

Phys 3344: Thursday 19 November

Office Hours: Wed 5:00-6:00

Today after class: Nobel Prize Panel:

Final Hw12: Due Wed 02 December

CH: 15 Relativity

Please join us -- Meeting ID 943 5593 4792
Security Passcode 687795

Mechanical Universe 42: <https://youtu.be/feBT0Anpg4A> (22:00)

Mechanical Universe 43: <https://youtu.be/BFLUa0ciMjw> (14:30)

Mechanical Universe 44: <https://youtu.be/IZUrLq0LLIU> (12:00)

Shape of space: https://youtu.be/-gLNIC_hQ3M

2020 FALL PHYS 3344

#	DAY	LECTURE:	NOTES:	Chpt	TOPIC
1	TUE	08/25/20	First Class	1	Newtons Laws
2	THUR	08/27/20		2	Projectiles
3	TUE	09/01/20		3	Momentum & Angular Momentum
4	THUR	09/03/20		4	Energy
5	TUE	09/08/20		5	Oscillations
6	THUR	09/10/20			
7	TUE	09/15/20			
8	THUR	09/17/20			EXAM 1
9	TUE	09/22/20		6	Calculus of Variations
10	THUR	09/24/20		7	Lagrange's Equation
11	TUE	09/29/20			
12	THUR	10/01/20		8	Two Body Problems
13	TUE	10/06/20			
14	THUR	10/08/20		9	Non-Inertial Frames
	TUE	10/13/20	Fall-Break	10	Rotational Motion
15	THUR	10/15/20			EXAM 2
16	TUE	10/20/20		10	Rotational Motion
17	THUR	10/22/20		11	Coupled Oscillations
18	TUE	10/27/20			
19	THUR	10/29/20		13	Hamiltonian Mechanics
20	TUE	11/03/20			
21	THUR	11/05/20	Drop Date	14	Collision Theory
22	TUE	11/10/20			
23	THUR	11/12/20			EXAM 3
24	TUE	11/17/20		15	Special relativity
25	THUR	11/19/20			
26	TUE	11/24/20			
27	THUR	11/26/20	Thanksgiving		No Class
28	TUE	12/01/20			No Class
29	THUR	12/03/20	Last Class		Review
	WED	Dec 16	FINAL EXAM	Wednesday Dec. 16,2020, 11:30am - 2:30p	

CHAPTER 13 Hamiltonian Mechanics 521

- 13.1 The Basic Variables 522
- 13.2 Hamilton's Equations for One-Dimensional Systems 524
- 13.3 Hamilton's Equations in Several Dimensions 528
- 13.4 Ignorable Coordinates 535
- 13.5 Lagrange's Equations vs. Hamilton's Equations 536
- 13.6 Phase-Space Orbits 538
- 13.7 Liouville's Theorem* 543
- Principal Definitions and Equations of Chapter 13 550
- Problems for Chapter 13 550

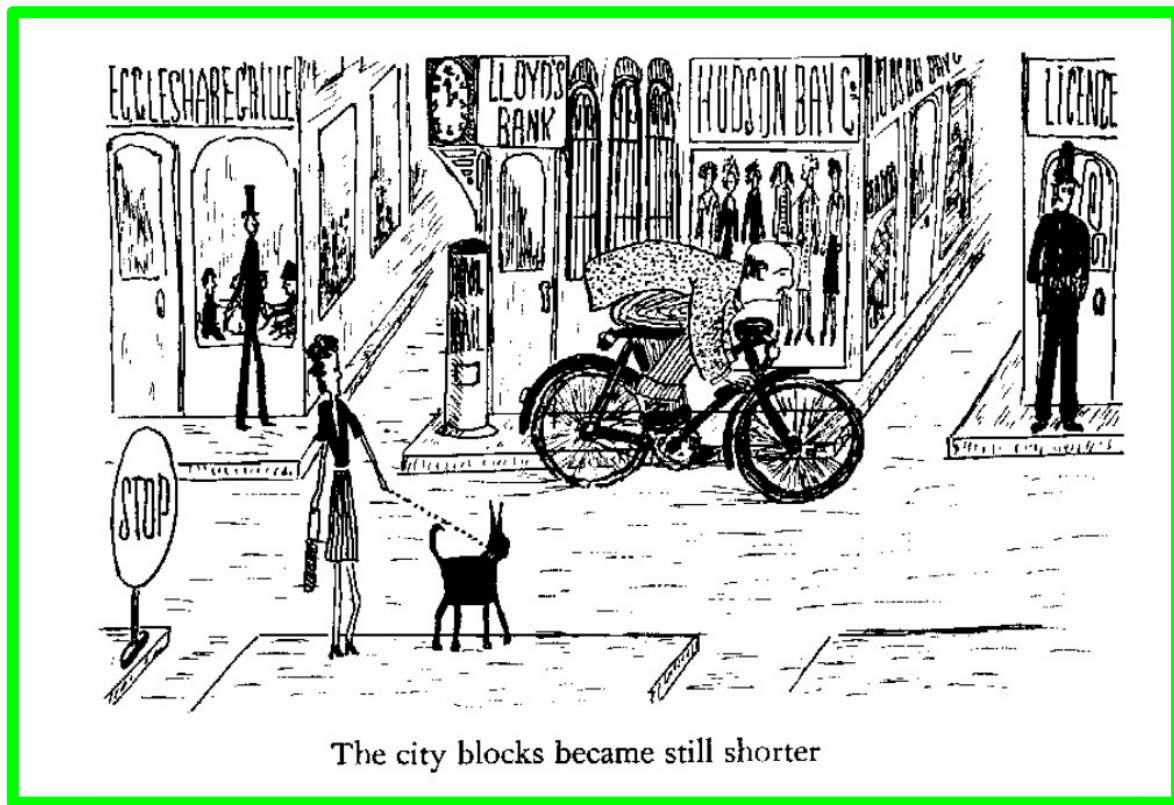
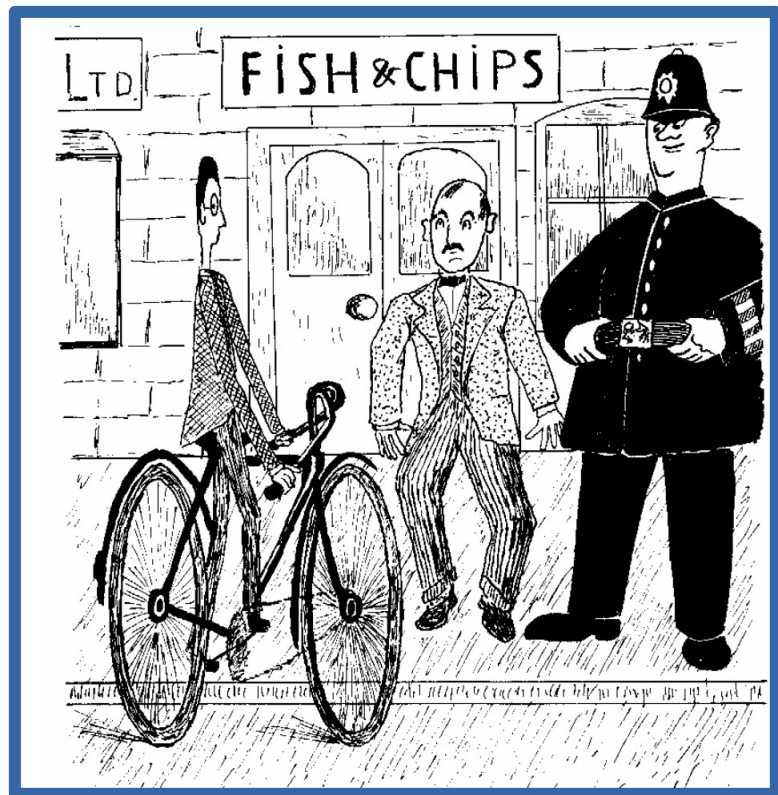
CHAPTER 14 Collision Theory 557

- 14.1 The Scattering Angle and Impact Parameter 558
- 14.2 The Collision Cross Section 560
- 14.3 Generalizations of the Cross Section 563
- 14.4 The Differential Scattering Cross Section 568
- 14.5 Calculating the Differential Cross Section 572
- 14.6 Rutherford Scattering 574
- 14.7 Cross Sections in Various Frames* 579
- 14.8 Relation of the CM and Lab Scattering Angles* 582
- Principal Definitions and Equations of Chapter 14 586
- Problems for Chapter 14 587

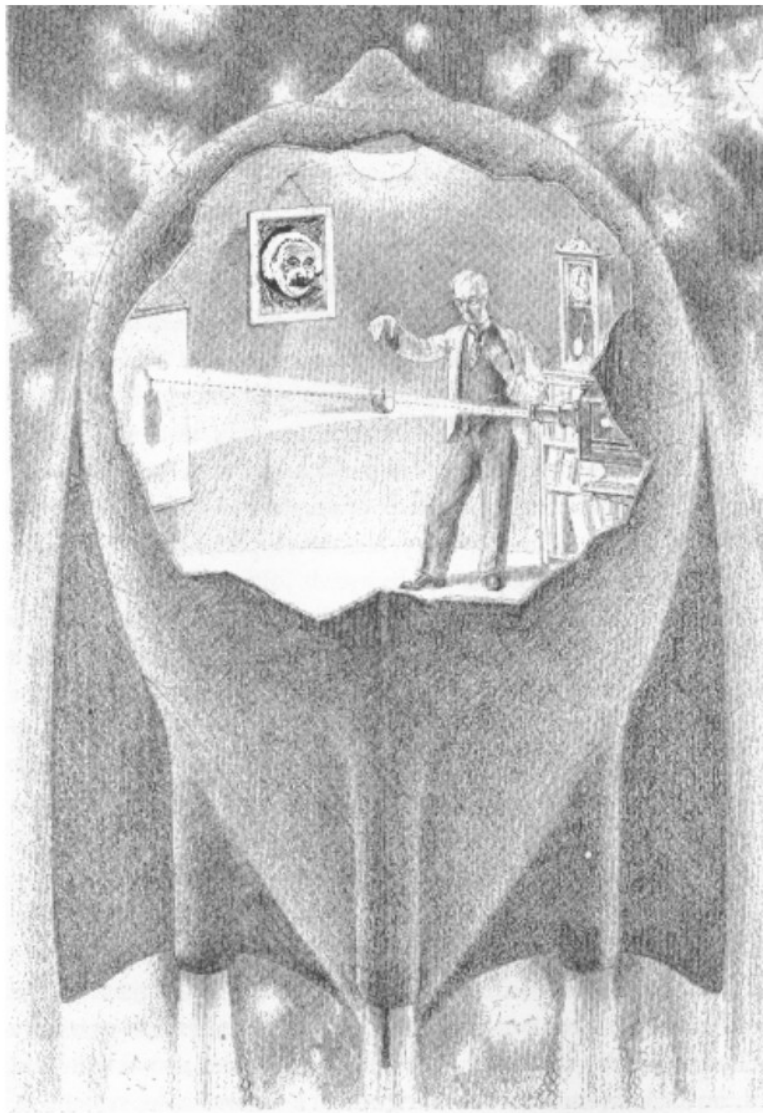
CHAPTER 15 Special Relativity 595

- 15.1 Relativity 596
- 15.2 Galilean Relativity 596
- 15.3 The Postulates of Special Relativity 601
- 15.4 The Relativity of Time; Time Dilation 603
- 15.5 Length Contraction 608
- 15.6 The Lorentz Transformation 610
- 15.7 The Relativistic Velocity-Addition Formula 615

- 15.8 Four-Dimensional Space-Time; Four-Vectors 617
- 15.9 The Invariant Scalar Product 623
- 15.10 The Light Cone 625
- 15.11 The Quotient Rule and Doppler Effect 630
- 15.12 Mass, Four-Velocity, and Four-Momentum 633
- 15.13 Energy, the Fourth Component of Momentum 638
- 15.14 Collisions 644
- 15.15 Force in Relativity 649
- 15.16 Massless Particles; the Photon 652
- 15.17 Tensors* 656
- 15.18 Electrodynamics and Relativity 660
- Principal Definitions and Equations of Chapter 15 664
- Problems for Chapter 15 666



The city blocks became still shorter



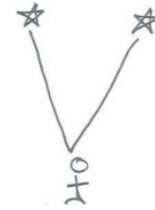
The floor... will finally overtake the apple and hit it

Test of Bending Light.

Observe 2 stars:

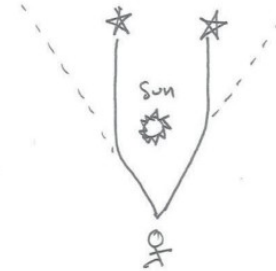
No Sun:

$$\theta = 20^\circ$$

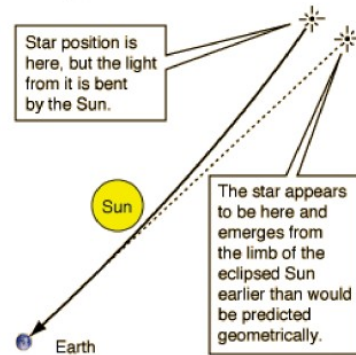


With Sun

$$\theta = 30^\circ$$



Bending of light
makes stars
appear further
apart.



Einstein's Equation

LS

$$G = 8\pi T - \Lambda$$

$\nearrow$

Einstein Tensor
(Curvature of
space)

$\uparrow$

Stress-Energy
Tensor
(mass)

$\nwarrow$

Cosmological
Constant

