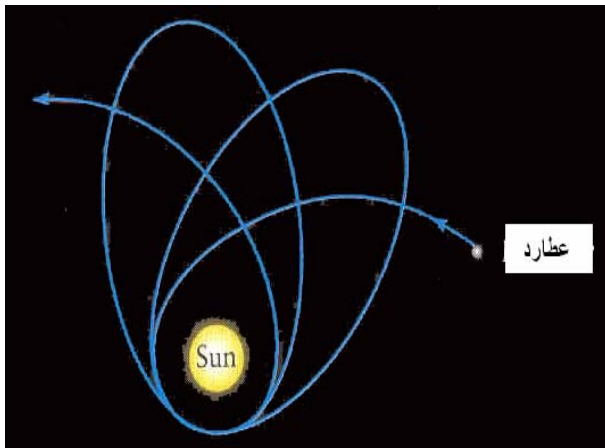
2/25/2007

(Curvature of space) ()



(Orbit precession of Mercury)

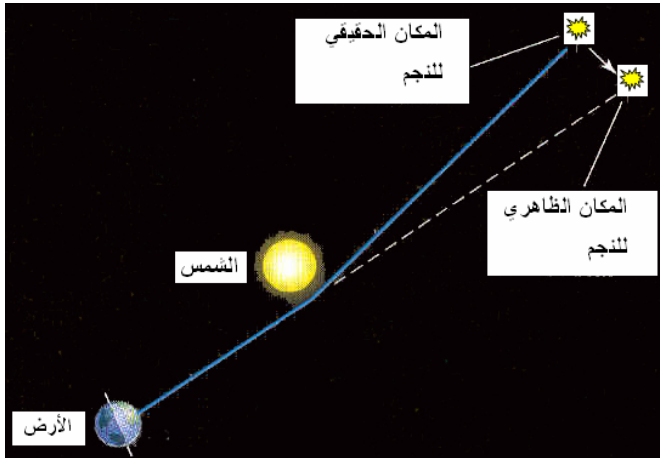
(Urbain Le Verrier)



40

43

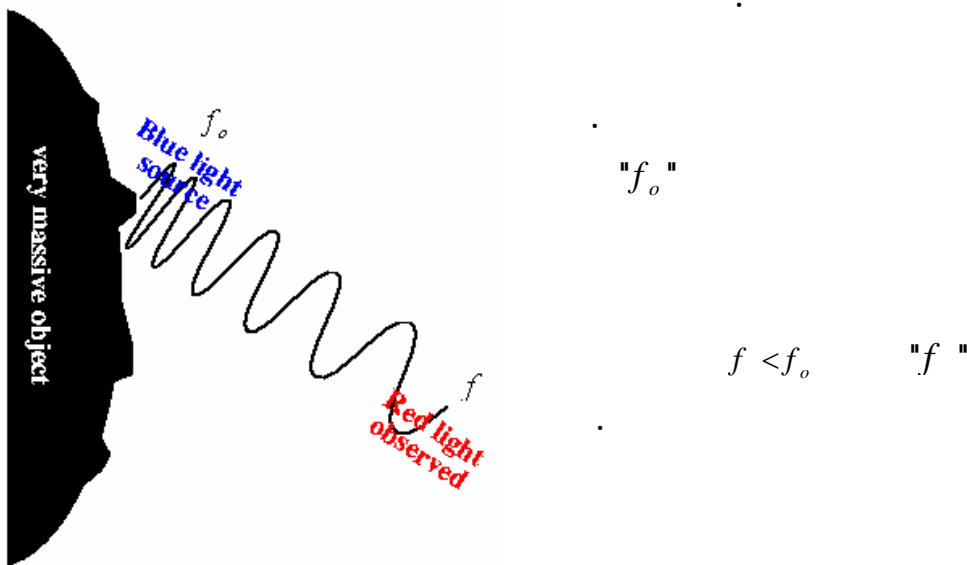
(Deflection of light)



(1.74")

1919

(Gravitational red shift)



1960

(Robert Pound & Glen Rebka)

(White dwarfs)

$$E = mc^2 = hf_o$$

m

" c "

$$U = -G \frac{Mm}{r} = -G \frac{Mh}{rc^2} f_o$$

$$hf = hf_o \left[1 - G \frac{M}{rc^2} \right] \Rightarrow \boxed{\frac{f - f_o}{f_o} = \frac{\Delta f}{f_o} = -G \frac{M}{rc^2}}$$

$$hf = hf_o \left[1 + G \frac{M}{rc^2} \right] \Rightarrow \boxed{\frac{f - f_o}{f_o} = \frac{\Delta f}{f_o} = +G \frac{M}{rc^2}}$$

$$\boxed{f = f_o \left[1 \pm G \frac{M}{rc^2} \right]}$$

(+)

(-)

:

-3

."Cosmological constant"

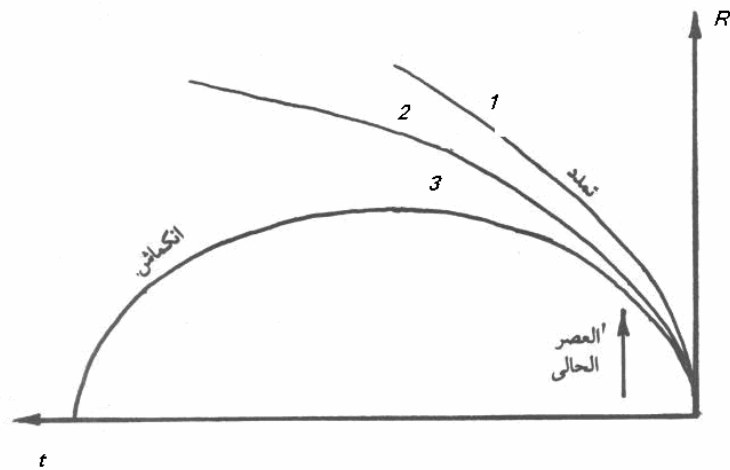
. 1922

"1888-1925" "Alexander Friedmann"

()

2 1

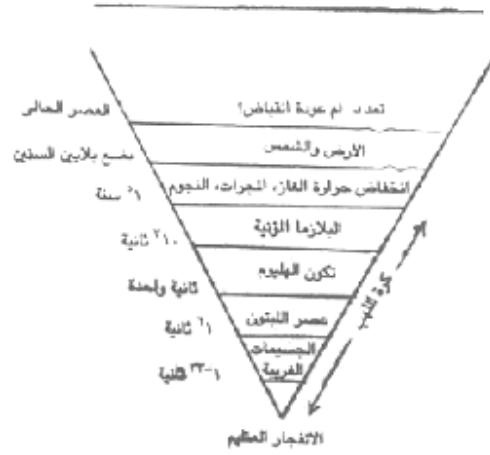
3



(1)

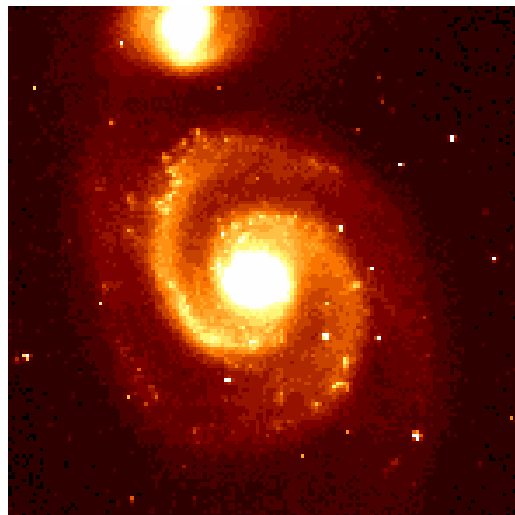
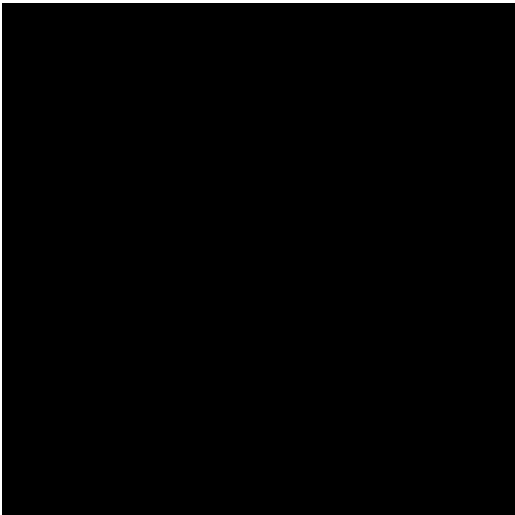
جدول تاريخ الكون : الشكل الأعلى يوضح التاريخ العكسي بينما يبين الشكل الأسفل التاريخ الجارى منذ الانفجار العظيم

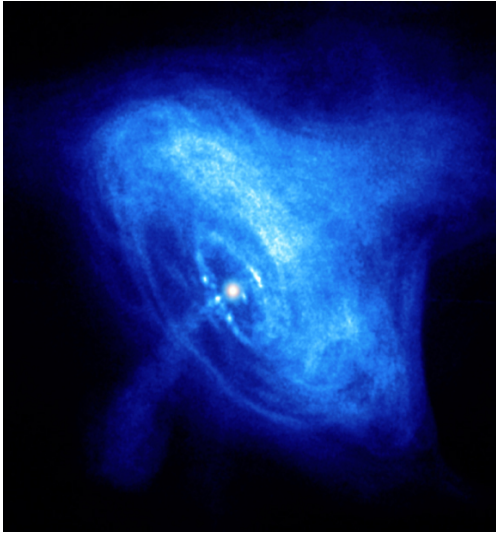
العصر بالسنين	السمة
١٠٠	الثقافة التكنولوجية
١٠ ٠٠٠	الحضارة
٥ ملايين	نشأة الانسان
٢٠٠ مليون	نشأة الثدييات
٣ بلايين	نشأة الحياة على الأرض
٤/٣ بلايون	تكون الأرض
١٠ - ٢٠ بلايون	الكون



الانفجار العظيم

.(Black hole)





(Neutron star)

(White dwarf)

