Standard Model of

FUNDAMENTAL PARTICLES AND INTERACTIONS

The Standard Model is a quantum theory that summarizes our current knowledge of the physics of fundamental particles and fundamental interactions (interactions are manifested by forces and by decay rates of unstable particles).

FERMIONS

matter constituents
spin = 1/2, 3/2, 5/2, ...

Leptons spin

Flavor	Mass GeV/c^2	Electric charge
ν_L lightest neutrino*	(0–0.13)×10	0
e electron	0.000511	−1
ν_M middle neutrino*	(0.009–0.13)×10^{-9}	0
μ muon	0.106	
ν_H heaviest neutrino*	(0.04–0.14)×	
τ tau	1.777	−1

Quarks spin =1/2

Flavor	Approx. Mass GeV/c^2	Electric charge
u up	0.002	
d down	0.005	−1/3
c charm	1.3	2/3
s strange	0.1	−1/
t top	173	2/
b bottom	4.2	−1/

*See the neutrino paragraph below.

Spin is the intrinsic angular momentum of particles. Spin is given in units of ħ, which is the quantum unit of angular momentum where ħ = h/2π = 6.58×10^{-25} GeV s =1.05×10^{-34} J s.

Electric charges are given in units of the proton's charge. In SI units the electric charge of the proton is 1.60×10^{-19} coulombs.

The energy unit of particle physics is the electronvolt (eV), the energy gained by one electron in crossing a potential difference of one volt. **Masses** are given in GeV/c^2 (remember E = mc^2) where 1 GeV = 10^9 eV =1.60×10^{-10} joule. The mass of the proton is 0.938 GeV/c^2 = 1.67×10^{-27} kg.

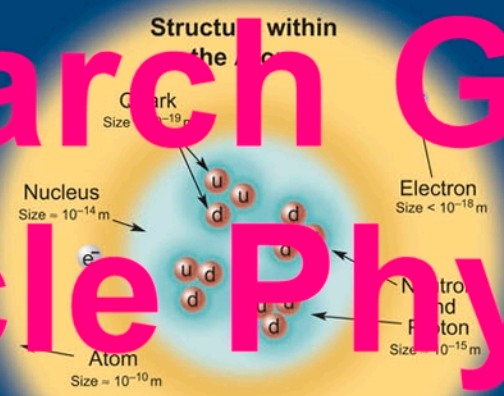
Neutrinos

Neutrinos are produced in the sun, supernovae, reactors, accelerator collisions, and many other processes. Any produced neutrino can be described as one of three neutrino flavor states ν_e, ν_μ, or ν_τ, labelled by the type of charged lepton associated with its production. Each is a defined quantum mixture of the three definite mass neutrinos ν_L, ν_M, and ν_H for which currently allowed mass ranges are shown in the table. Fu exploration of the properties of neutrinos may yield powerful clu puzzle about matter and antimatter and the evolution of stars and gala tructures.

Matter and Antimatter

For every particle type there is a corresponding antiparticle type noted by a bar over the particle symbol (unless + or – charge is shown). cle and antiparticle have identical mass and spin but opposite charges. electrically neutral bosons (e.g., Z^0, γ, and $\eta_c = c\bar{c}$ but not $K^0 = d\bar{s}$) are their own antiparticles.

Structu within the A



If the proton and neutrons in this picture were s, then the quarks and electrons ould be than 0.1 mm in size and the ntire ato ould about 1 m across.

Pr ties of t nteractions

The strengths of the interactions (forces) are shown relative to the strength of the tromagnetic force for two u quarks separated by the specified distances.

Property	Gravitational Interaction	Weak Interaction (Electroweak)	Electromagnetic Interaction	Strong Interaction
Acts on:	Mass – Energy	Flavor	Electric Charg	Color Charge
s experi ng:	All	s, Le	El Ch	Gluo
ticles mediat	Gravitor (no obser	W^+ W^- 0		G s
ength		0.8 fm		
	3×10^{-17} m			
	10^{-41}	10^{-4}	1	60

BOSONS

force carriers
spin = 0, 1, 2, ...

Unifie lectrowea spin = 1

ame	Mass eV/	Electri ch ge
γ photon	0	
W^-	80.39	−1
W^+ W bosons	80.39	+1
Z^0 Z boson	91	

Strong (color) spin =1

Name	Mass GeV/c^2	Electric charge
g gluon	0	0

Color Charge

Only quarks and gluons carry "strong charge" (also called "color charge") and can have strong interactions. Each quark carries three types of color charge. These charges have nothing to do with the colors of visible light. Just as electrically-charged particles interact by exchanging photons, in strong interactions, color-charged particles ract by exchanging gluons.

ks C ined ons yons

Quarks and gluons cannot be isolated – they are confined in color-neutral particles called **hadrons**. This confinement (binding) results from multiple exchanges of gluons among the color-charged constituents. As color-charged particles (quarks and gluons) move apart, the energy in the color-force field between them increases. This energy eventually is converted into additional quark-antiquark pairs. The quarks and antiquarks then combine into hadrons; these are the particles seen to emerge.

Two types of hadrons have been observed in nature **mesons** $q\bar{q}$ and **baryons** qqq. Among the many types of baryons observed are the proton (uud), antiproton ($\bar{u}\bar{u}\bar{d}$), neutron (udd), lambda Λ (uds), and omega Ω^- (sss). Quark charges add in such a way as to make the proton have charge 1 and the neutron charge 0. Among the many types of mesons are the pion π^+ ($u\bar{d}$), kaon K^- ($s\bar{u}$), B^0 ($d\bar{b}$), and η_c ($c\bar{c}$). Their charges are +1, −1, 0, 0 respectively.

Visit the award-winning web feature *The Particle Adventure* at

ParticleAdventure.org

This chart has been made possible by the generous support of:

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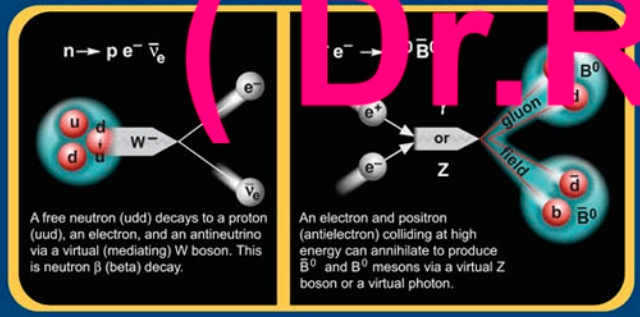
Particle Processes

These diagrams are an artist's ception. Blu areas represent the clou



A free neutron (udd) decays to a proton (uud), an electron, and an antineutrino via a virtual (mediating) W boson. This is neutron β (beta) decay.

An electron and positron (antielectron) colliding at high energy can annihilate to produce $B\bar{B}^0$ and B^0 mesons via a virtual Z boson or a virtual photon.

Unsolved Mysteries

Driven by new puzzles in our understanding of the physical world, particle physicists are following paths to new wonders and startling discover Experiments may ev d extra ensions of space, mini ck hol and/or evidence of strin heory.

U vers ac rating?

The expansion of the universe appears to be accelerating. Is this due to Einstein's Cosmological Constant? If not, will experiments reveal a new force of nature or even extra (hidden) dimensions of space?

y No Antim t?

Matter and antimatter were created in the Big Bang. Why do we now see only matter except for the tiny amounts of antimatter that we make in the lab and observe in cosmic rays?

k Ma ?

Invisible forms of matter make up much of the mass observed in galaxies and clusters of galaxies. Does this dark matter consist of new types of particles that interact very weakly with ordinary matter?

Origin of Mass?

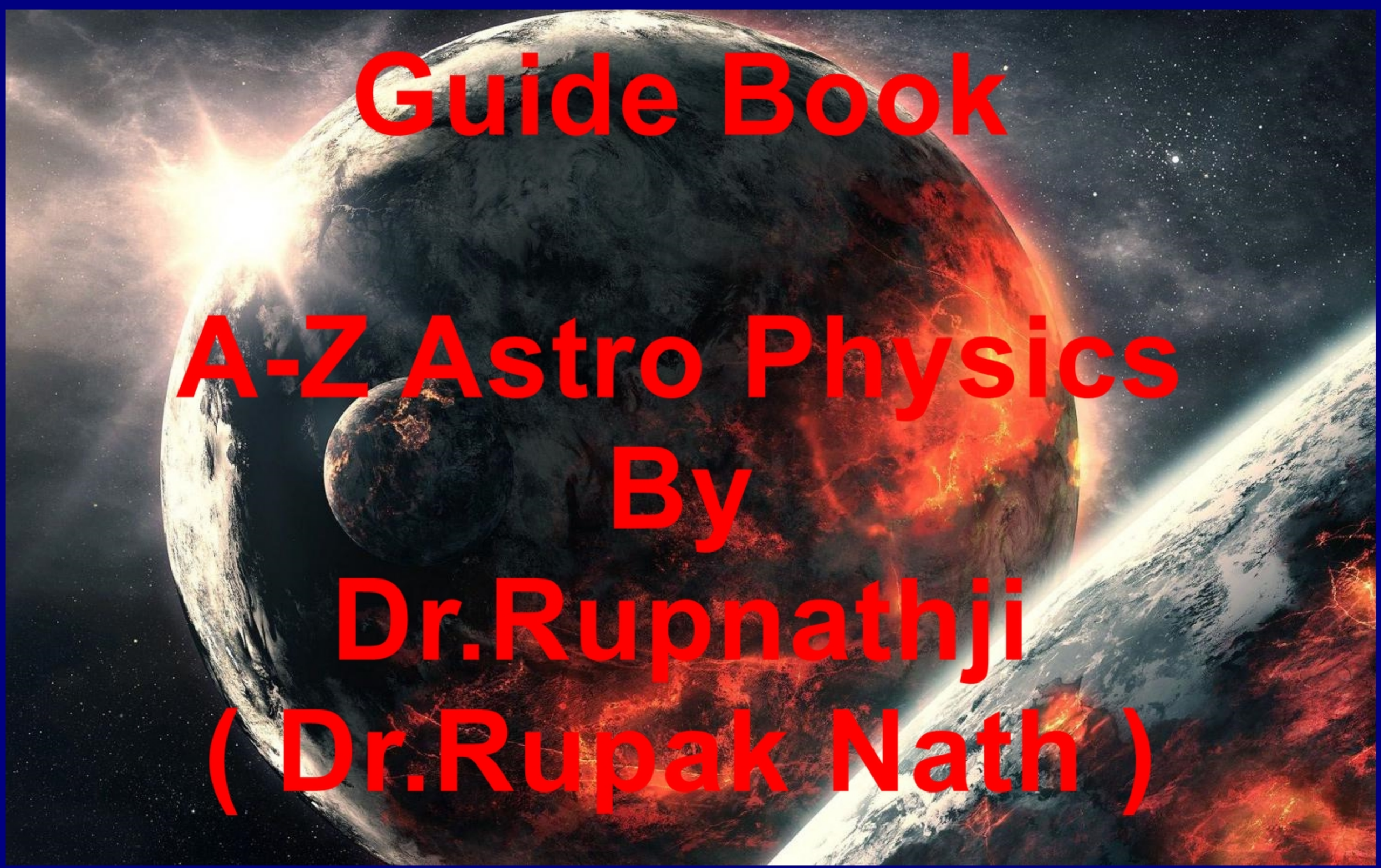
In the Standard Model, for fundamental particles to have masses, there must exist a particle called the Higgs boson. Will it be discovered soon? Is supersymmetry theory correct in predicting more than one type of Higgs?

Research Book Of God Particle Physics

By

Dr.Rupnathji

(Dr.Rupak Nath)



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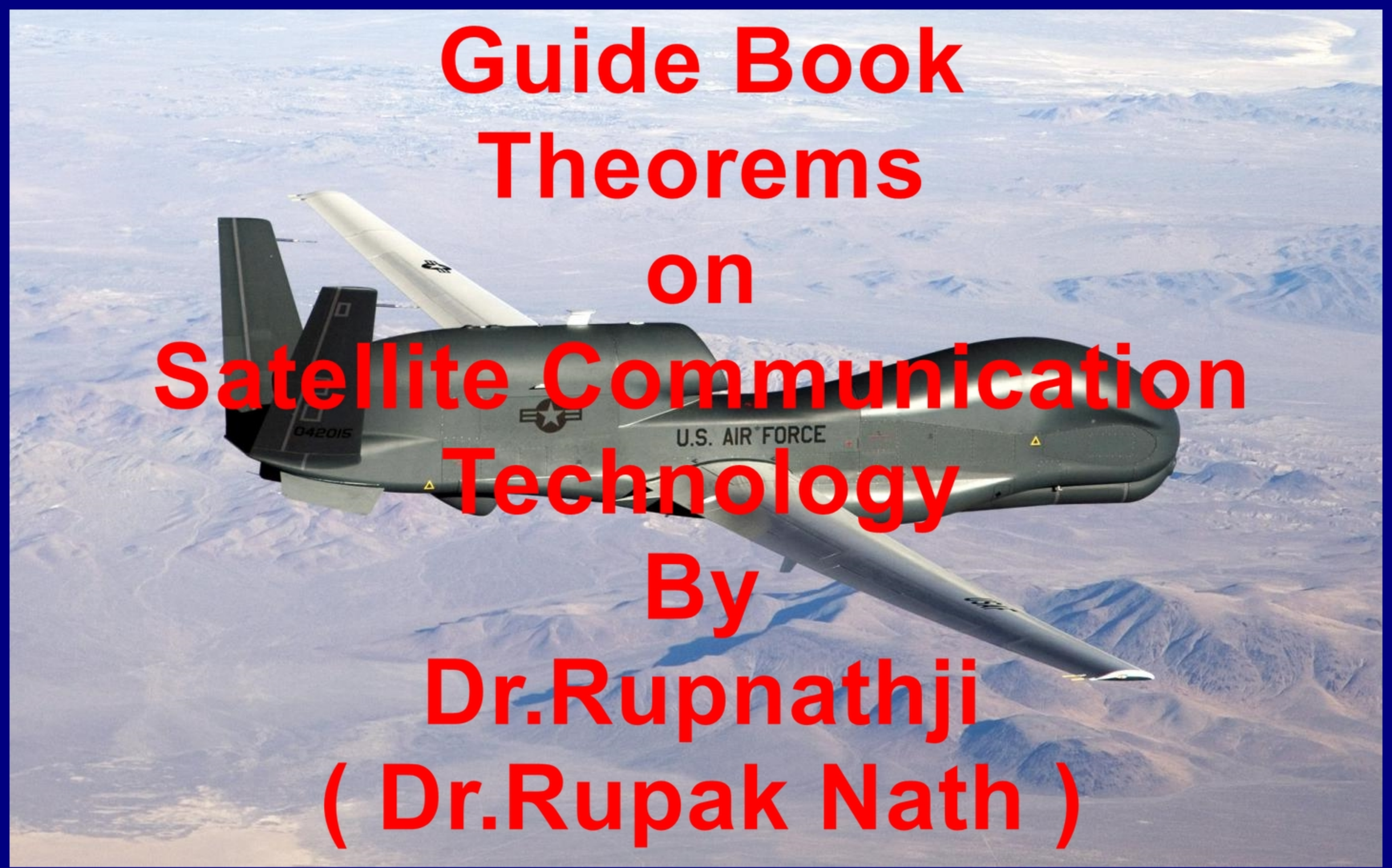

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$$T = 2\pi\sqrt{\frac{a^3}{\mu}}$$

$$\mu = G \times M(\text{sun})$$

$$T = 2\pi\sqrt{\frac{149{,}597{,}887.5^3\ \text{km}}{132{,}712{,}440{,}018\ \text{km}^3\,\text{s}^{-2}}}$$

$$T = 2\pi(5022643.737)\,\text{s}$$

$$T = 31558201.33 \text{ seconds}$$

$$31558201.33\text{s} \times \frac{1 \text{ minute}}{60 \text{ seconds}} = 525{,}970 \text{ minutes}$$

$$525{,}970 \times \frac{1 \text{ hour}}{60 \text{ minutes}} \times \frac{1 \text{ day}}{24 \text{ hours}} \approx 365.25$$

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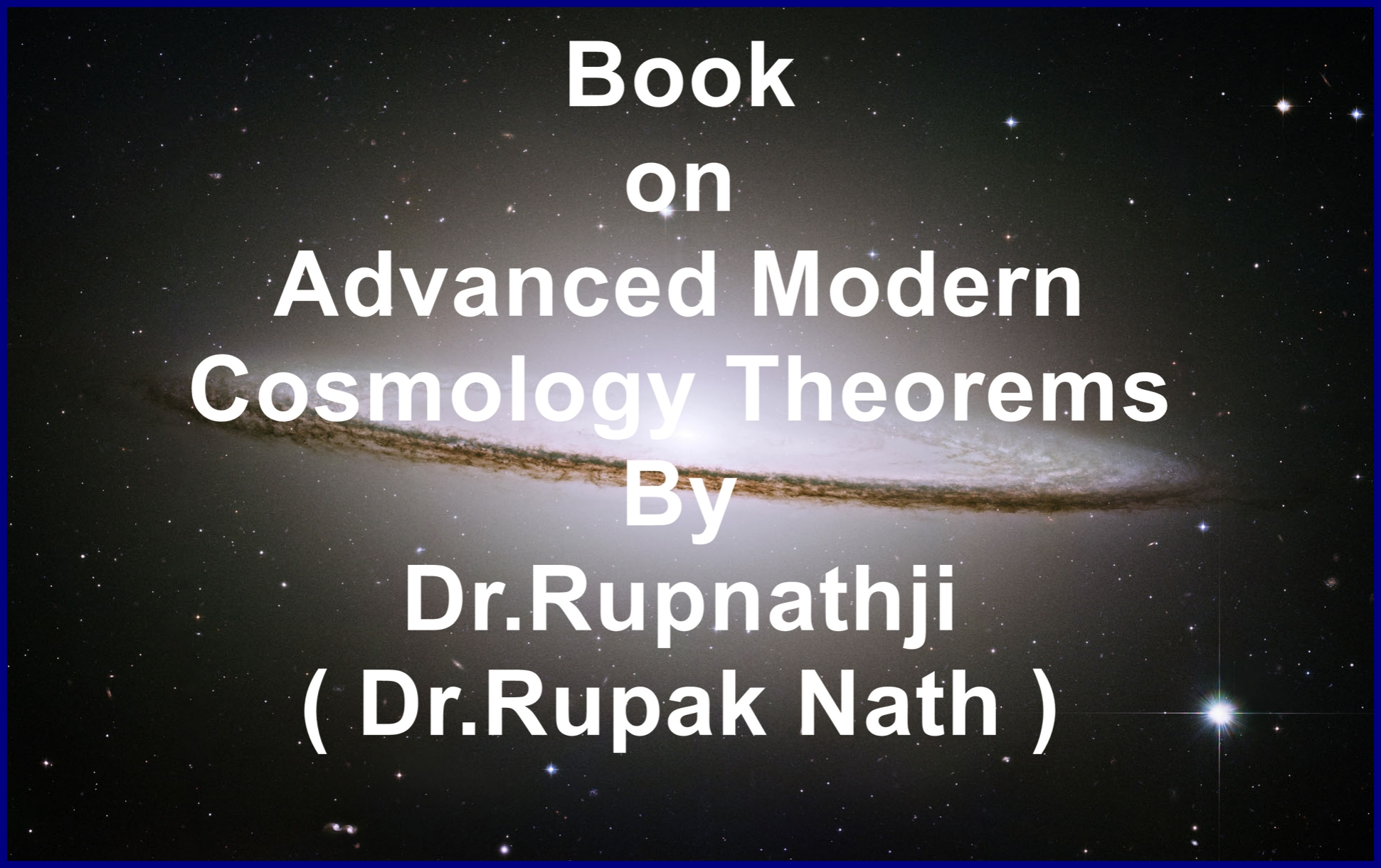
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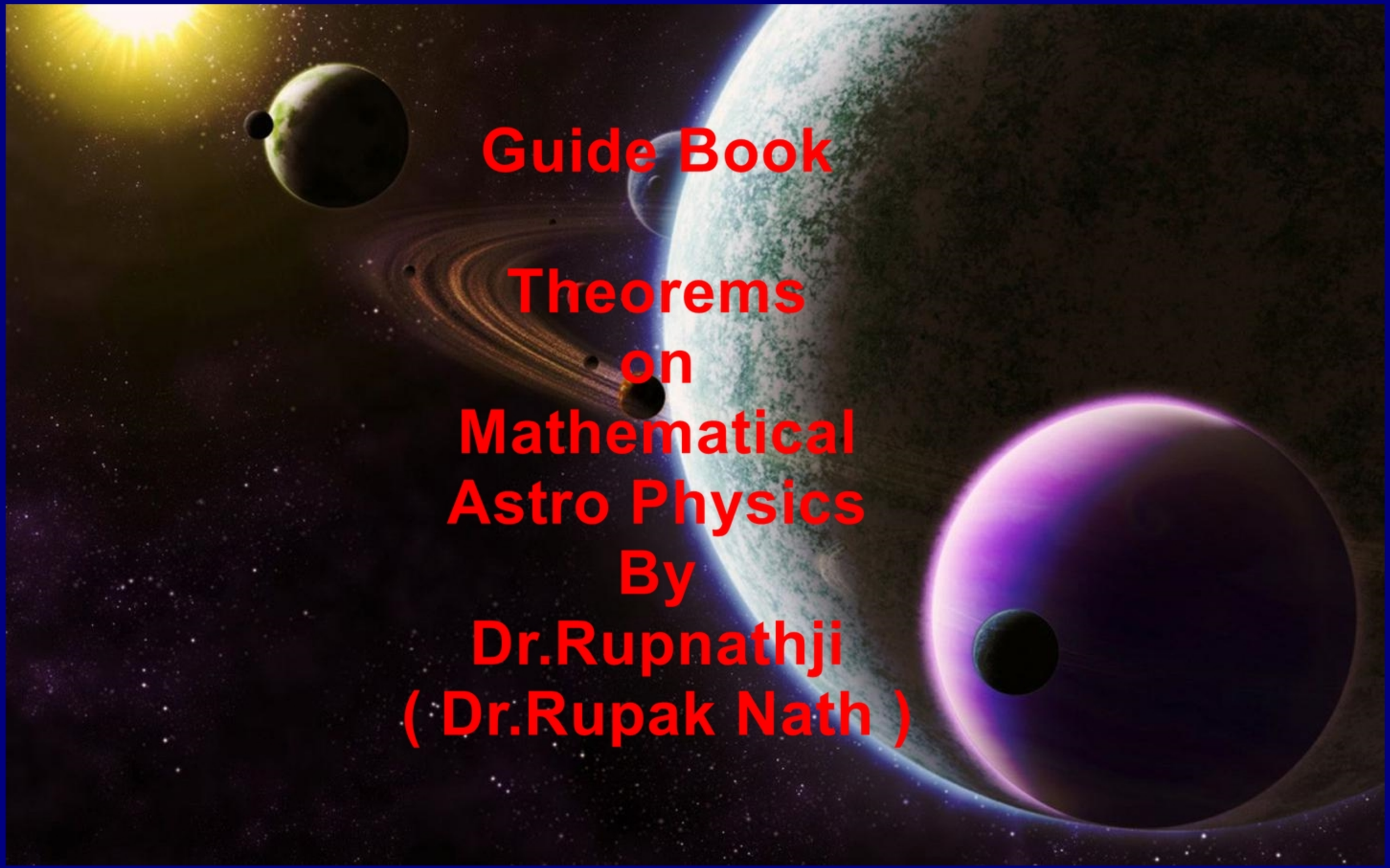
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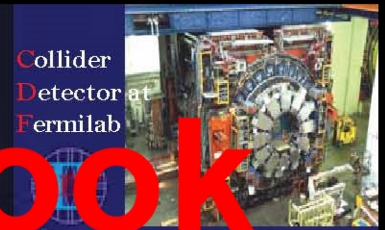
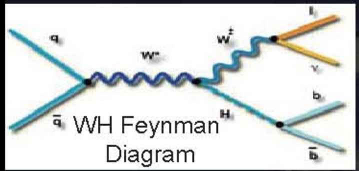
Tevatr... Accelerating protons ...d a...protons to appr...mate... 2 T...

Where is the Higgs Hiding?

By: D... Sch...fer with Dr. Brian ... Dr. Richard Hughes, B...ndan P... and ...n Slaunwhite
Ohio State Department of Physics

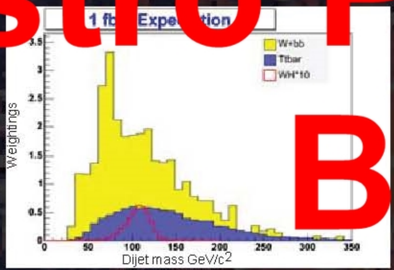


Where is WH?


WH Feynman Diagram

Standard Model

- Higgs is the only undiscovered particle in the Standard Model
- One Mechanism for Higgs Production at the Tevatron



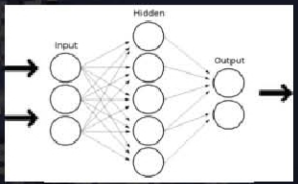
Problems

- Large Background
- Small Cross-section

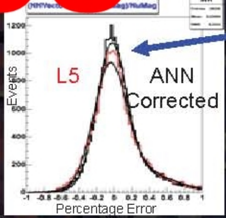
Tools and Results

Artificial Neural Network

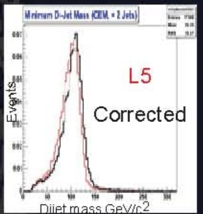
- Advanced analysis technique
- Based on the human brain's ability to recognize patterns
- Varies weights in a series of tests called training to improve the E_t



Improving the MET measurement to correct the jet measurement



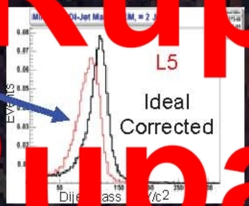
More peaked at zero



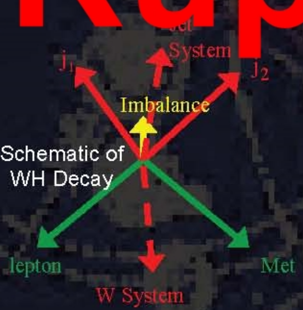
How to make Improvements?

$$\text{Resolution} = \frac{\sigma}{\mu}$$

Want to sharpen this peak by improving the measurement of the neutrino



- Every one percent improvement in resolution leads to a 10% increase in sensitivity
- This analysis aims for an improvement of at least a 2-3%.
- This analysis may requires improvement in the measurement of the missing energy from the neutrino



Future?

- Use track met variables to try to eliminate some fake MET from events
- Develop cuts to eliminate events with poorly measured MET
- Examine these cuts on previously eliminated signal regions

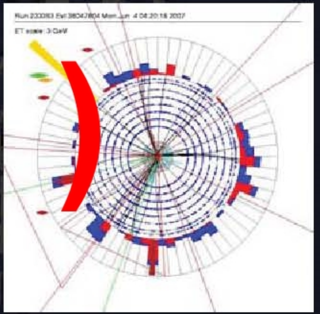

Track and cone definition for jets

Photo credit: http://www.fnal.gov/

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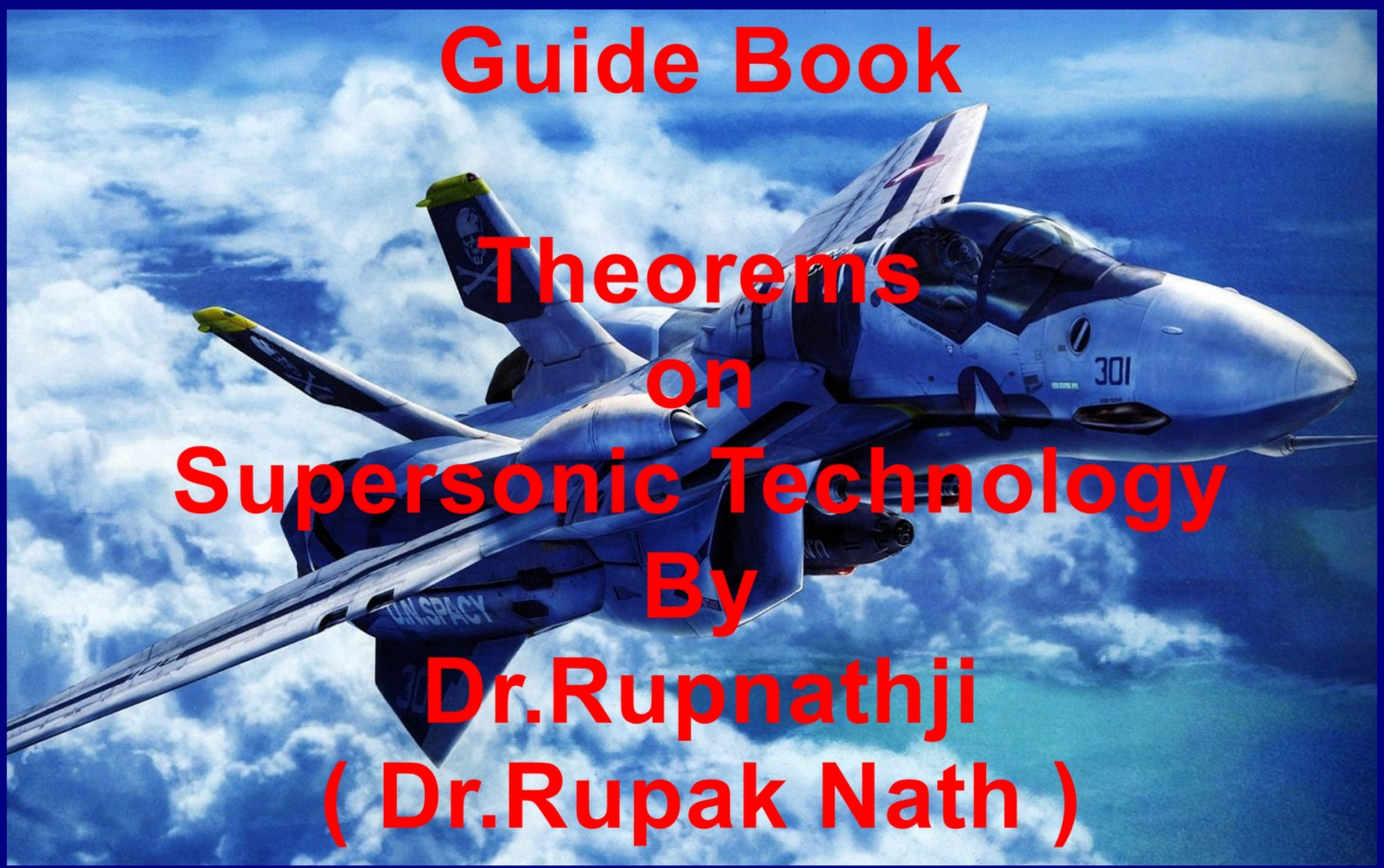

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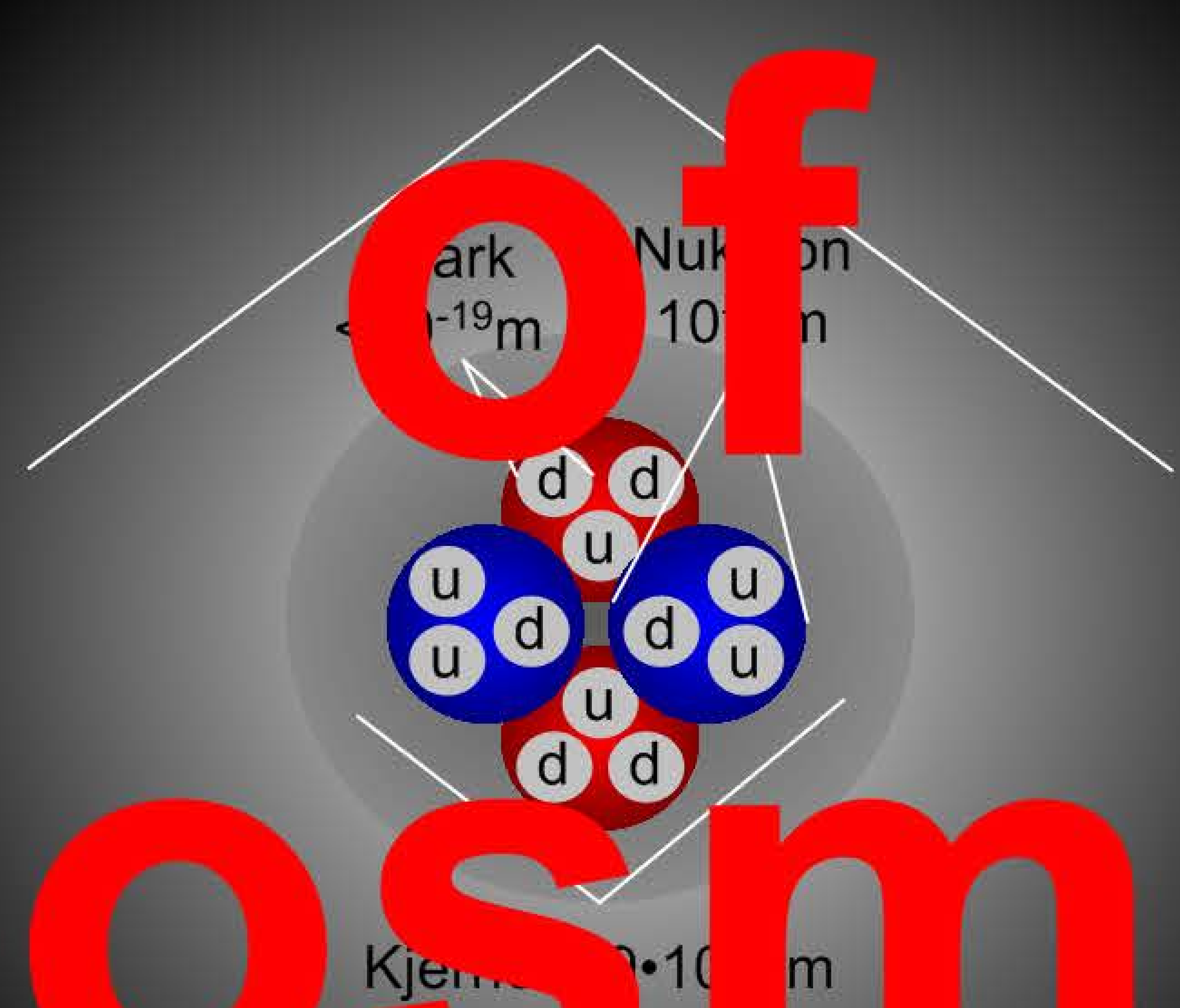
STANDARDMODELLEN
ELEMENTÆRPARTIKLER OG VEKSELVIRKNINGER

Standardmodellen er summen av vå[…]unnsk[…]inne[…]artikk[…]k. Det[…]en kvantefe[…]inklu[…]er ku[…]skar[…]om […]tro[…]g[…]isme og svak kjernekraft beskrevet I kvanteelektrosvak teori og fargekra[…]beskr[…]vantek[…]odynar[…]k (QCD) . G[…]vitasjon[…]vis[…]om en[…]lig[…]kselvi[…]ing[…]mfattes I dag av standardmodellen.

Baryoner (utvalg av ca 120 typer) spinn = ½, 3/…

Partikkel	Kvark Innhold	S	C	B	Spinn	Masse MeV/c^2	El. Ladn	Henfall tid (s)	Henfall til
p Proton	uud	0	0	0	½	938,3	+1	>3•10^{44}	Not
$\bar{p}$ antiproton	$\bar{u}\bar{u}\bar{d}$	0	0	0	½	938,3	-1	?	observed
n Nøytron	udd	0	0	0	½	939,6	0	885,7	p,e^-,ν_e
Δ^{++} Delta	uuu	0	0	0	3/2	1232	+2	6•10^{-24}	π^+,p
Δ^+ Delta	uud	0	0	0	3/2	1232	+1	6•10^{-24}	π^+,n / π^0,p
Δ^0 Delta	udd	0	0	0	3/2	1232	0	6•10^{-24}	π^0,n / π^{-1},p
Δ^- Delta	ddd	0	0	0	3/2	1232	-1	6•10^{-24}	π^{-1},n
Λ Lambda	uds	-1	0	0	½	1115,7	0	2,6•10^{-10}	π^{-1},p / π^0,n
Ξ^0_b Bott. Xi	dsb	-1	0	1	1/2	5792	-1	1,4•10^{-12}	Ξ^{-1},J/Ψ
Ω Omega	sss	-3	0	0	3/2	1672	-1	8,2•10^{-11}	Λ^0,K^- /Ξ^0,p



[…]esoner (utvalg av ca 140 typer) spinn = 0,1

Partikkel	Kvark Innhold	S	C	B	Spinn	Masse MeV/c^2	El. Ladn	Henfall tid (s)	Henfall til
π^+ Pion	$u\bar{d}$	0	0	0	0	139,6	+1	2,6•10^{-8}	μ^+,ν_μ
π^- Pion(π^-)	$\bar{u}d$	0	0	0	0	139,6	-1	2,6•10^{-8}	μ^-,$\bar{\nu}_\mu$
π^0 Pion	$(u\bar{u}-d\bar{d})/\sqrt{2}$	0	0	0	0	135,0	0	8,4•10^{-15}	2γ
K^+ Kaon	$u\bar{s}$	1	0	0	0	493,7	+1	1,24•10^{-8}	μ^+,ν_μ/π^+,π^0
K^0 Kaon	$d\bar{s}$	1	0	0	0	497,7	0	(svak)	–
ρ^+ Rho	$u\bar{d}$	0	0	0	1	776	+1	4,0•10^{-24}	
φ Phi	$s\bar{s}$	0	0	0	1	1020	0	1,6•10^{-22}	
B^0 B-null	$d\bar{b}$	0	0	1	0	5279	0	1,5•10^{-12}	
η_c eta-c	$c\bar{c}$	0	0	0	0	2980	0		
Υ Upsilon	$b\bar{b}$	0	0	0	1	9460	0	2,6•10^{-8}	e^+,e^-/μ^+,μ^-

Energien oppgis i elektronvolt (eV) som er energien for å flytte en elementær ladning (e) gjennom et potensiale på 1 V 1 eV = 1,60•10[…] Total bevart energi er sum av ma[…], kinetisk energi, fotonenergi osv.

Elektrisk Ladning er multipler[…] elementærladningen e = 1,60[…]^{19} C

Masse oppgis i atommasseenheter u eller i eV delt på[…]ens kvadrat (etter E= mc^2) 1 MeV/c[…],782•10^{-30}kg 1 u=1,66•10^{-27} kg = 9[…] MeV/c^2 og

[…]pinn […]dre […]lært moment so[…]ngs z aksen) […]gis i multipler av […]sert planck[…] ħ = h/2π = 6,[…]10^{-22} MeV[…] J s

[…]viser et […]tom me[…]toner […]d) og […] nøy[…]ner (u[…]. Elementærpartiklener har en radius på høyst 10^{-18}m og regnes som punktformede. Skyggeleggingen illustrerer at partiklenes posisjon er sannsynlighetsfordelt, de to elektronene I 1s orbitalet befinner seg her innen et kuleformet område. Figurens målestokk er komprimert: I virkeligheten kan kjernen sammenlignes m[…]m) I midten av et fotballstation (200m)

Baryoner og mesoner so[…]står a[…]amm[…]ombi[…]jon av kvarker men der kvantetall (f.eks spinn og […]kjellig[…]ttet[…]opphav til partikler med forskjellige egenskaper, s[…]eks. Bo[…]er p o[…]$^+$[…]er Mesoner π^+og ρ^+

For hver partikkel eksisterer en antipartikkel . D[…]markeres enten med strek over tegnet eller ved spesifisert ladning ($\bar{e}$ =[…]= p^-). Antipartikkelen har eksakt samme masse og spinn, elektrisk ladning har mosatt fortegn. Baryon, Særhet (S), Sjarm (C) og Bunn(B) kvantetalletene endrer også fortegn. Ytterligere effekter opptrer i supersymmetri, og strengtreori

Fargekraft formidles av gluoner: Kvarker bærer tre typer fargeladning som gir […]pphav til 8 ulike typer fargeladning. Gluonene danner "fluksrør" der kraften avtar […]der 10^{-18} m og over er konstant 104 N på lang avstand. Det fører til at kvarkene […]innel[…]farge-n[…]ppe[…]å tre ([…]yoner) og to (Mesoner). Forsøk […]å s[…]arere[…]rke[…]gir ra[…]ene[…](E=[…]) som danner kvarkepar som […]rbin[…]seg n[…]de[…]prinne[…]e til […]en[…]rale grupper.

[…]en fa[…]grup[…]il d[…]optre e[…]lanse i fargekraften som som […]sulterer[…]rk kjernekraft m[…]m hadr[…]r. Denne formidles av mesoner.

Leptoner spinn = ½

Smak	Masse MeV/c^2	Elektrisk Ladning
ν_e Elektron Nøytrino	< 1•10^{-5}	0
e Elektron	0,511	-1
ν_μ Muon Nøytrino	< 0,2	0
μ Muon	106	-1
ν_τ Tau Nøytrino	< 20	0
τ Tau	1777,1	-1

Kvarker spinn = ½

Smak	Masse MeV/c^2	Elektrisk Ladning
u Opp	3	+2/3
d Ned	6	-1/3
c Sjarm	1300	+2/3
s Sær	100	-1/3
t Topp	175000	+2/3
b Bunn	4300	-1/3

Vekselvirkningsbosoner spinn = 1 (2)

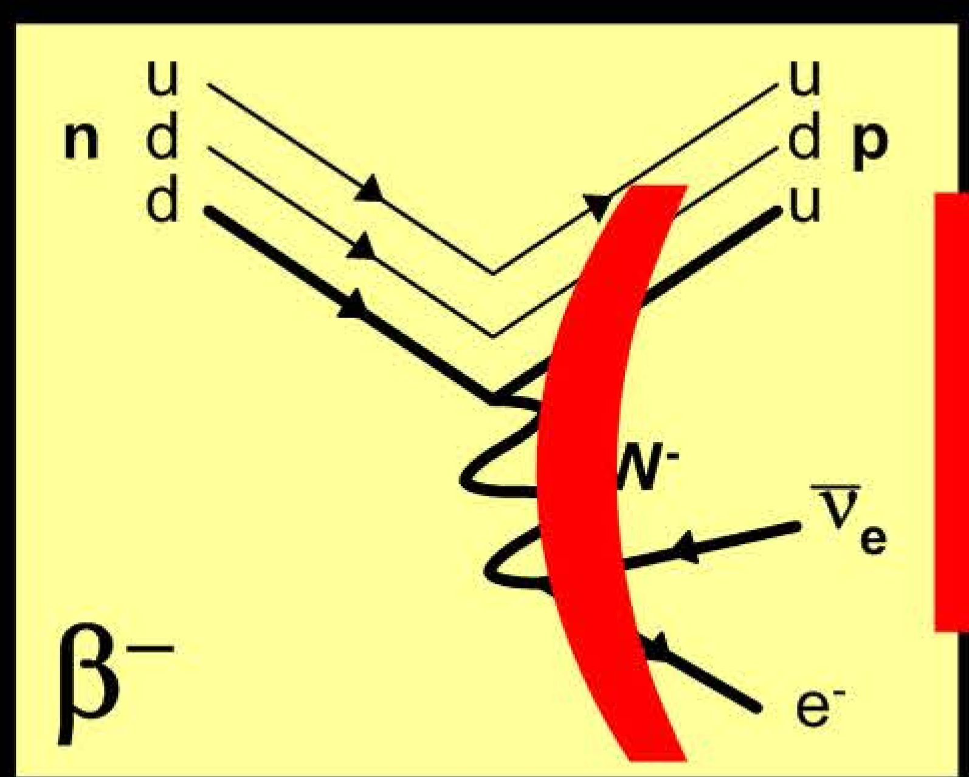
Vekselvirkning	Navn	Masse MeV/c^2	Elektrisk Ladning	Relativ styrke mellom 10^{-18}m	u kvarker	protoner
Elektromagnetisme	γ Foton	0	0	1	1	1
Elektrosvak / Svak kjernekraft	W^- Massive / W^+ Gauge / Z^0 Bosoner	80398 / 80398 / 91188	-1 / +1 / 0	0,8	10^{-4}	10^{-7}
Fargekraft	g Gluon	0	0	25	60	Ikke hadroner
Sterk kjernekraft	Meson	140-9400	+/-1, 0	Ikke kvarker	Ikke kvarker	20
Masse	h Higgs	> 114400	0	Ikke verifisert, formidler masse til partikler og elektrosvakt symmetribrudd		
Gravitasjon	g Graviton	Hypotetisk, masse 0, ladning 0, spinn 2		10^{-41}	10^{-41}	10^{-36}

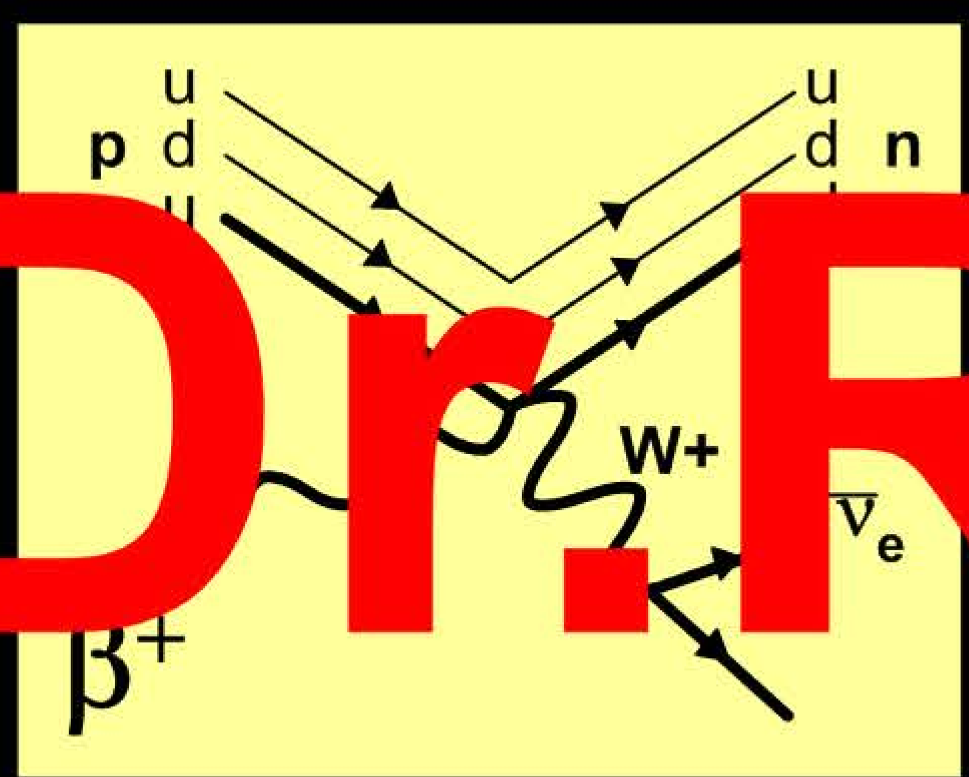
Vekselvirkning beskrives med et Feynman diagra[…]Normalt[…]er ti[…]høyre mot venstre. Pilene viser partikler ▶ og antipartikl[…]◀. Rette[…]er e[…]tikler, og bølgelinjer er vekselvirkningsbosoner. Nedenfor v[…]s β^- her[…]me[…]vak kjernekraft som skjer spontant når et fritt nøytron […]over til[…]roto[…]et elektron og en antielektron nøytrino. β^+ krever energi, f.ek[…]et fo[…]og om[…]mer et proton til et nøytron, et positron (antielektron) og e[…]nøytrino

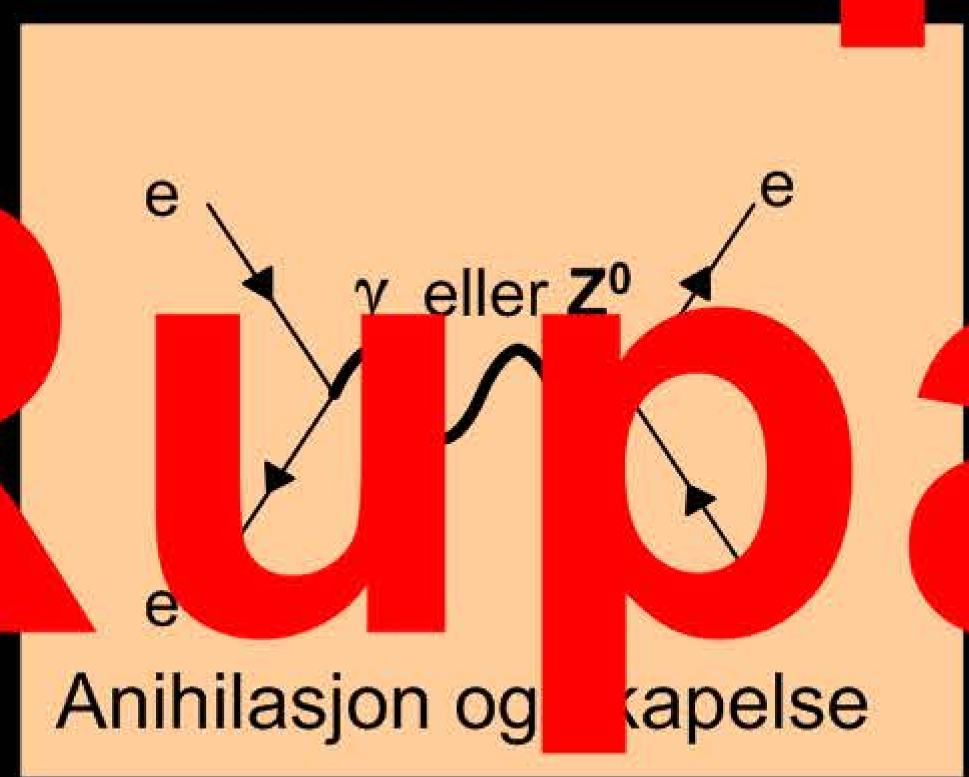
[…]partikk[…]g de[…]antip[…]kkel[…]Hvis e[…]g posi[…]ar n[…] […]gi et[…]on el[…]en Z[…]ergi[…]de[…]så s[…]es […]luon[…]son. Tils[…]ende[…]n[…]t so[…]anne[…]ye partikl[…]er […]oner[…]Z0 me[…]strek[…]g en[…]i[…]nne[…]unn […]Ned[…]ikle[…]g […]ontant[…]pe et[…]rtikk[…]r[…]tipa[…]ler so[…]dan[…]et P[…]g et […]anti B[…]eson

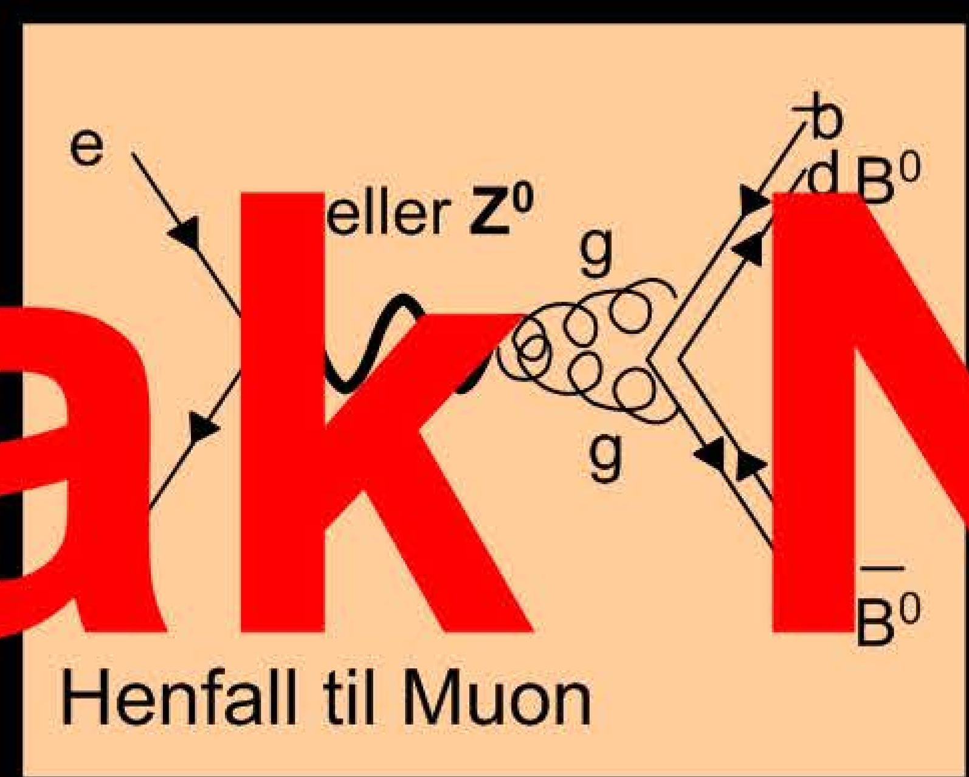
I pa[…]k[…]elera[…]er m[…]høy energi kan[…]ved[…]llisjo[…]pro[…]eres virk[…]e pa[…]er s[…]eller[…]are er virtu[…]e, og[…]n ka[…]bse[…]re deres hen[…]sprod[…]er. H[…]koll[…]er to pro[…]er og[…]aper[…]fåtal[…]bosoner sammen med en re[…]e andre hadroner

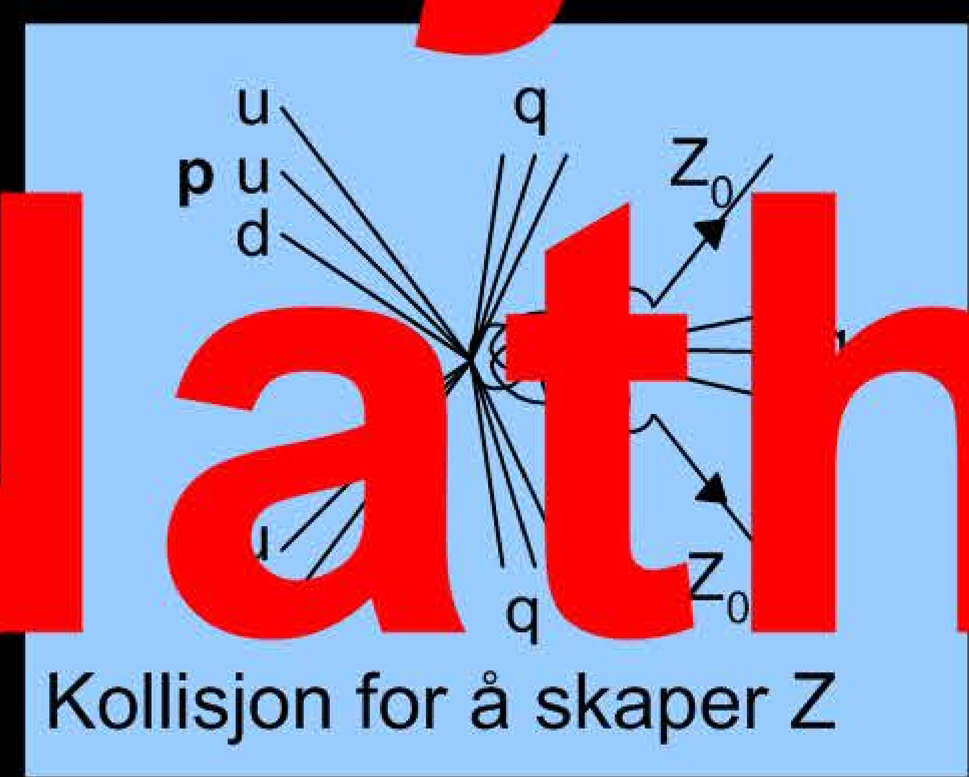
Large Hadron Collider (LHC) som er under bygging ved CERN kolliderer protoner med høy energi og gir forskellige hadroner og gluoner. ATLAS eksperimentet og vil kunne se henfall av Higgs bosonet som en unik kombinasjon av partikler.

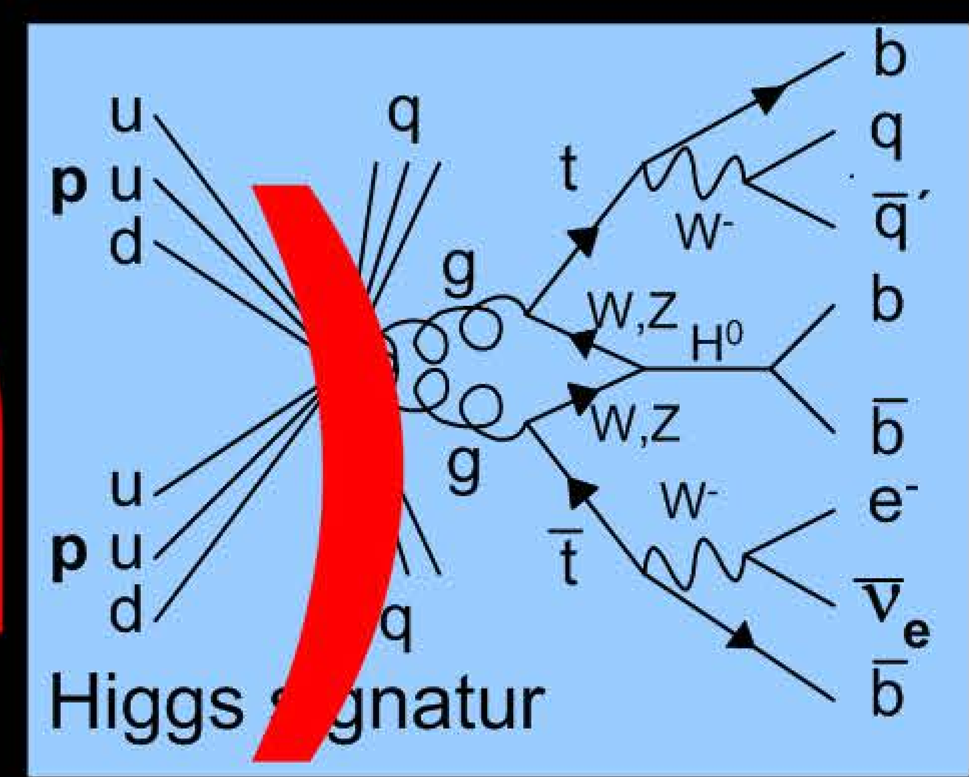












Inspirert av http://ParticleAdventure. org

Finnes på http://no.wikipedia.org/wiki/Standardmodellen

Text Book

Modern Geostationary Satellites

By
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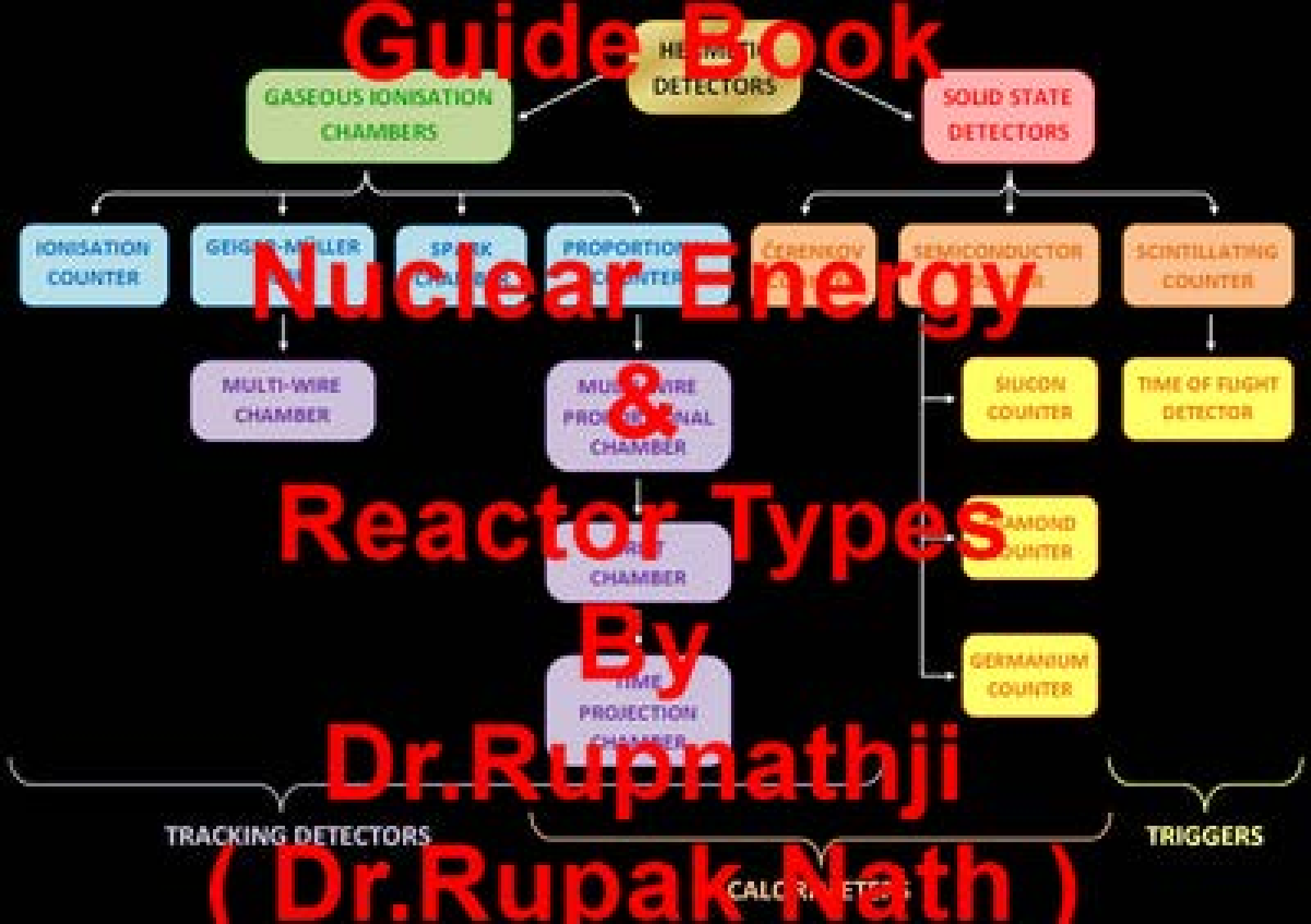
(Dr.Rupak Nath)


Guide Book
GASEOUS IONISATION CHAMBERS
DETECTORS
SOLID STATE DETECTORS
IONISATION COUNTER
SPARK
SCINTILLATING COUNTER
MULTI-WIRE CHAMBER
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TIME OF FLIGHT DETECTOR
Nuclear Energy
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TRACKING DETECTORS
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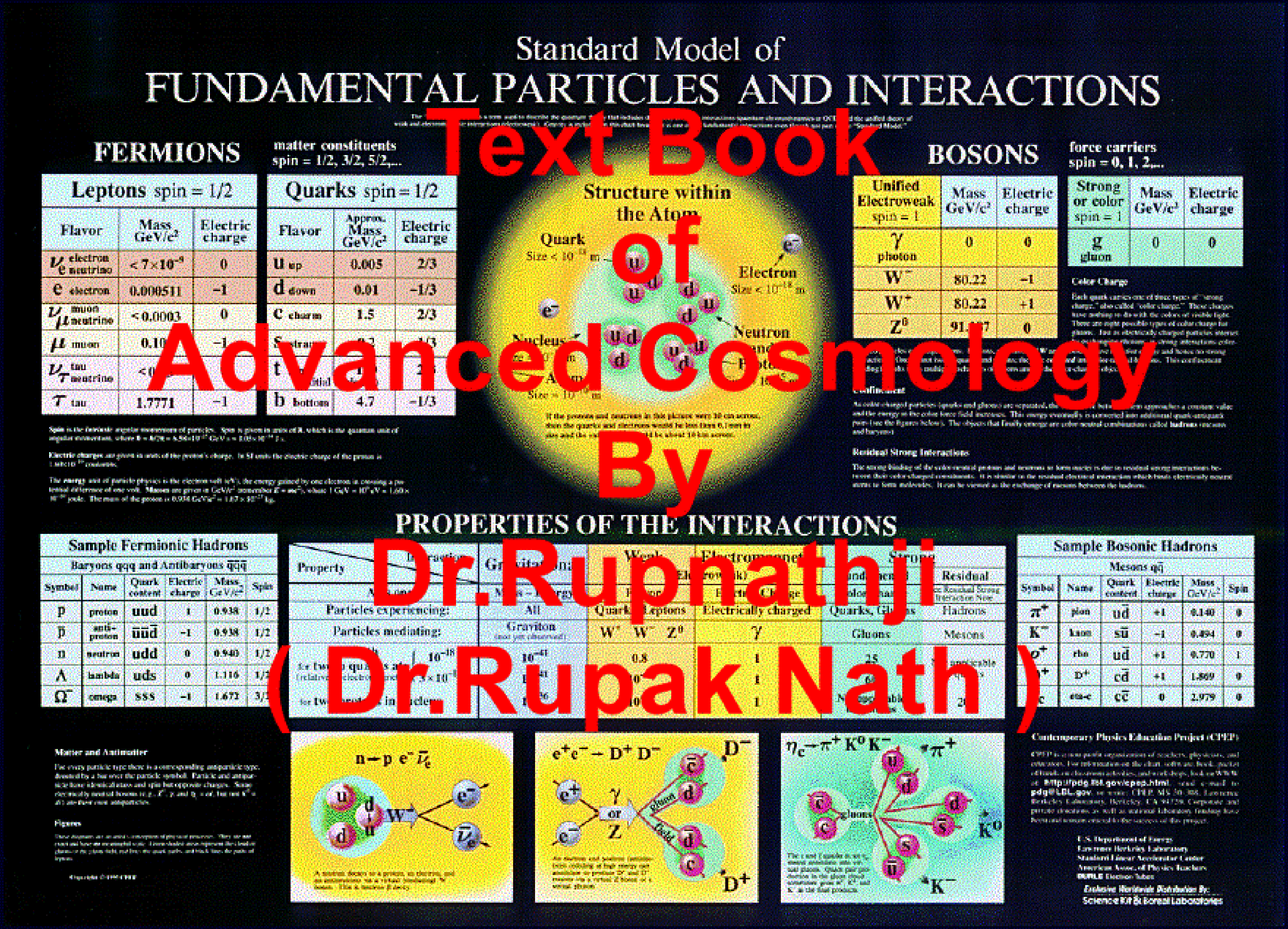
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Standard Model of
FUNDAMENTAL PARTICLES AND INTERACTIONS
FERMIONS
matter constituents spin = 1/2, 3/2, 5/2,...
Leptons spin = 1/2
Quarks spin = 1/2
Structure within the Atom
Quark
Electron
Nucleus
Neutron
BOSONS
force carriers spin = 0, 1, 2,...
Unified Electroweak spin = 1
Strong or color spin = 1
Color Charge
Confinement
Residual Strong Interactions
PROPERTIES OF THE INTERACTIONS
Sample Fermionic Hadrons
Baryons qqq and Antibaryons q̄q̄q̄
Sample Bosonic Hadrons
Mesons qq̄
Matter and Antimatter
Figures
Contemporary Physics Education Project (CPEP)


Explore
Particle Physics
New Concept
of
Particle Physics
By
Dr.Rupnathji
(Dr.Rupak Nath)

[WHY THE HIGGS?]

BREAKING SYMMETRY

A central question of the Standard Model is why the electroweak forces are asymmetrical: electromagnetism is long-ranged, whereas the weak nuclear force is short-ranged. Physicists think these forces are actually symmetrical, but their symmetry is hidden, or "broken."

MAGNETIC SPATIAL SYMMETRY

A simple analogy is an infinite grid of magnetic filings. The symmetry in this case is the equivalence of all directions in space.

The symmetry is evident at high temperatures. Heat jostles the filings every which way.

Symmetry

When the temperature drops, the filings lock one another in place. Although their alignment may seem more orderly, it is less symmetrical, because it singles out one randomly chosen direction over the others.

Broken symmetry

ELECTROWEAK SYMMETRY

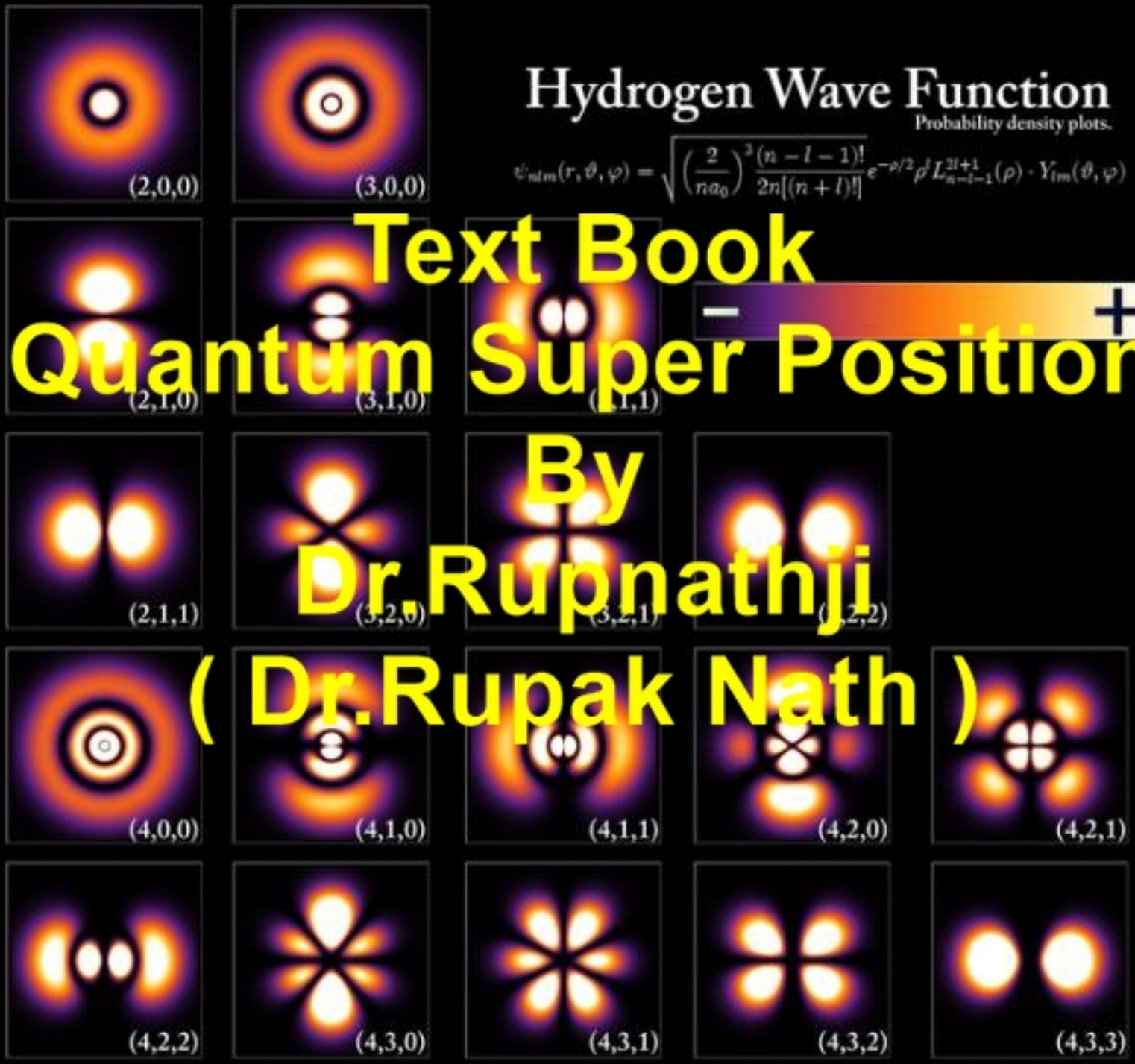
This symmetry is more abstract. It means the freedom to decide which leptons are electrons and which are neutrinos or how to label up and down quarks.

In the symmetrical case, the lepton-naming convention (*represented by an arrow*) is set independently at each point in space. What one person calls an electron, another might call some mixture of electron and neutrino, and it would make no difference to their predictions.

In the broken symmetry, the convention is fixed everywhere. What one person calls an electron, all do. The Higgs field brings about this symmetry breaking.

Electroweak symmetry makes all the electroweak force particles massless.

Broken symmetry gives masses to the *W* and *Z* bosons, thereby restricting their range.


Hydrogen Wave Function
Probability density plots.
$\psi_{n\ell m}(r,\vartheta,\varphi) = \sqrt{\left(\frac{2}{na_0}\right)^3 \frac{(n-l-1)!}{2n[(n+l)!]}} e^{-\rho/2} \rho^l L^{2l+1}_{n-l-1}(\rho) \cdot Y_{lm}(\vartheta,\varphi)$
(2,0,0)
(3,0,0)
(2,1,0)
(3,1,0)
(3,1,1)
(2,1,1)
(3,2,0)
(3,2,1)
(3,2,2)
(4,0,0)
(4,1,0)
(4,1,1)
(4,2,0)
(4,2,1)
(4,2,2)
(4,3,0)
(4,3,1)
(4,3,2)
(4,3,3)
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Quantum Super Position
By
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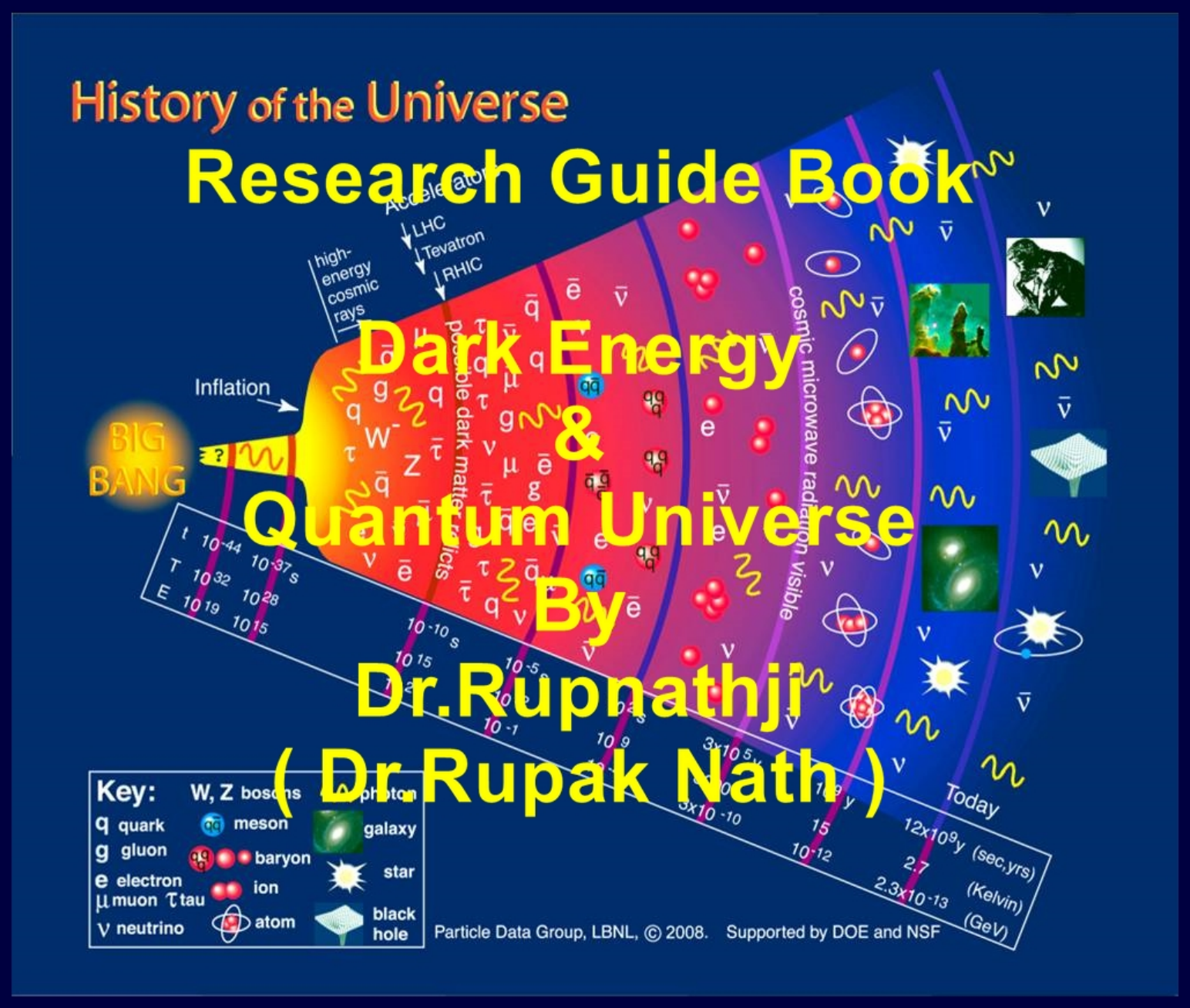
(Dr.Rupak Nath)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Dark Energy
&
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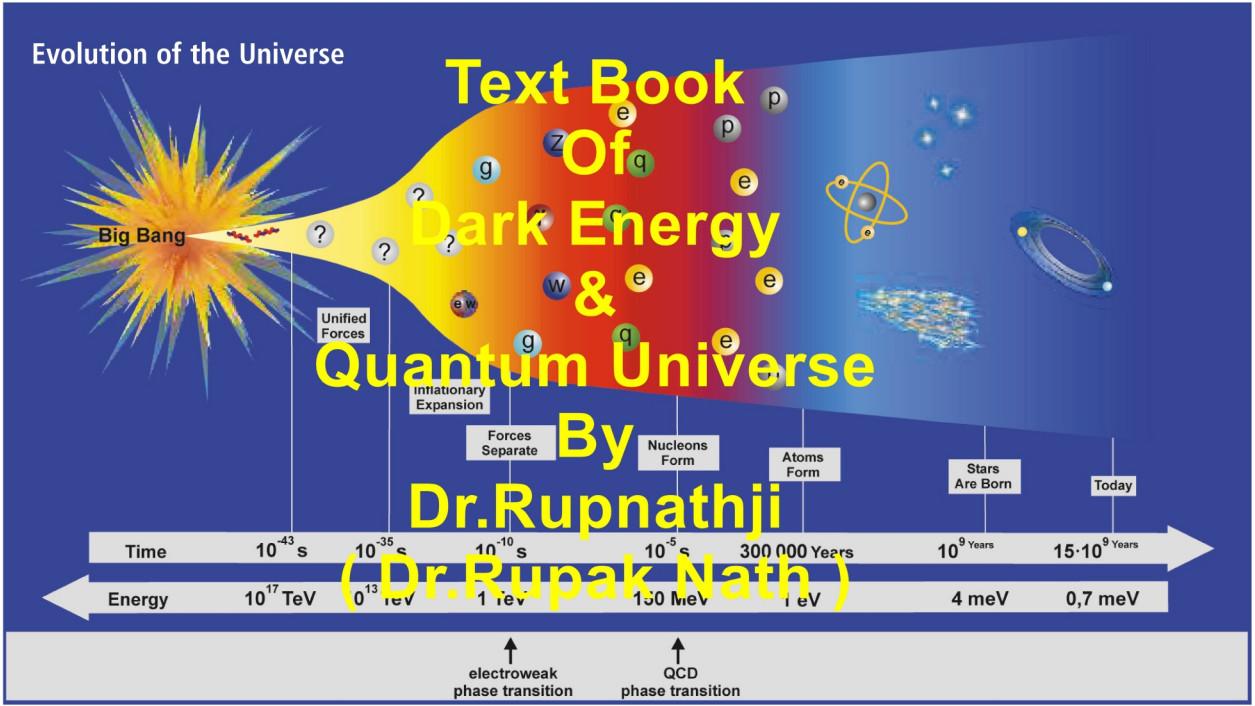
Accelerators
LHC
Tevatron
RHIC
high-energy cosmic rays
Inflation
BIG BANG
possible dark matter relicts
cosmic microwave radiation visible
Today
Key:
W, Z bosons
photon
q quark
meson
galaxy
g gluon
baryon
star
e electron
ion
μ muon τ tau
atom
black hole
ν neutrino
Particle Data Group, LBNL, © 2008. Supported by DOE and NSF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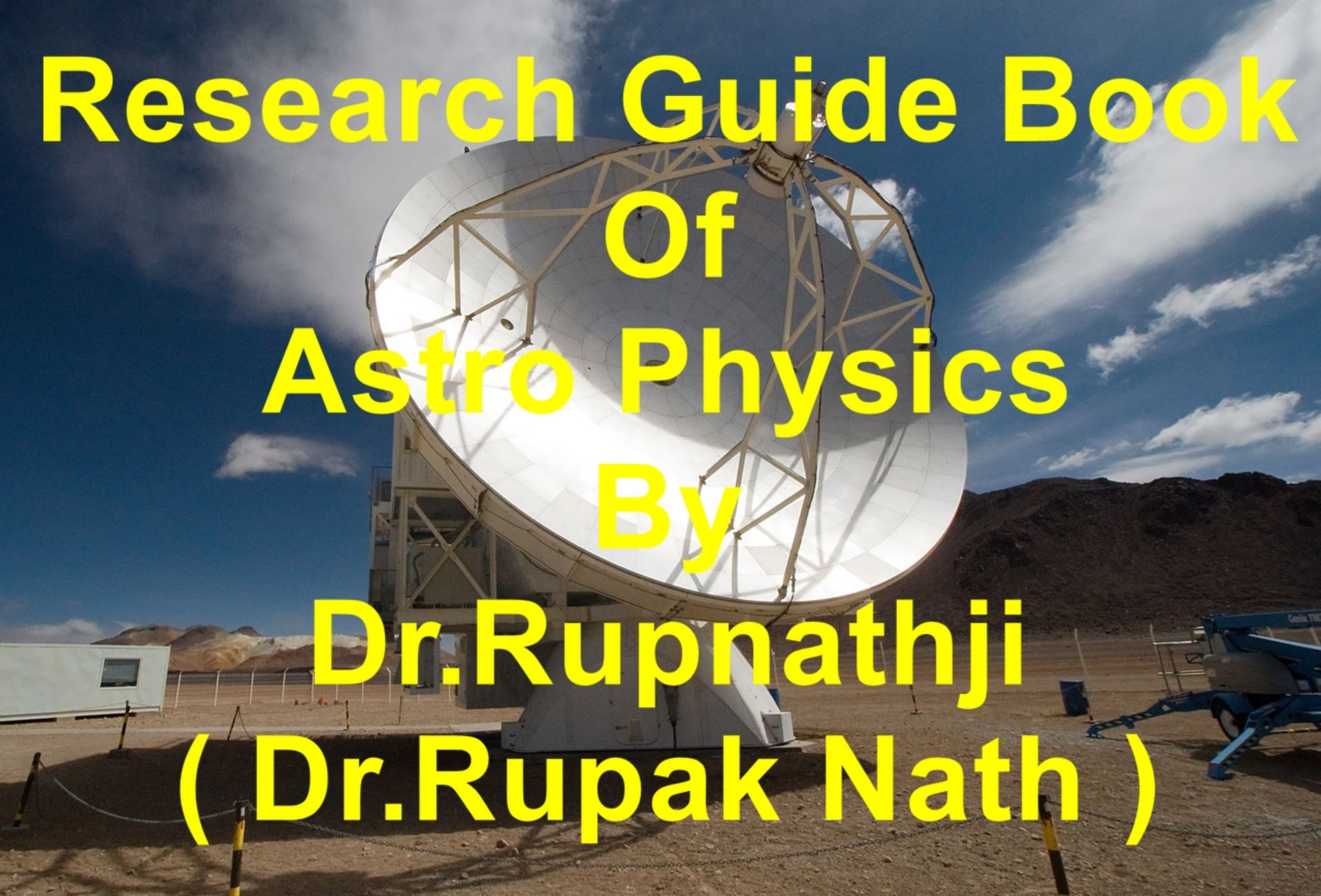
Big Bang
Unified Forces
Inflationary Expansion
Forces Separate
Nucleons Form
Atoms Form
Stars Are Born
Today
Time
10-43 s
10-35 s
10-10 s
10-5 s
300 000 Years
109 Years
15·109 Years
Energy
1017 TeV
1013 TeV
1 TeV
150 MeV
1 eV
4 meV
0,7 meV
electroweak phase transition
QCD phase transition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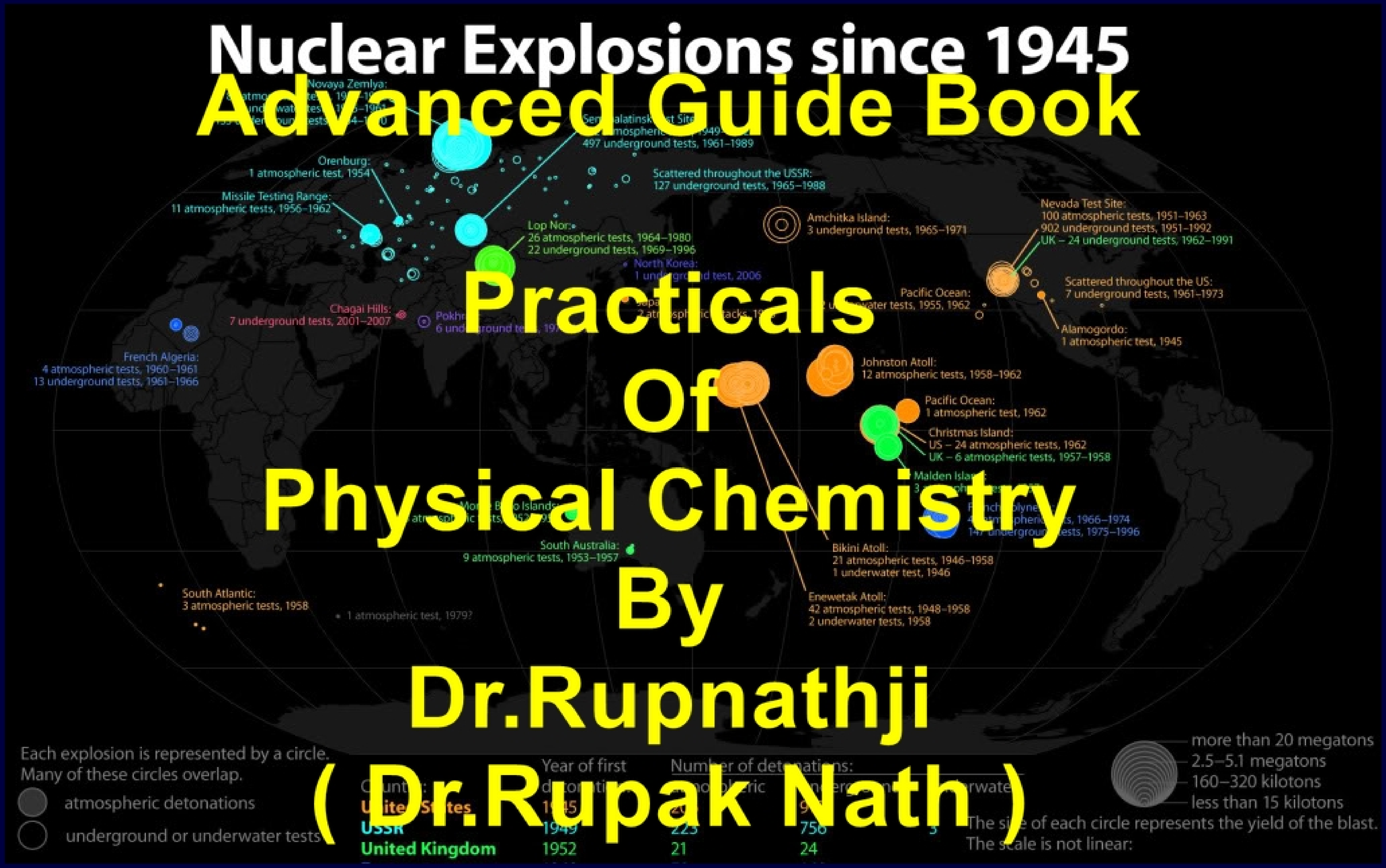

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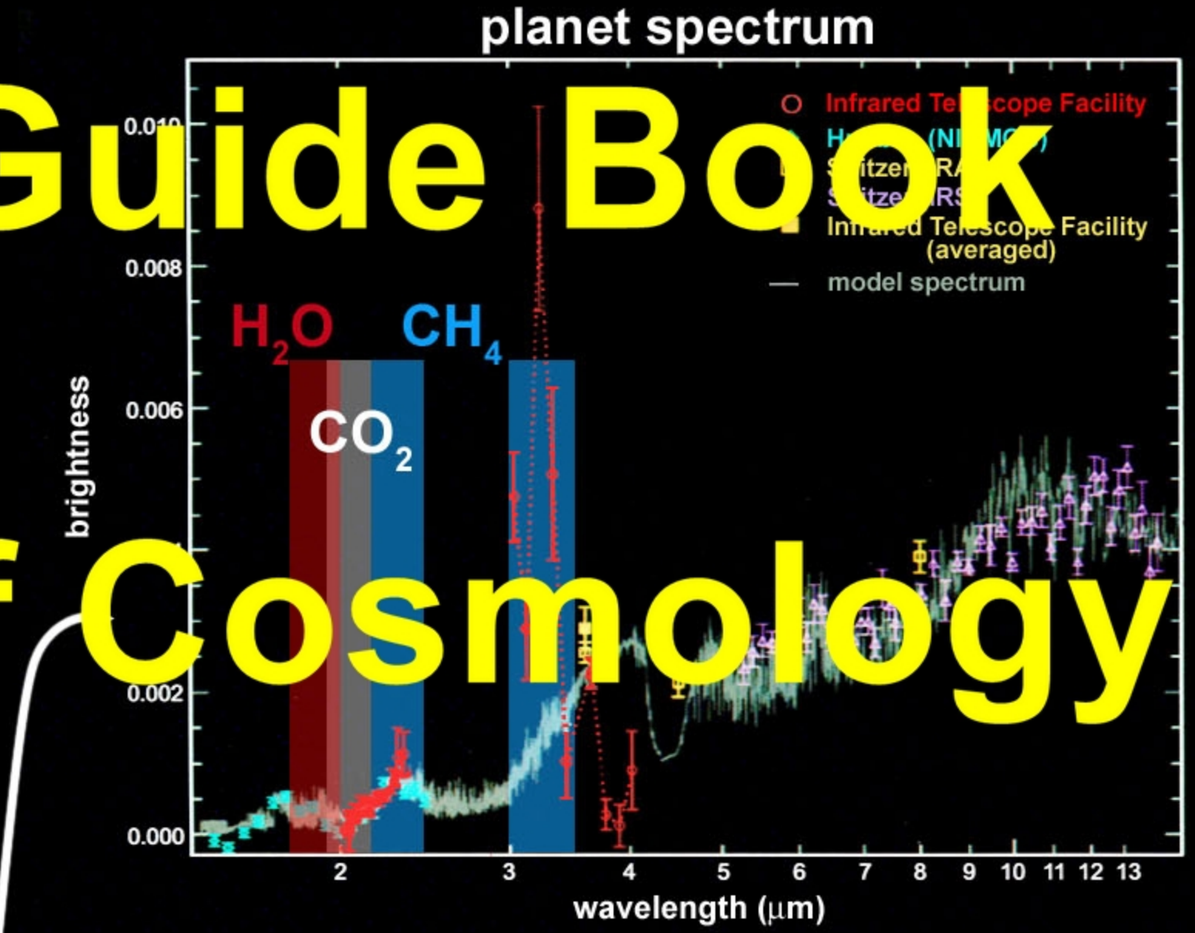

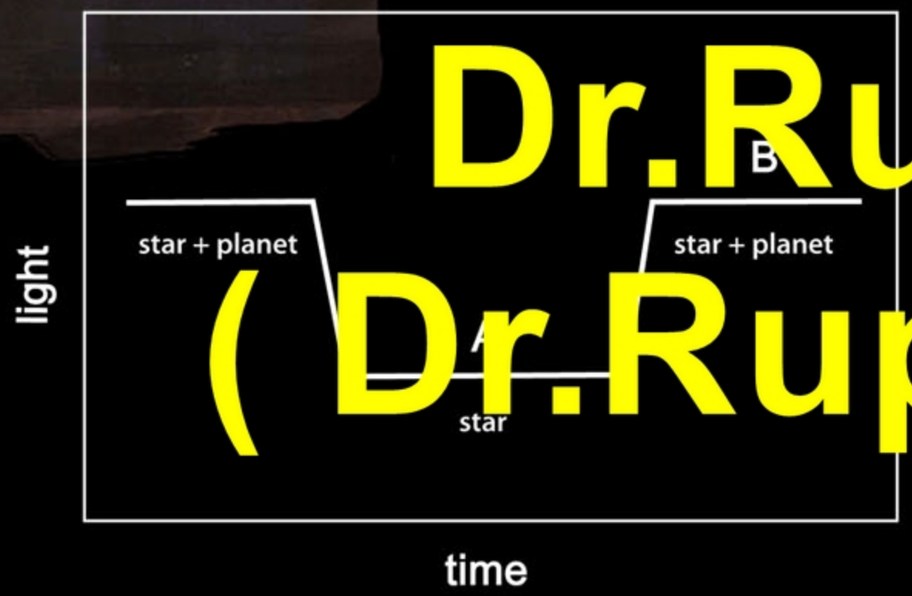

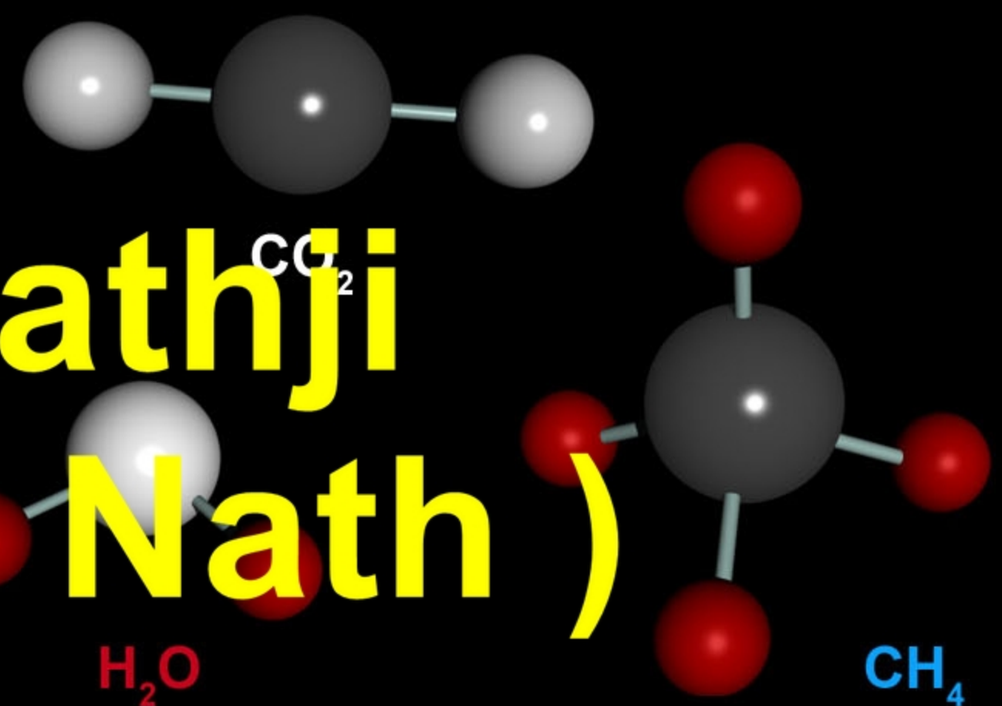

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Phases of Nuclear Matter
Unstable Nuclei
Element 112
Radioactivity
Alpha Decay
Beta Minus Decay
Beta Plus Decay
Gamma Decay
The Nucleus
neutron
proton
strong field
quark
Nuclear Energy
Fusion
Fusion
Sun
photon
Chart of the Nuclides
http://pdg.lbl.gov/cpep.html
Applications
Radioactive Dating
Space Exploration
Nuclear Reactors
Smoke Detectors
Nuclear Medicine
Magnetic Resonance Imaging

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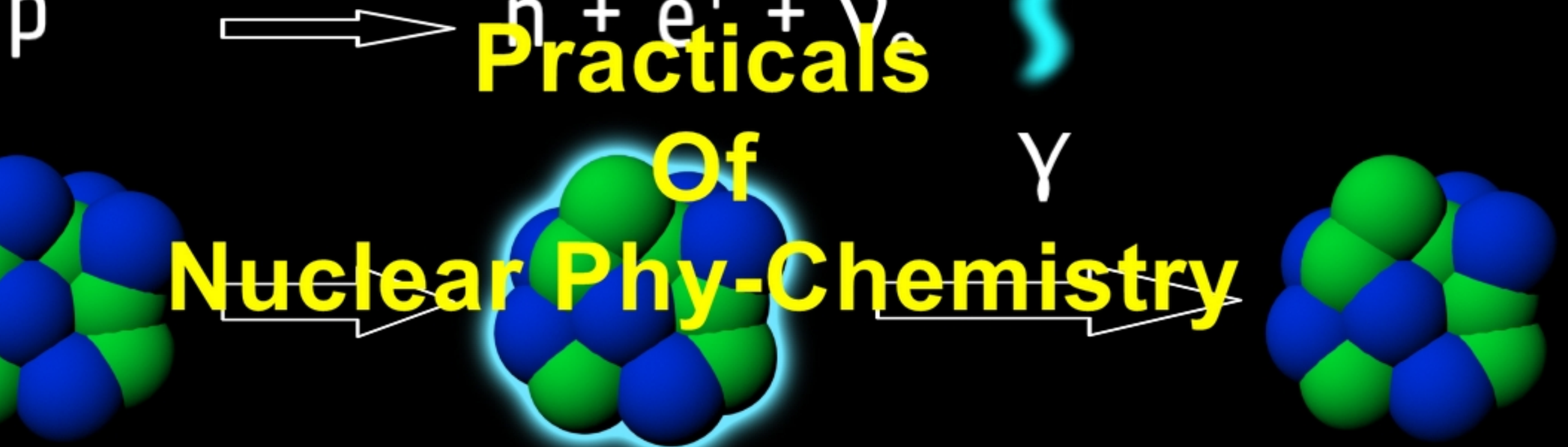

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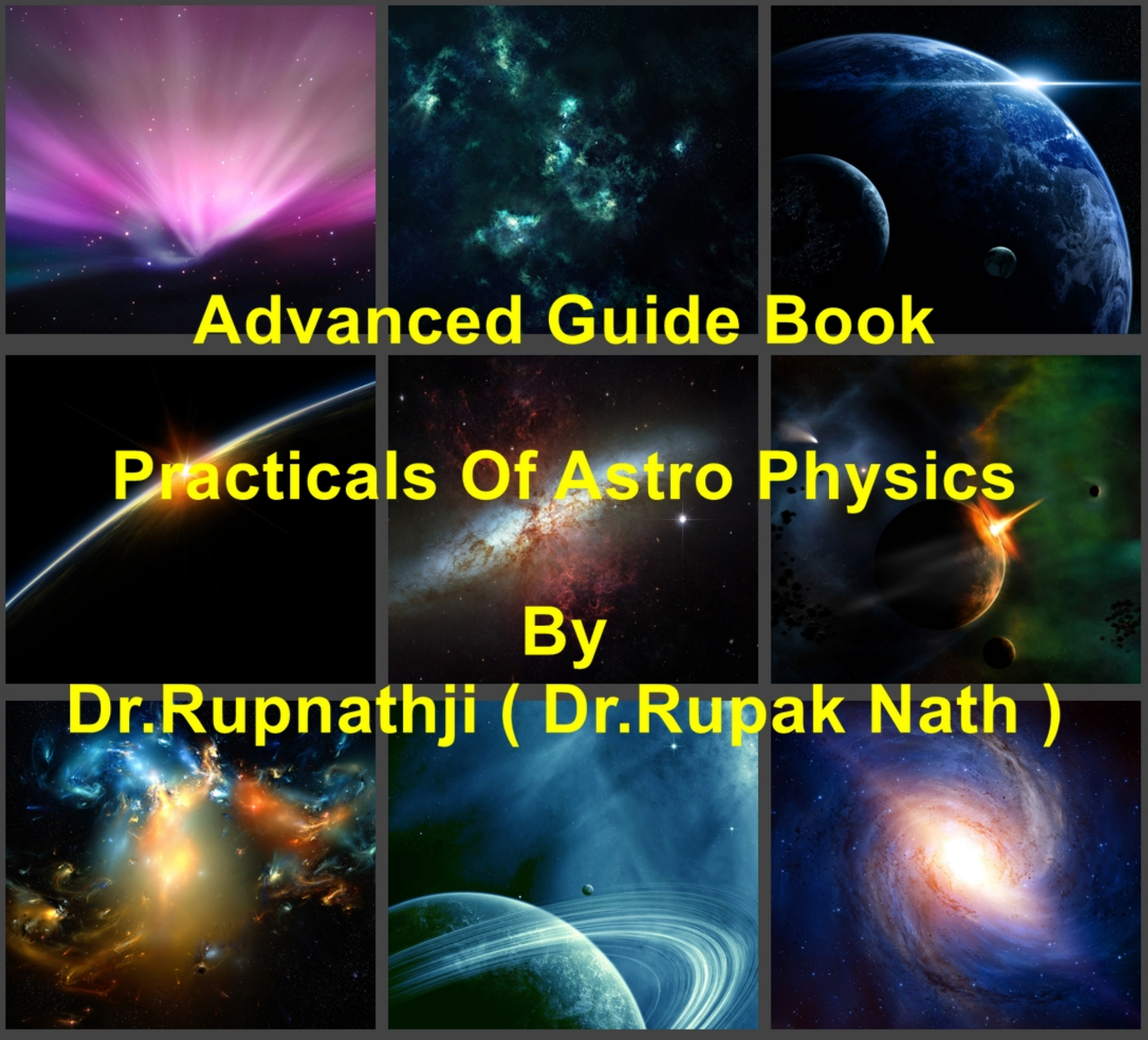
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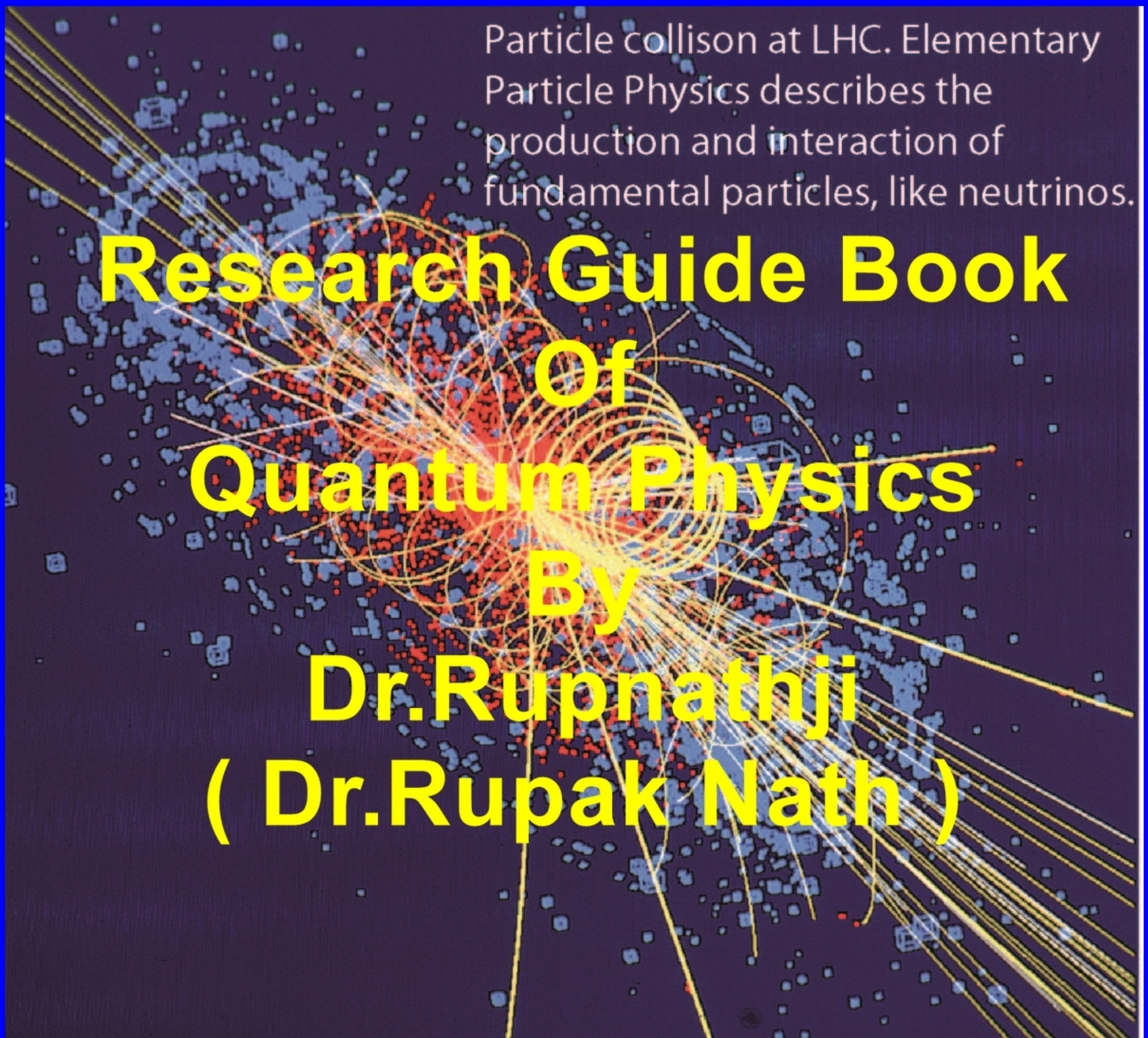

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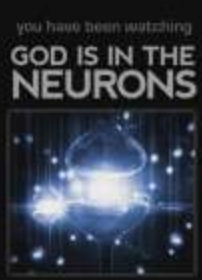

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THE PLANETS - THE SUN

01 SUN 02 MERCURY 03 VENUS 04 EARTH 05 MARS 06 JUPITER 07 SATURN 08 URANUS 09 NEPTUNE 10 PLUTO

The Sun

History

Until the middle ages it was assumed that the Sun orbited around the Earth. The first man to suggest that the Earth actually orbited the Sun was Nicolaus Copernicus in the early 16th century.

However his model of the Solar System was not accepted for many years, and many astronomers including Galileo were persecuted for endorsing his ideas.

The theory was widely accepted until Newton formulated his laws of motion, successfully modelling the dynamics of the Solar System.

The Sun is by far the largest object in the solar system. It contains more than 99.8% of the total mass of the Solar System (Jupiter contains most of the rest).

More Information

Like other gas giants in the Solar System, the gasses that make up the Sun spin around its axis. This rotation is not constant, but happens at different speeds between the poles and the equator and at different depths beneath the Sun's surface. This differential rotation causes the Sun's magnetic field, which initially varies smoothly between the North and South poles to warp. Eventually the field becomes so complex that it collapses, causing the north and south poles to swap, and the process to begin again.

A complete Sun cycle takes 22 years, after which the original North pole is restored. Maximum Sunspot activity occurs during the period when the poles are switching. Such a change occurred in 2001.

The time it takes for light from the Sun to reach Earth is 8.3 minutes.

THE SUN

The Sun has been given many names over the course of history. The Greeks named it Helios, from which we obtain the adjective heliocentric. The Romans referred to the Sun as Sol.

Solar Flares

Variations in the Sun's magnetic field often cause huge jets or loops of stellar material to shoot out into space. Often these emit clouds of charged particles, dense enough to affect communications satellites and even the Earth.

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" The power source that drives the entire Solar System "

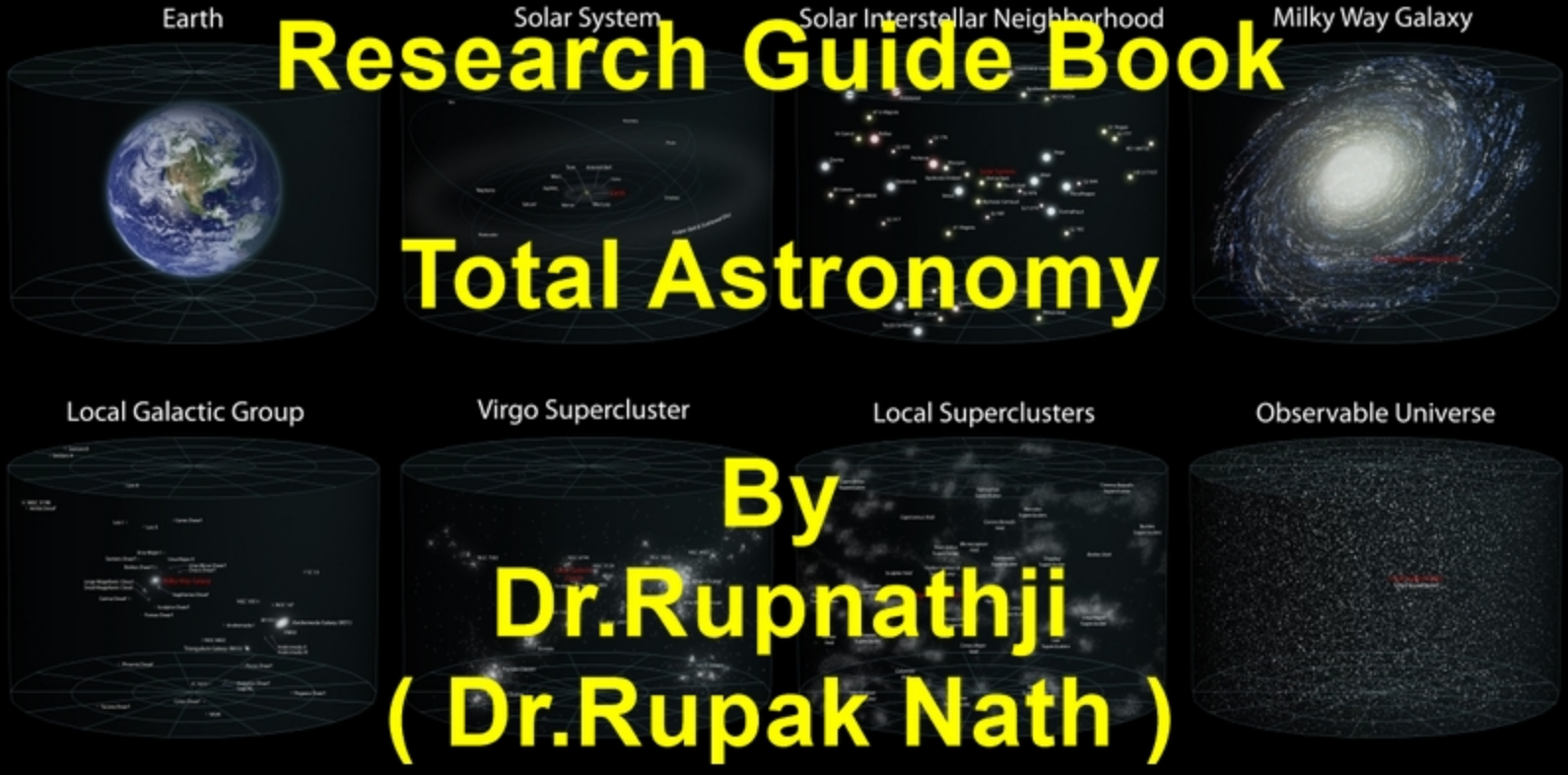
Facts and figures :-

The Sun's energy output is estimated to be 386 billion billion megawatts. A figure so immense even Professor Stephen Hawking might have problems getting his head around it. Rephrased, it's estimated that in 15 minutes our Sun radiates as much energy as mankind consumes in all forms, during an entire year.

The Sun is by far the brightest object in the sky; so bright that its light renders virtually every other astronomical body invisible when it is visible. It is also so bright that it will damage eyesight when viewed with the naked eye.

The temperature at the surface reaches 5500oC. Yet even this is cool compared with temperature at the core; a sweltering 15.6 million oC.

SIZE :	DIAMETER 1.39 MKM
MASS :	1.989E30 KG
TYPE :	G2 STAR
ATMOSPHERE :	HYDROGEN/HELIUM
MOONS :	THE NINE PLANETS
TEMPERATURE :	5800 KELVIN
COLOUR :	YELLOW / ORANGE
CORE :	HYDROGEN
ORBITAL PERIOD :	-
FROM EARTH :	149.6 (MKM
LENGTH OF DAY :	25H - 30 EARTH DAYS



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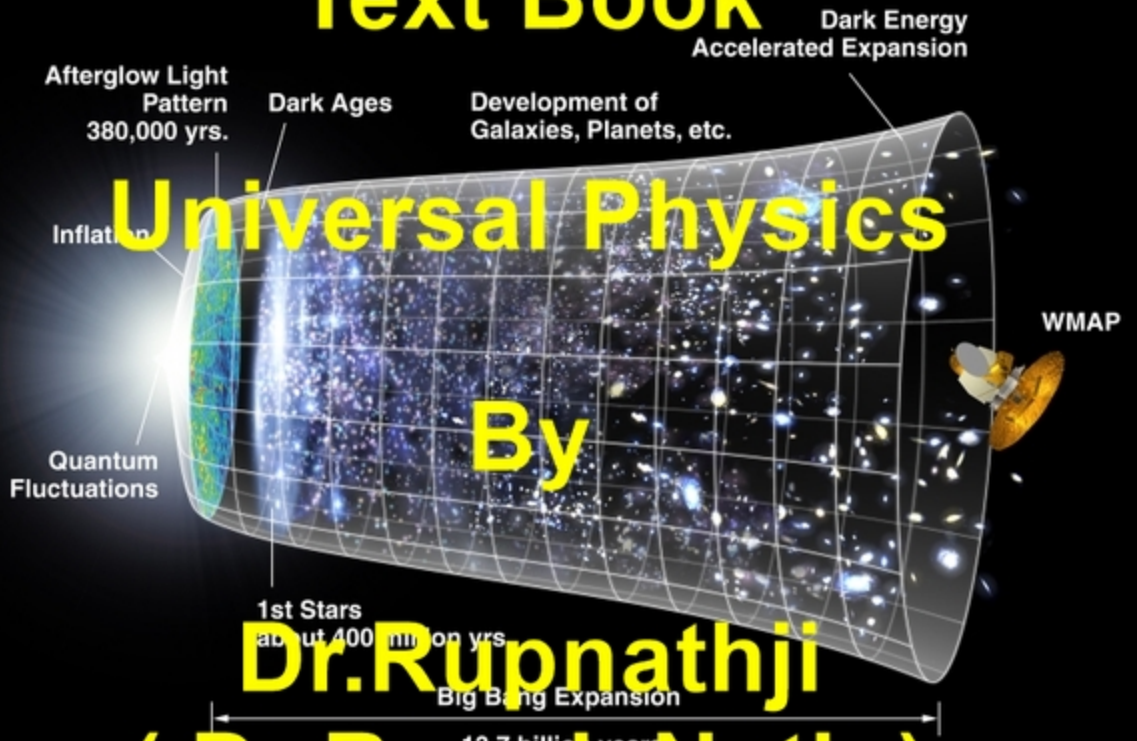

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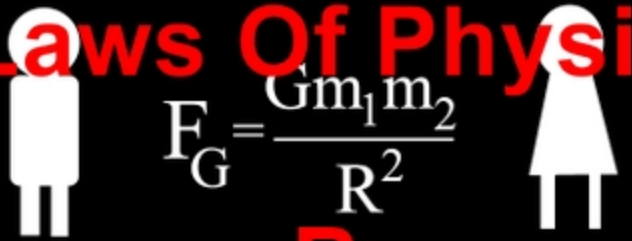

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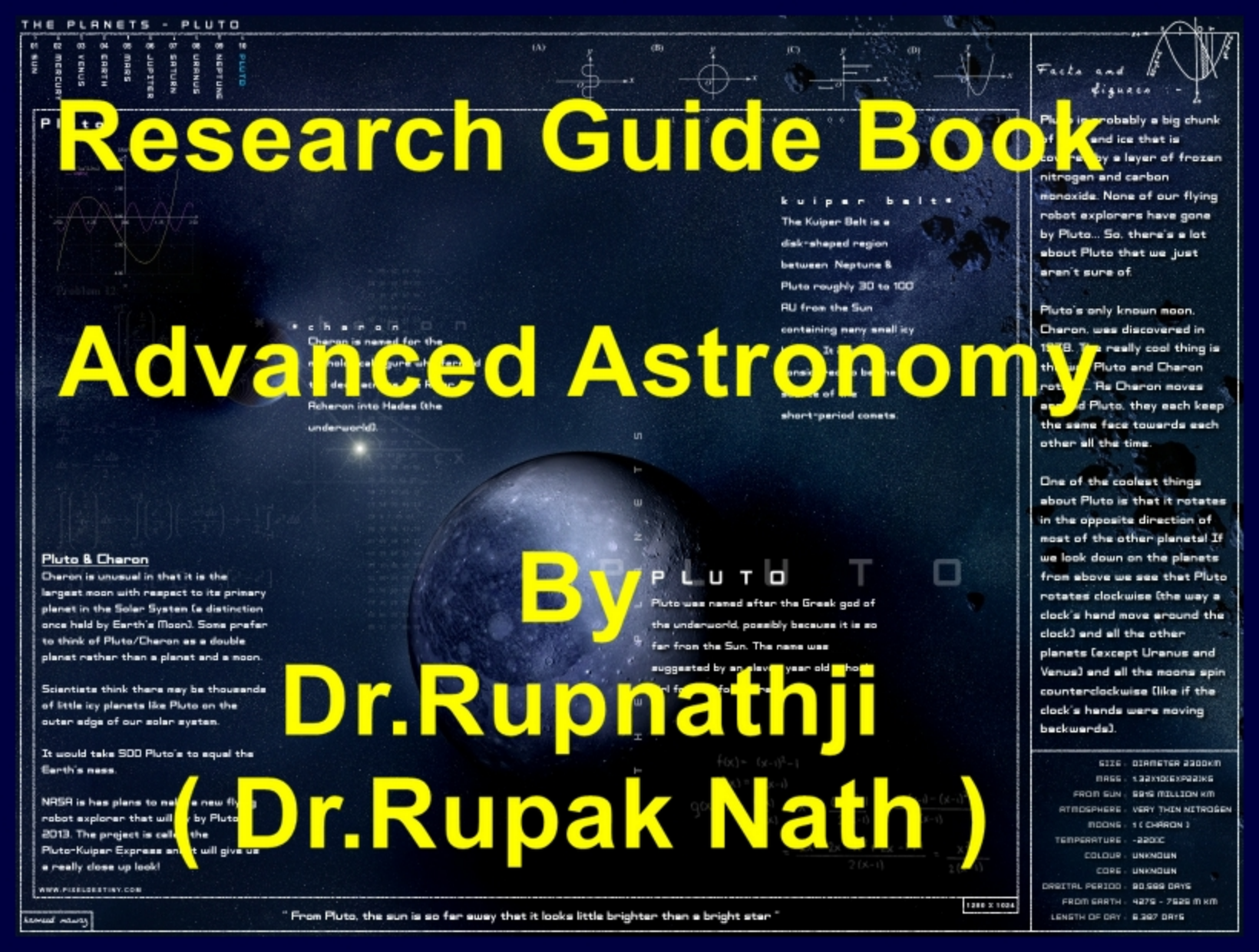
We Have a Natural Attraction to One Another


THE PLANETS - PLUTO
01 SUN
02 MERCURY
03 VENUS
04 EARTH
05 MARS
06 JUPITER
07 SATURN
08 URANUS
09 NEPTUNE
10 PLUTO
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kuiper belt
The Kuiper Belt is a disk-shaped region between Neptune & Pluto roughly 30 to 100 AU from the Sun containing many small icy
short-period comets.
charon
Charon is named for the
Acheron into Hades (the
underworld).
Pluto & Charon
Charon is unusual in that it is the largest moon with respect to its primary planet in the Solar System (a distinction once held by Earth's Moon). Some prefer to think of Pluto/Charon as a double planet rather than a planet and a moon.
Scientists think there may be thousands of little icy planets like Pluto on the outer edge of our solar system.
It would take 500 Pluto's to equal the Earth's mass.
NASA is has plans to launch a new flyby robot explorer that will fly by Pluto in 2013. The project is called the Pluto-Kuiper Express and it will give us a really close up look!
PLUTO
Pluto was named after the Greek god of the underworld, possibly because it is so far from the Sun. The name was
suggested by an eleven year old girl
Facts and figures :-
Pluto is probably a big chunk of rock and ice that is covered by a layer of frozen nitrogen and carbon monoxide. None of our flying robot explorers have gone by Pluto... So, there's a lot about Pluto that we just aren't sure of.
Pluto's only known moon, Charon, was discovered in 1978. The really cool thing is that as Pluto and Charon rotate... As Charon moves around Pluto, they each keep the same face towards each other all the time.
One of the coolest things about Pluto is that it rotates in the opposite direction of most of the other planets! If we look down on the planets from above we see that Pluto rotates clockwise (the way a clock's hand move around the clock) and all the other planets (except Uranus and Venus) and all the moons spin counterclockwise (like if the clock's hands were moving backwards).
SIZE : DIAMETER 2300KM
MASS : 1.32X10EX22KG
FROM SUN : 5915 MILLION KM
ATMOSPHERE : VERY THIN NETROGEN
MOONS : 1 (CHARON)
TEMPERATURE : -220DC
COLOUR : UNKNOWN
CORE : UNKNOWN
ORBITAL PERIOD : 90,588 DAYS
FROM EARTH : 4275 - 7525 M KM
LENGTH OF DAY : 6.387 DAYS
" From Pluto, the sun is so far away that it looks little brighter than a bright star "
1280 X 1024
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01 SUN
02 MERCURY
03 VENUS
04 EARTH
05 MARS
06 JUPITER
07 SATURN
08 URANUS
09 NEPTUNE
10 PLUTO

Neptune

Guide Book

Practicals Of Astronomy

* Neptunes most prominent feature "The G[illegible] Dark Spot" is 70[illegible] approx the size of earth.

NEPTUNE

Neptune was named after the Roman god of the sea.

* The compostition of Neptunes [illegible] rings is as yet [illegible]

By

Dr.Rupnathji

(Dr.Rupak Nath)

* proteus

* triton

Triton is the [illegible]nly really d[illegible]nt [illegible] discov[illegible] [illegible]n [illegible]

* moons

Naiad
Thalissa
Despina
Galatea
Larissa
Nereid

Raining Diamonds

Scientists think that it is raining giant diamonds on neptune!!! That's right - raining diamonds! A simulation of Neptune's atmosphere was recently done at University of California, Berkeley... and it produced diamond dust. So, they think with all the carbon in Neptune's atmosphere and the extreme pressure on that planet that it may be, literally, raining giant diamonds!

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"As well as raining diamonds. Neptune also has the fastest winds in the entire solar system."

1280 X 1024

hameed nawaz

Facts and figures :-

Neptune has been visited by only one spacecraft, Voyager 2 on Aug 25 1989. Much of we know about Neptune comes from this single encounter. But fortunately, recent ground-based and HST observations have added a great deal, too.

Neptune's blue color is largely the result of absorption of red light by methane in the atmosphere but there is some additional as-yet-unidentified chromophore which gives the clouds their rich blue tint.

Like a typical gas planet, Neptune has rapid winds confined to bands of latitude and large storms or vortices. Neptune's winds are the fastest in the solar system, reaching 2000 km/hour

Like Jupiter and Saturn, Neptune has an internal heat source - it radiates more than twice as much energy as it receives from the Sun.

SIZE :	DIAMETER 49,532KM
MASS :	1.024X10(EXP26)KG
FROM SUN :	4504 MILLION KM
ATMOSPHERE :	HYDROGEN
MOONS :	8
TEMPERATURE :	-220oC
COLOUR :	DEEP BLUE
CORE :	ROCKY/ICE CORE
ORBITAL PERIOD :	60,190.3 DAYS!
FROM EARTH :	4354 - 4564 MKM
LENGTH OF DAY :	16 HOURS 7 MINS

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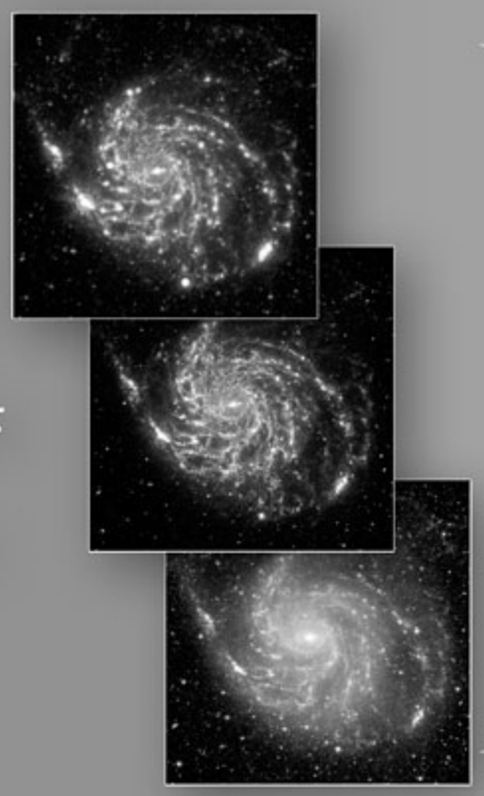
M101

NASA's Great Observatories

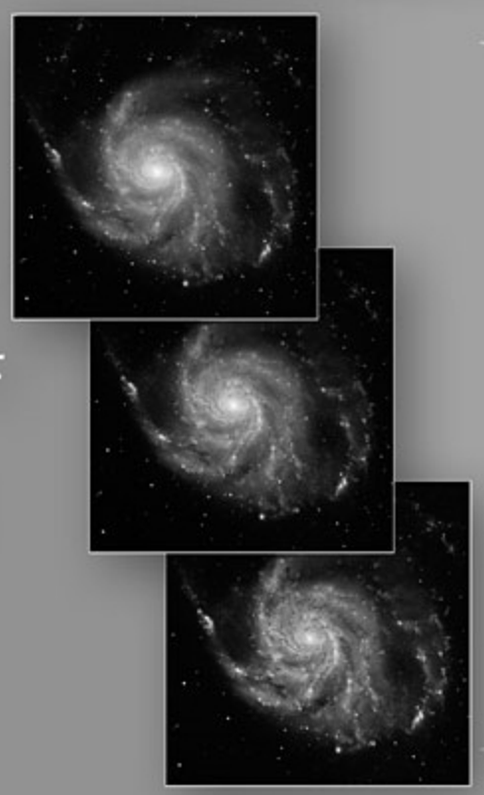
Spitzer Space Telescope

Infrared



Hubble Space Telescope

Visible



Chandra X-ray Observatory

X-ray

These images combine data from NASA's three Great Observatories in a single color composite image. At the left are separate images from three different regions of infrared light from *Spitzer Space Telescope*, three images from different regions of visible light from *Hubble Space Telescope*, and three different regions of x-ray light from *Chandra X-ray Observatory*. The three images from each observatory are combined into a single black and white image representing the light from that part of the spectrum. Each of these images is assigned a color: red for infrared light, yellow for visible light, and blue for x-ray light. These three separate color images can blend together to see the light from a very broad range of light energy in one image.

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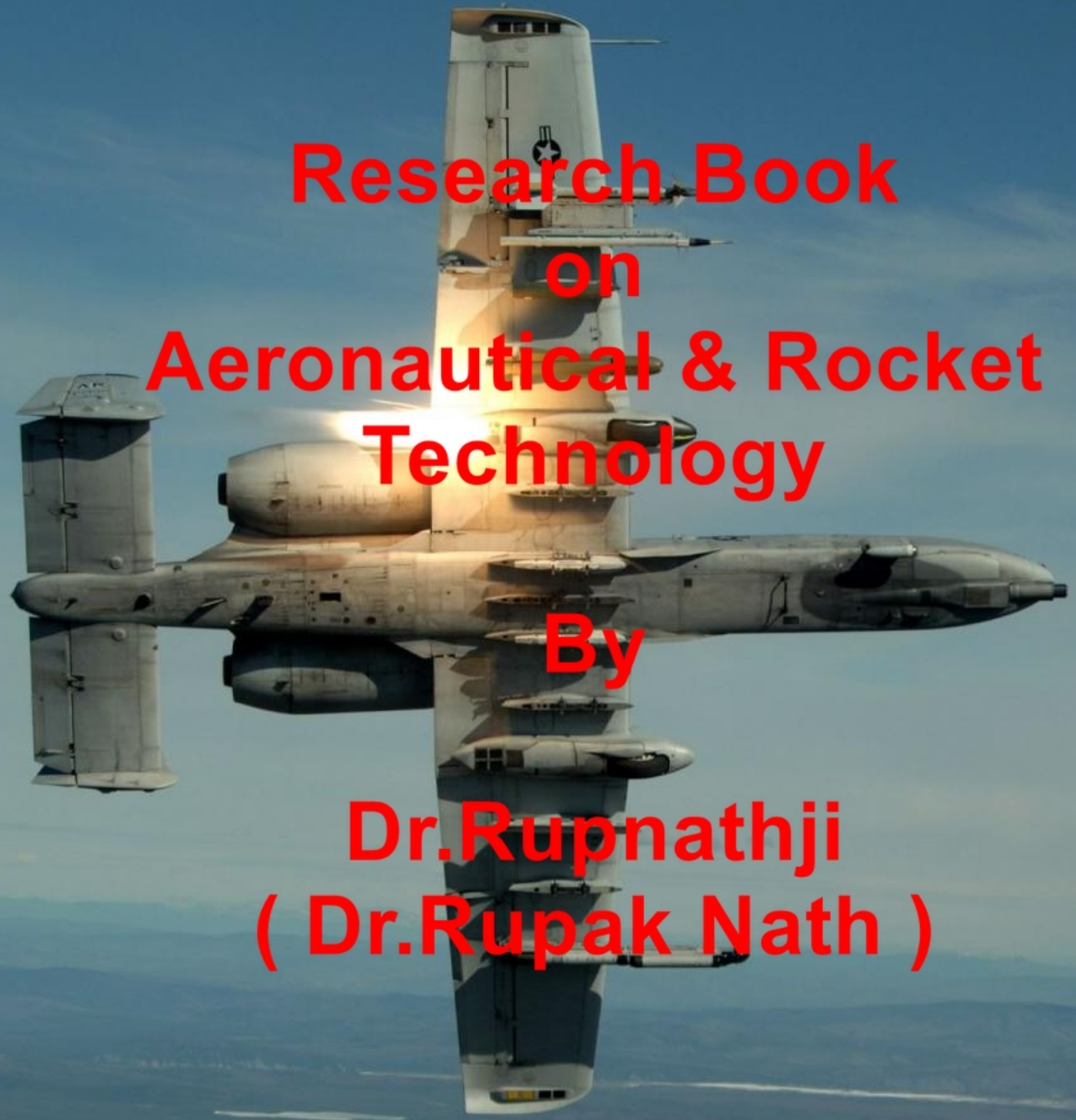

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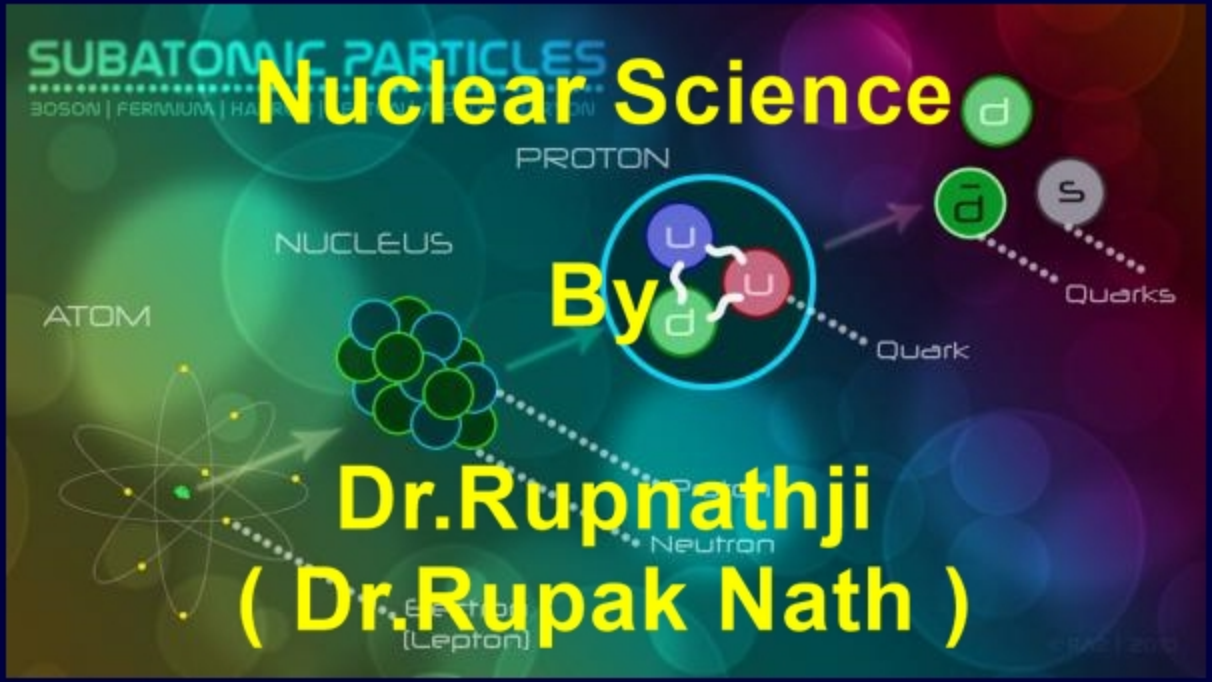
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PROTON
NUCLEUS
ATOM
By
Quarks
Quark
Neutron
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Nuclear Explosions since 1945

Nuclear Physics

Novaya Zemlya:
[illegible] tests, [illegible]–1962
[illegible] tests, [illegible]–19[illegible]
[illegible] tests, 1[illegible]–1[illegible]

Semipalatinsk Test S[illegible]
122 [illegible]mospheric tes[illegible] 1949–1962
197 [illegible]derground te[illegible] 1961–1989

Orenburg:
1 atmospheric test, 1954

Missile Testing Range:
11 atmospheric tests, 1956–1962

Scattered throughout the USSR:
127 underground tests, 1965–1988

Lop Nor:
26 atmospheric tests, 1964–1980
22 underground tests, 1969–1996

North Korea:
1 underground test, 2006

Japan:
2 atmospheric attacks, 1945

Amchitka Island:
3 underground tests, 1965–1971

Nevada Test Site:
100 atmospheric tests, 1951–1963
902 underground tests, 1951–1992
UK – 24 underground tests, 1962–1991

Scattered throughout the US:
7 underground tests, 1961–1973

Alamogordo:
1 atmospheric test, 1945

Pacific Ocean:
2 underwater tests, 1955, 1962

Chagai Hills:
7 underground tests, 2001–2007

Pokhran:
6 underground tests, 1974, 1998

French Algeria:
4 atmospheric tests, 1960–1961
13 underground tests, 1961–1966

By

Johnston Atoll:
12 atmospheric tests, 1958–1962

Pacific Ocean:
1 atmospheric test, 1962

Christmas Island:
US – 24 atmospheric tests, 1962
UK – 6 atmospheric tests, 1957–1958

Malden Island:
3 atmospheric tests, 1957

French Polynesia:
46 atmospheric tests, 1966–1974
147 underground tests, 1975–1996

Monte Bello Islands:
3 atmospheric tests, 1952–1956

South Australia:
9 atmospheric tests, 1953–1957

Bikini Atoll:
21 atmospheric tests, 1946–1958
1 underwater test, 1946

South Atlantic:
3 atmospheric tests, 1958

1 at[illegible]pheric test, 1979?

Enewetak Atoll:
42 atmo[illegible]heric [illegible]ts, 1948–1[illegible]
[illegible]nde[illegible] te[illegible]

Dr.Rupnathji

(Dr.Rupak Nath)

Each explosion is repre[illegible]nted by [illegible] circl[illegible]
Many of these circles o[illegible]erlap.

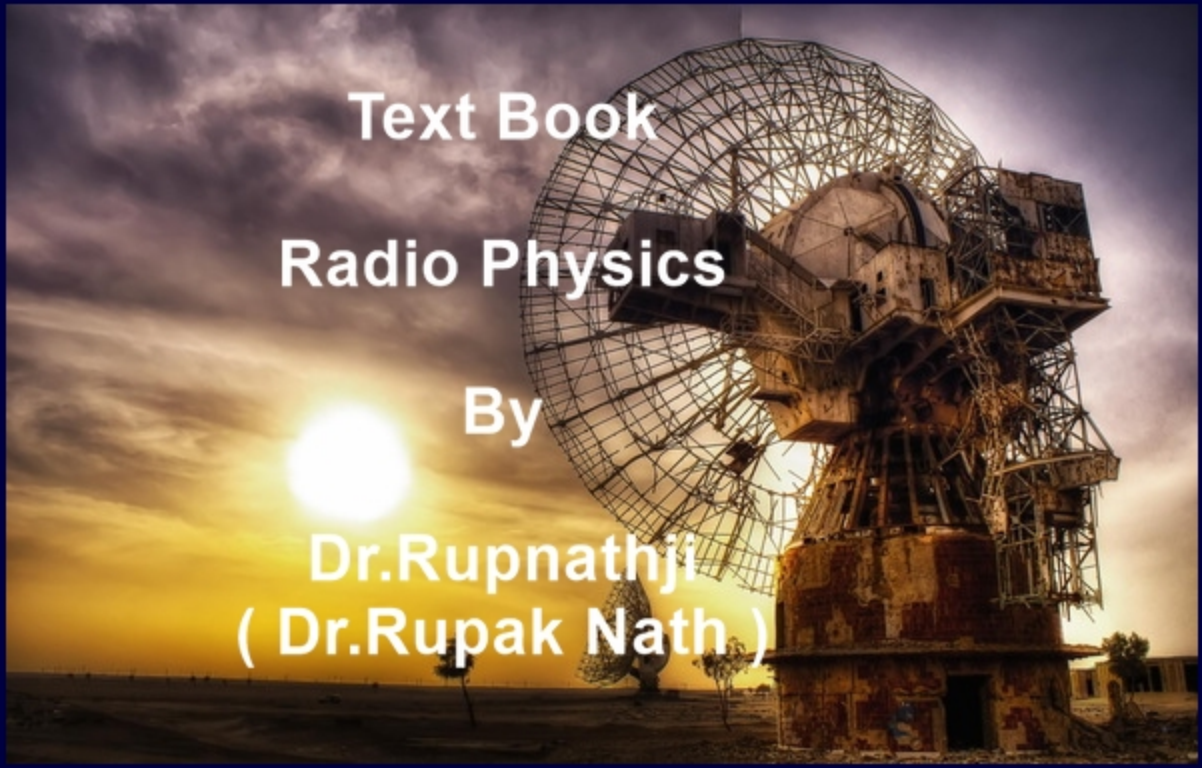
atmospheric det[illegible]ations

underground or underwater tests

Country	Year [illegible]rs	Number detonat[illegible]		
	detonation	atmospheric	underground	underwater
United States	1945	2[illegible]	912	3
USSR	1949	223	756	3
United Kingdom	1952	21	24	

more than 20 megatons
2.5–5.1 megatons
160–320 kilotons
less than 15 kilotons

The size of each circ[illegible] represents the yield of the blast.
The scale is not linear: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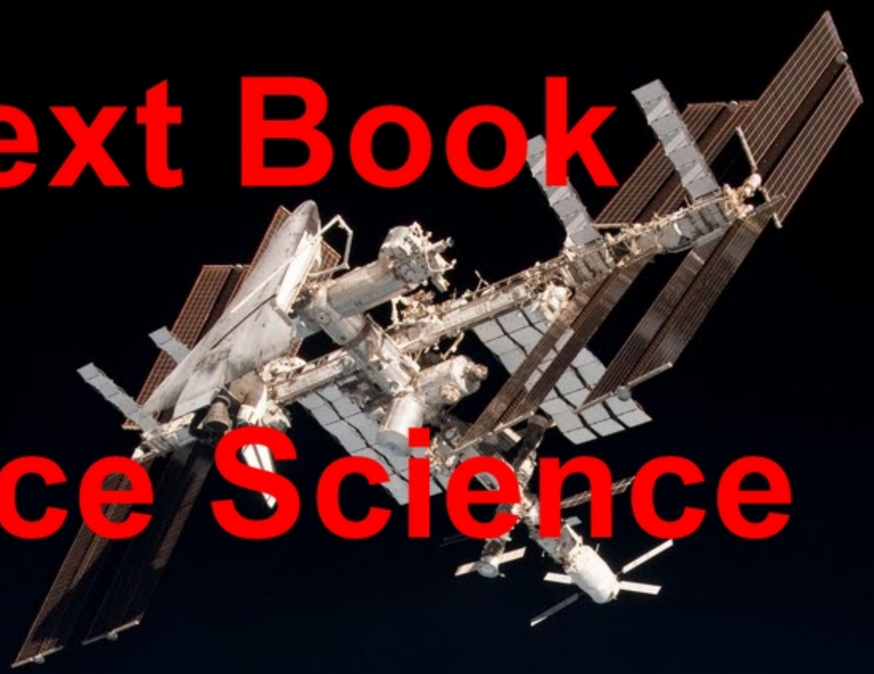

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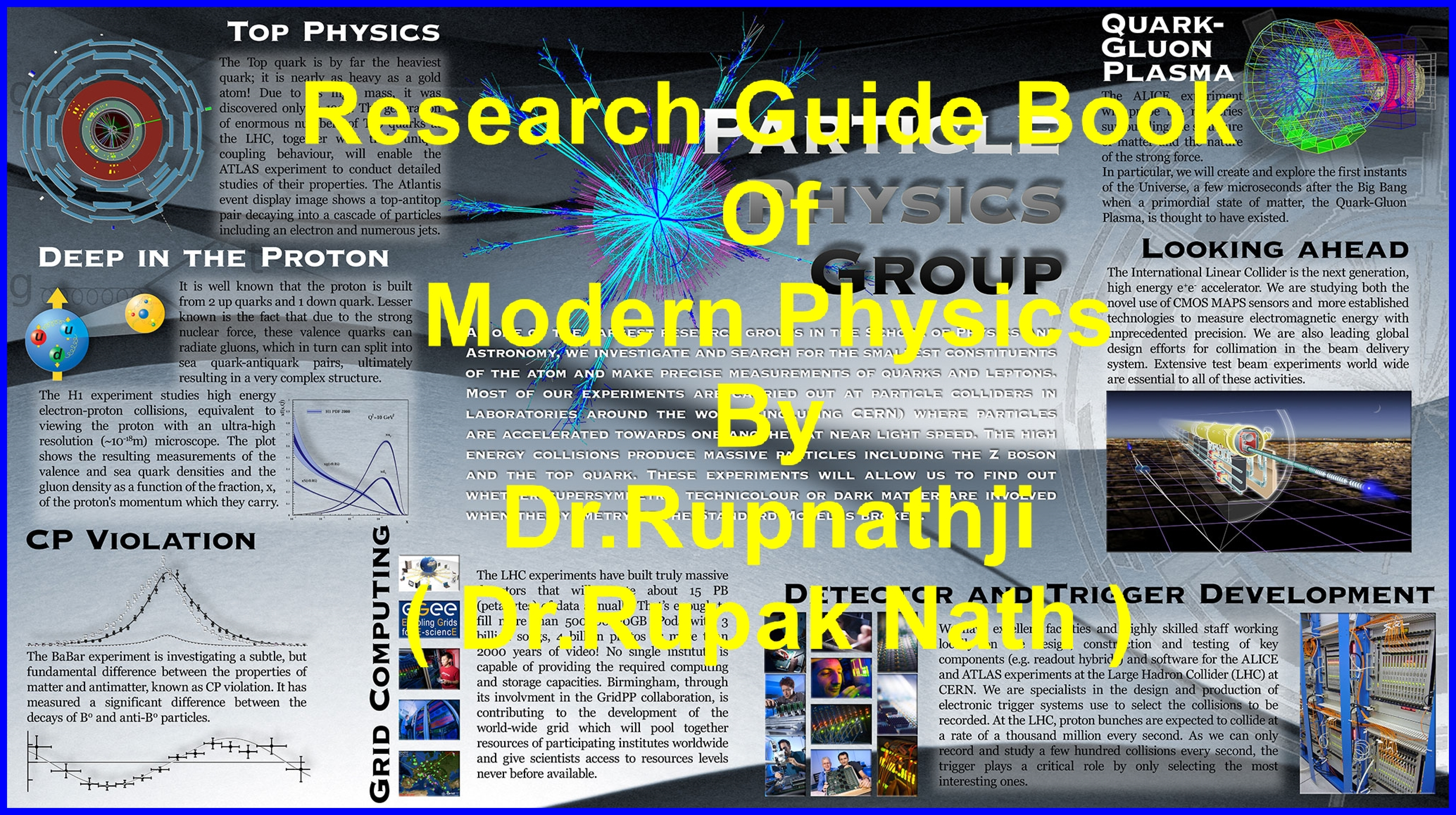
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Top Physics
Quark-Gluon Plasma
Particle Physics Group
In particular, we will create and explore the first instants of the Universe, a few microseconds after the Big Bang when a primordial state of matter, the Quark-Gluon Plasma, is thought to have existed.
Deep in the Proton
It is well known that the proton is built from 2 up quarks and 1 down quark. Lesser known is the fact that due to the strong nuclear force, these valence quarks can radiate gluons, which in turn can split into sea quark-antiquark pairs, ultimately resulting in a very complex structure.
The H1 experiment studies high energy electron-proton collisions, equivalent to viewing the proton with an ultra-high resolution (~10-18m) microscope. The plot shows the resulting measurements of the valence and sea quark densities and the gluon density as a function of the fraction, x, of the proton's momentum which they carry.
Looking ahead
The International Linear Collider is the next generation, high energy e+e- accelerator. We are studying both the novel use of CMOS MAPS sensors and more established technologies to measure electromagnetic energy with unprecedented precision. We are also leading global design efforts for collimation in the beam delivery system. Extensive test beam experiments world wide are essential to all of these activities.
CP Violation
The BaBar experiment is investigating a subtle, but fundamental difference between the properties of matter and antimatter, known as CP violation. It has measured a significant difference between the decays of B0 and anti-B0 particles.
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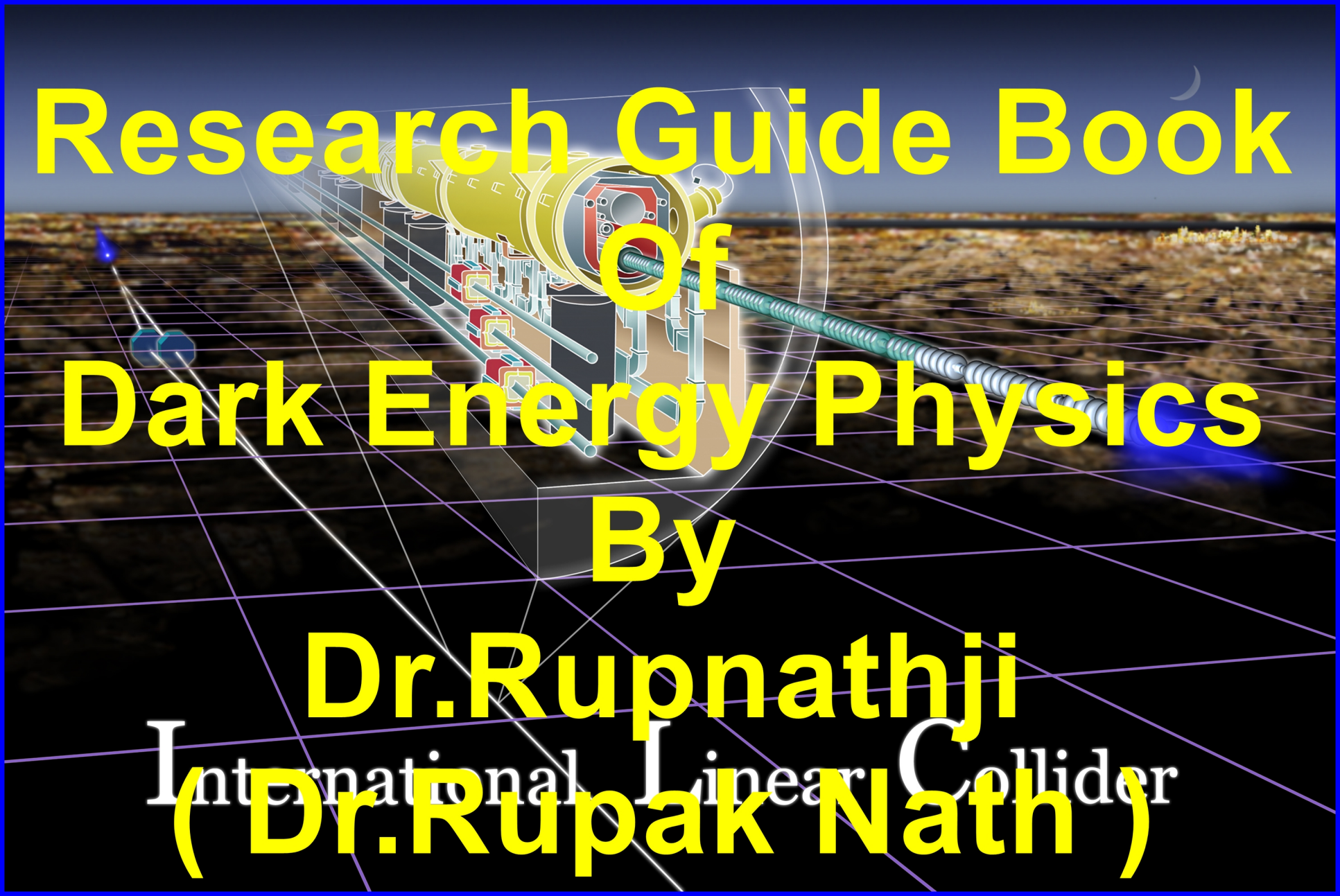

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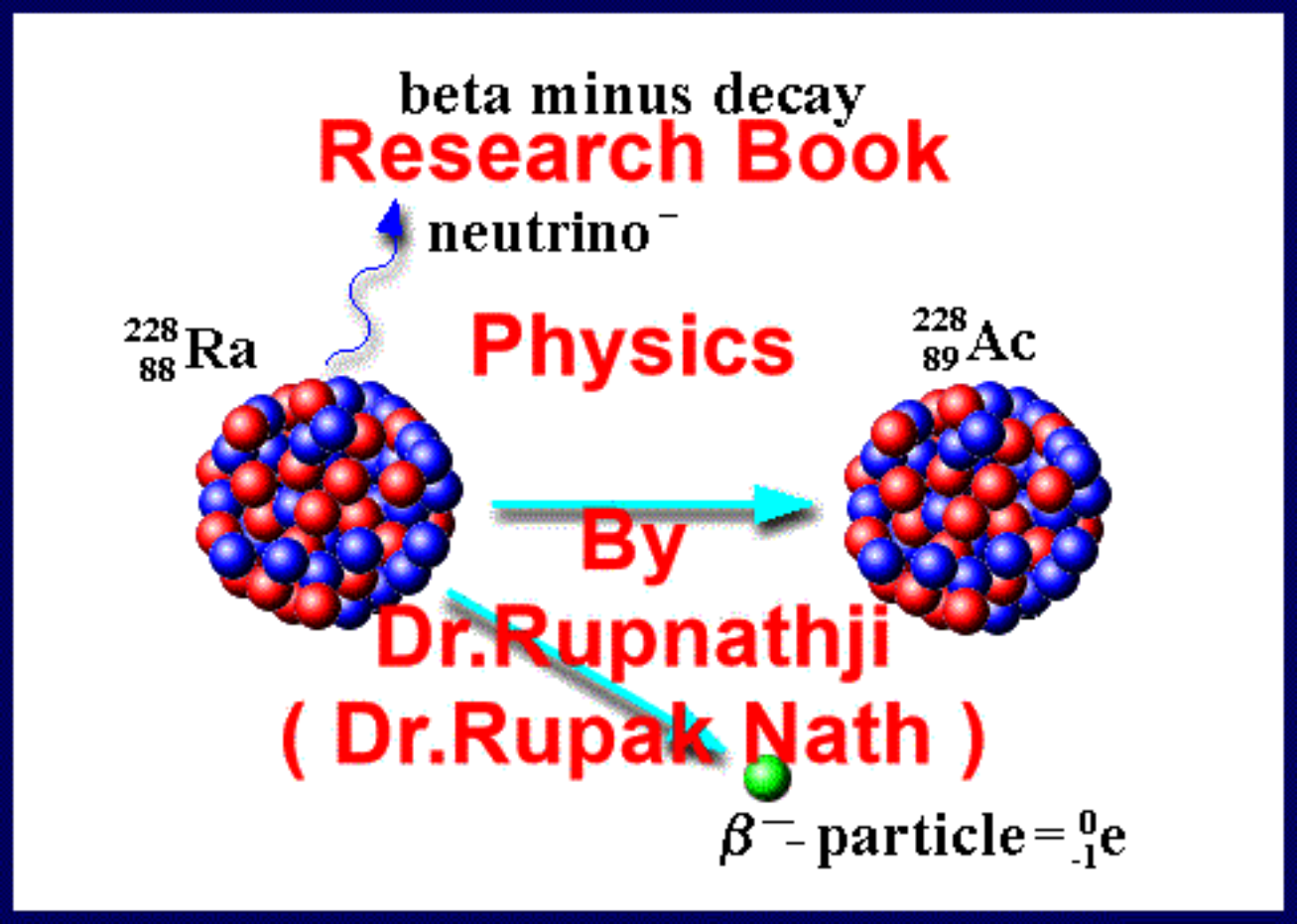
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β^- - particle = $^{0}_{-1}e$

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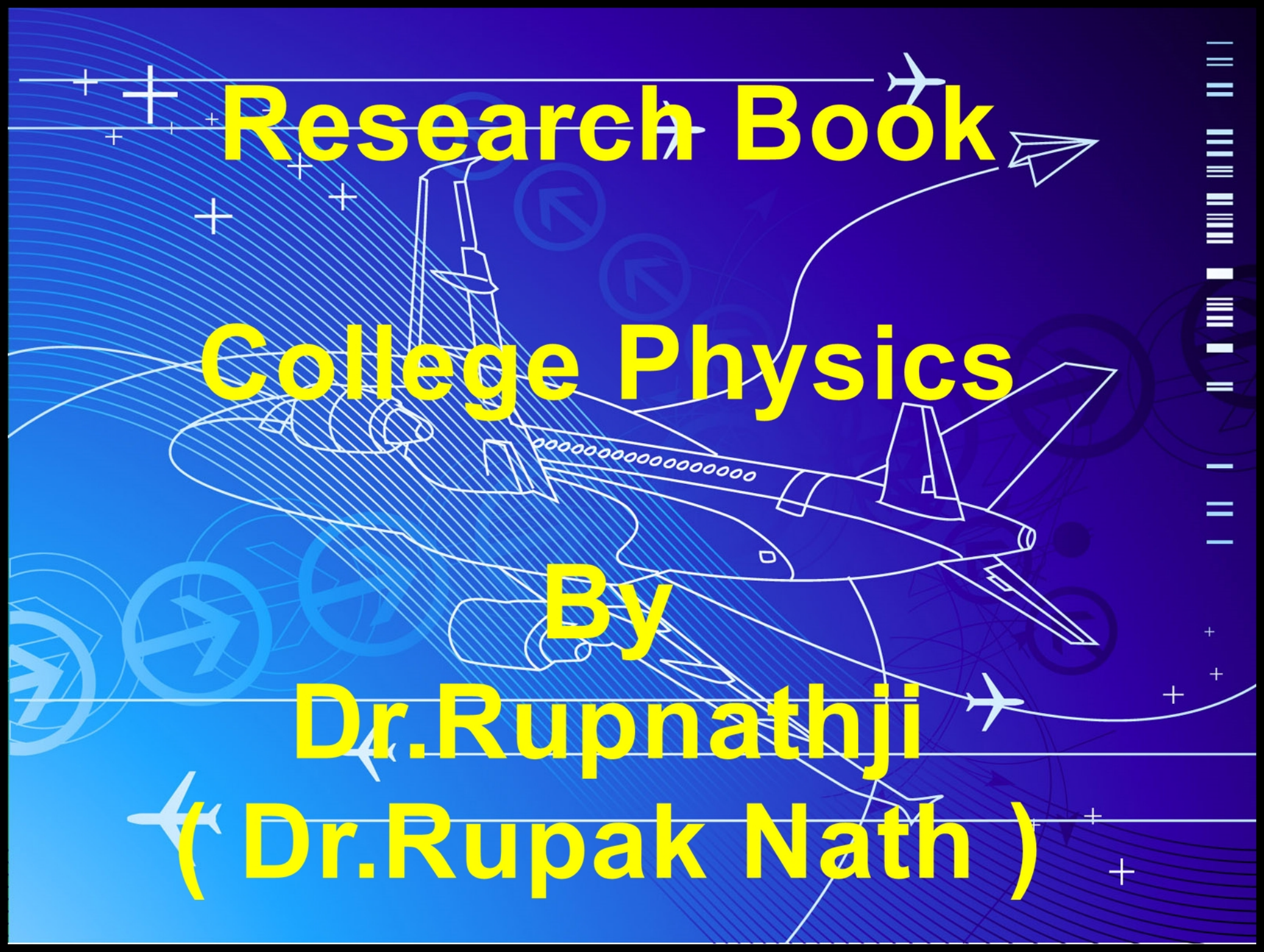
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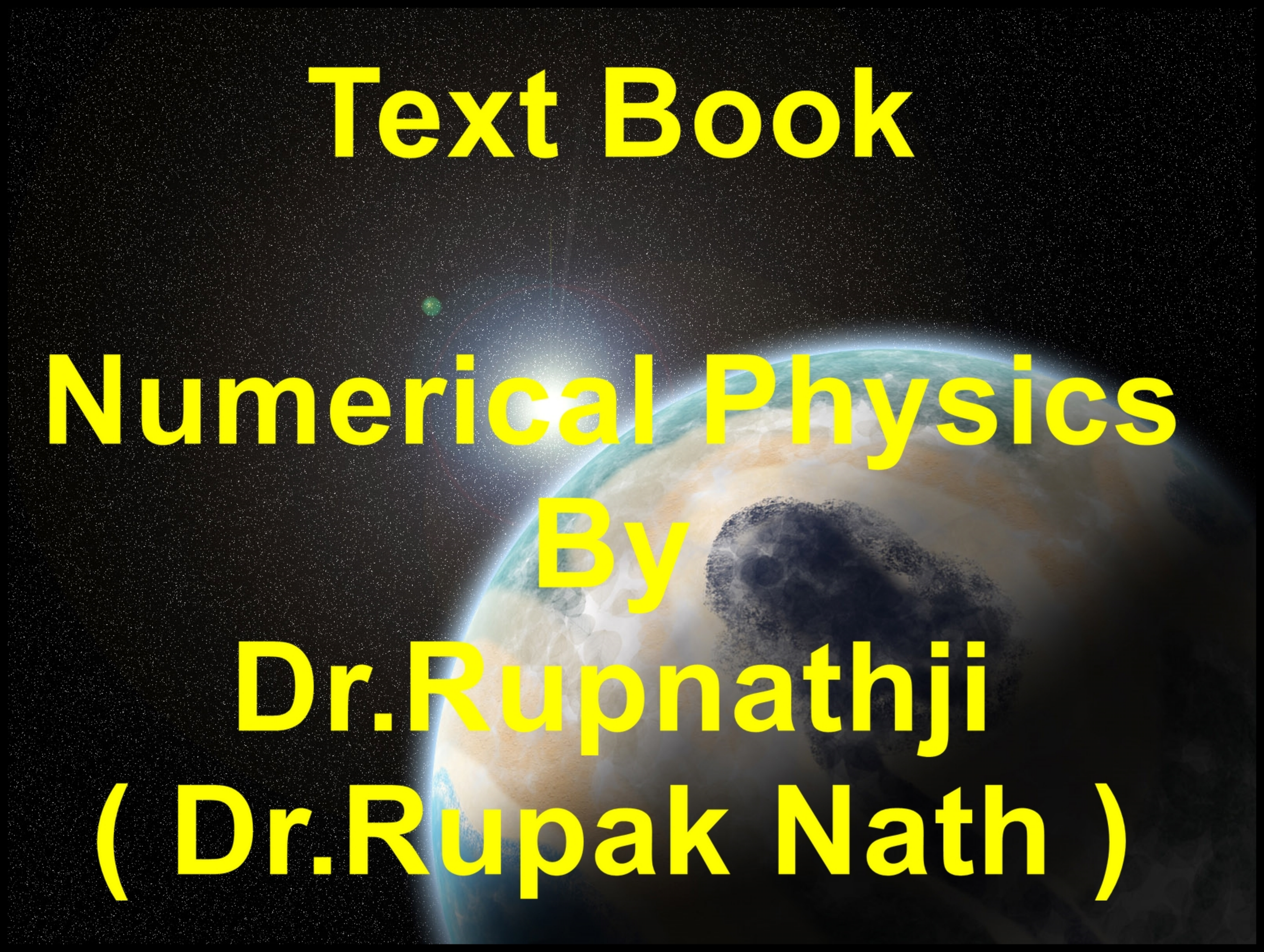

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Standard Model of

FUNDAMENTAL PARTICLES AND INTERACTIONS

The Standard Model summarizes the current knowledge in Particle Physics. It is the quantum theory that includes the theory of strong interactions (quantum chromodynamics or QCD) and the unified theory of weak and electromagnetic interactions (electroweak). Gravity is included on this chart because it is one of the fundamental interactions even though not part of the "Standard Model."

FERMIONS matter constituents spin = 1/2, 3/2, 5/2, ...

Leptons spin = 1/2

Flavor	Mass GeV/c^2	Electric charge
ν_e electron neutrino	$<1\times10^{-8}$	0
e electron	0.000511	–1
ν_μ muon neutrino	<0.0002	0
μ muon	0.106	–1
ν_τ tau neutrino	<0.02	0
τ tau	1.7771	–1

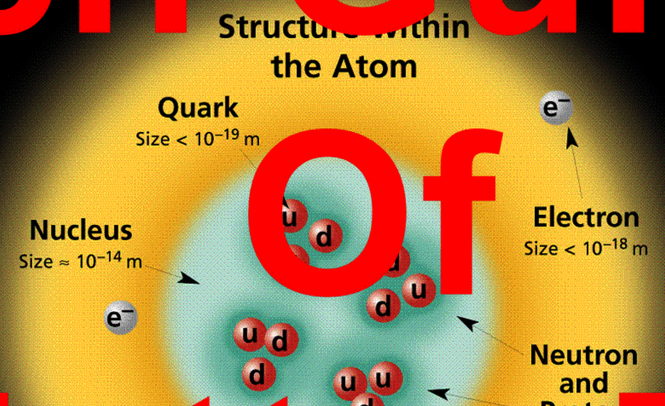
Quarks spin = 1/2

Flavor	Approx. Mass GeV/c^2	Electric charge
u up	0.003	2/3
d down	0.006	–1/3
c charm	1.3	2/3
s strange	0.1	–1/3
t top	175	2/3
b bottom	4.3	–1/3

Spin is the intrinsic angular momentum of particles. Spin is given in units of $\hbar$, which is the quantum unit of angular momentum, where $\hbar = h/2\pi = 6.58\times10^{-25}$ GeV s $= 1.05\times10^{-34}$ J s.

Electric charges are given in units of the proton's charge. In SI units the electric charge of the proton is 1.60×10^{-19} coulombs.

The **energy** unit of particle physics is the electronvolt (eV), the energy gained by one electron in crossing a potential difference of one volt. **Masses** are given in GeV/c^2 (remember $E = mc^2$), where 1 GeV = 10^9 eV = 1.60×10^{-10} joule. The mass of the proton is 0.938 GeV/c^2 = 1.67×10^{-27} kg.



BOSONS force carriers spin = 0, 1, 2, ...

Unified Electroweak spin = 1

Name	Mass GeV/c^2	Electric charge
γ photon	0	0
W^-	80.4	–1
W^+	80.4	+1
Z^0	91.187	0

Strong (QCD) spin = 1

Name	Mass GeV/c^2	Electric charge
g gluon	0	0

Color Charge
Each quark carries one of three types of "strong charge," also called "color charge." These charges have nothing to do with the colors of visible light. There are eight possible types of color charge for gluons. Just as electrically-charged particles interact by exchanging photons, in strong interactions color-charged particles interact by exchanging gluons. Leptons, photons, and ***W*** and ***Z*** bosons have no strong interactions and hence no color charge.

Quarks Confined in Mesons and Baryons
Quarks and gluons, they are confined in color-neutral particles called **hadrons**. The confinement (color) results from multiple exchanges of gluons among the color-charged constituents. As color-charged particles (quarks and gluons) separate apart, the energy in the color field between them increases. This energy eventually is converted into additional quark-antiquark pairs (see below). The quarks and antiquarks then combine into hadrons; these are the particles seen to emerge. Two types of hadrons have been observed in nature: **mesons** $q\bar{q}$ and **baryons** qqq.

Residual Strong Interaction
The strong binding of color-neutral protons and neutrons to form nuclei is due to residual strong interactions between their color-charged constituents. It is similar to the residual electrical interaction that binds electrically neutral atoms to form molecules. It can also be viewed as the exchange of mesons between the hadrons.

PROPERTIES OF THE INTERACTIONS

Property \ Interaction	Gravitational	Weak (Electroweak)	Electromagnetic (Electroweak)	Strong: Fundamental	Strong: Residual
Acts on:	Mass – Energy	Flavor	Electric Charge	Color Charge	See Residual Strong Interaction Note
Participating:		Quarks, Leptons	Electrically charged	Quarks, Gluons	Hadrons
Particles mediating:	Graviton (not yet observed)	W^- W^+ Z^0	γ	Gluons	Mesons
Strength relative to electromag for two u quarks at	10^{-41}	0.8 10^{-4}	1	25 60	Not applicable to quarks
for two protons in nucleus	10^{-36}	10^{-7}	1	Not applicable to hadrons	20

Baryons qqq and Antibaryons $\bar{q}\bar{q}\bar{q}$

Baryons are fermionic hadrons. There are about 120 types of baryons.

Symbol	Name	Quark content	Electric charge	Mass GeV/c^2	Spin
p	proton	uud	1	0.938	1/2
$\bar{p}$	anti-proton	$\bar{u}\bar{u}\bar{d}$	–1	0.938	1/2
n	neutron	udd	0	0.940	1/2
Λ	lambda	uds	0	1.116	1/2
Ω^-	omega	sss	–1	1.672	3/2

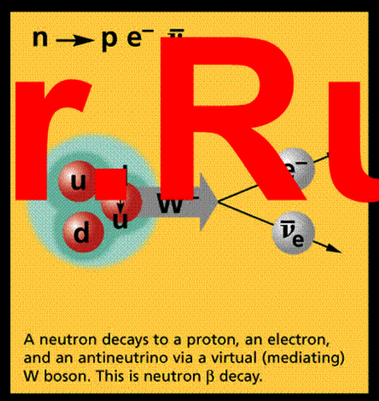
Mesons $q\bar{q}$

Mesons are bosonic hadrons. There are about 140 types of mesons.

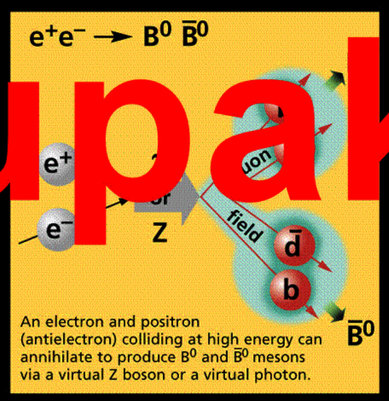
Symbol	Name	Quark content	Electric charge	Mass GeV/c^2	Spin
π^+	pion	$u\bar{d}$	+1	0.140	0
K^-	kaon	$s\bar{u}$	–1	0.494	0
ρ^+	rho	$u\bar{d}$	+1	0.770	1
B^0	B-zero	$d\bar{b}$	0	5.279	0
η_c	eta-c	$c\bar{c}$	0	2 .980	0

Matter and Antimatter
For every particle type there is a corresponding antiparticle, denoted by a bar over the particle symbol (unless it is + or – charge itself). Particle and antiparticle have identical mass and spin but opposite charges. Some electrically neutral bosons (e.g., Z^0, γ, and $c\bar{c}$, but $K^0 = d\bar{s}$) are their own antiparticles.

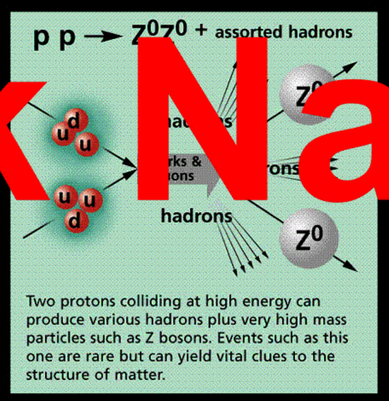
Figures
These diagrams are an artist's conception of physical processes. They are ***not*** exact and have ***no*** meaningful scale. Green shaded areas represent the cloud of gluons or the gluon field, and red lines the quark paths.



A neutron decays to a proton, an electron, and an antineutrino via a virtual (mediating) W boson. This is neutron β decay.



An electron and positron (antielectron) colliding at high energy can annihilate to produce B^0 and $\bar{B}^0$ mesons via a virtual Z boson or a virtual photon.



Two protons colliding at high energy can produce various hadrons plus very high mass particles such as Z bosons. Events such as this one are rare but can yield vital clues to the structure of matter.

The Particle Adventure
Visit the award-winning web feature *The Particle Adventure* at particleadventure.org

This chart has been made possible by the generous support of:
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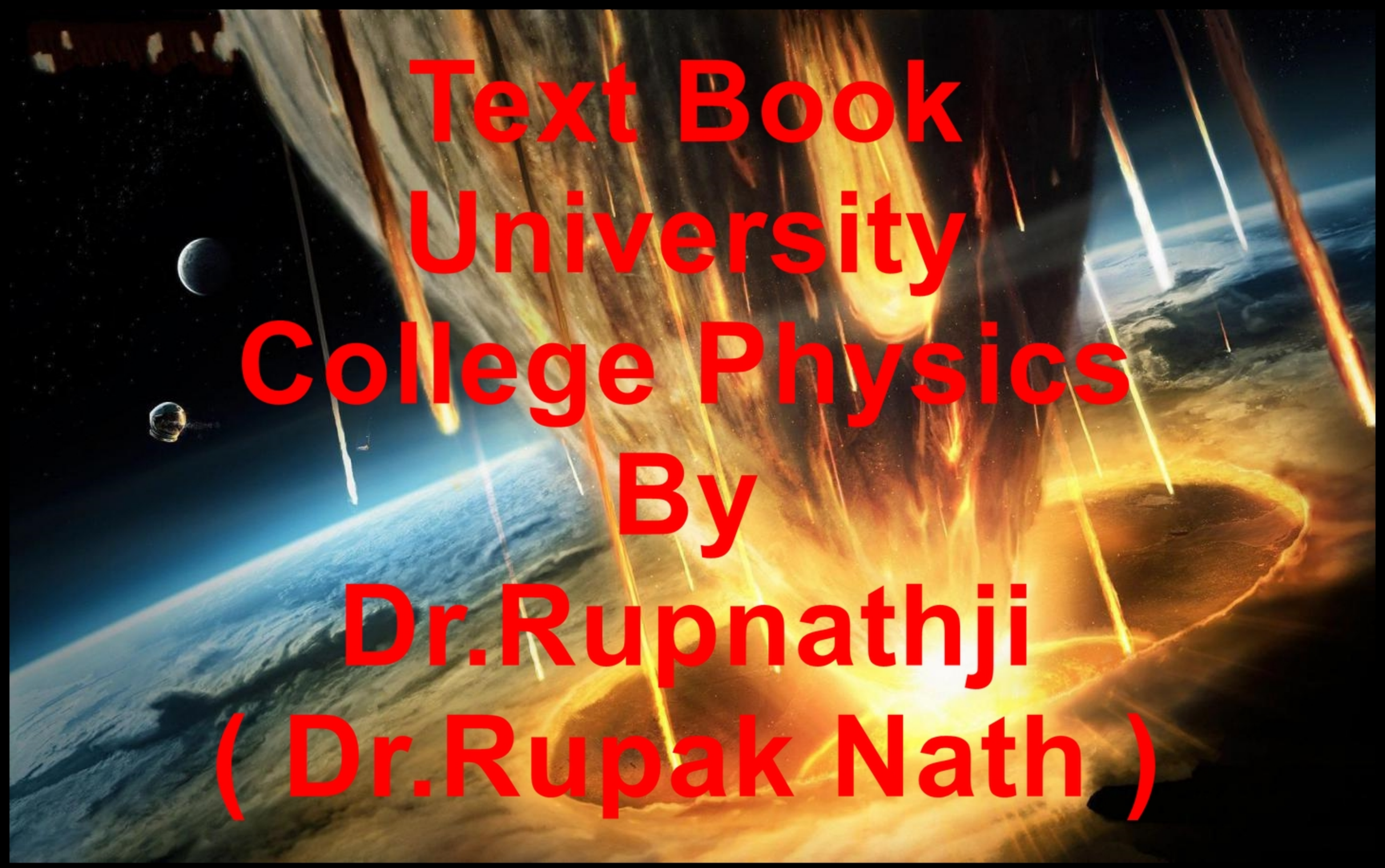
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TOP QUARK

DOWN QUARK

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MUON NEUTRINO

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MUON

TAU

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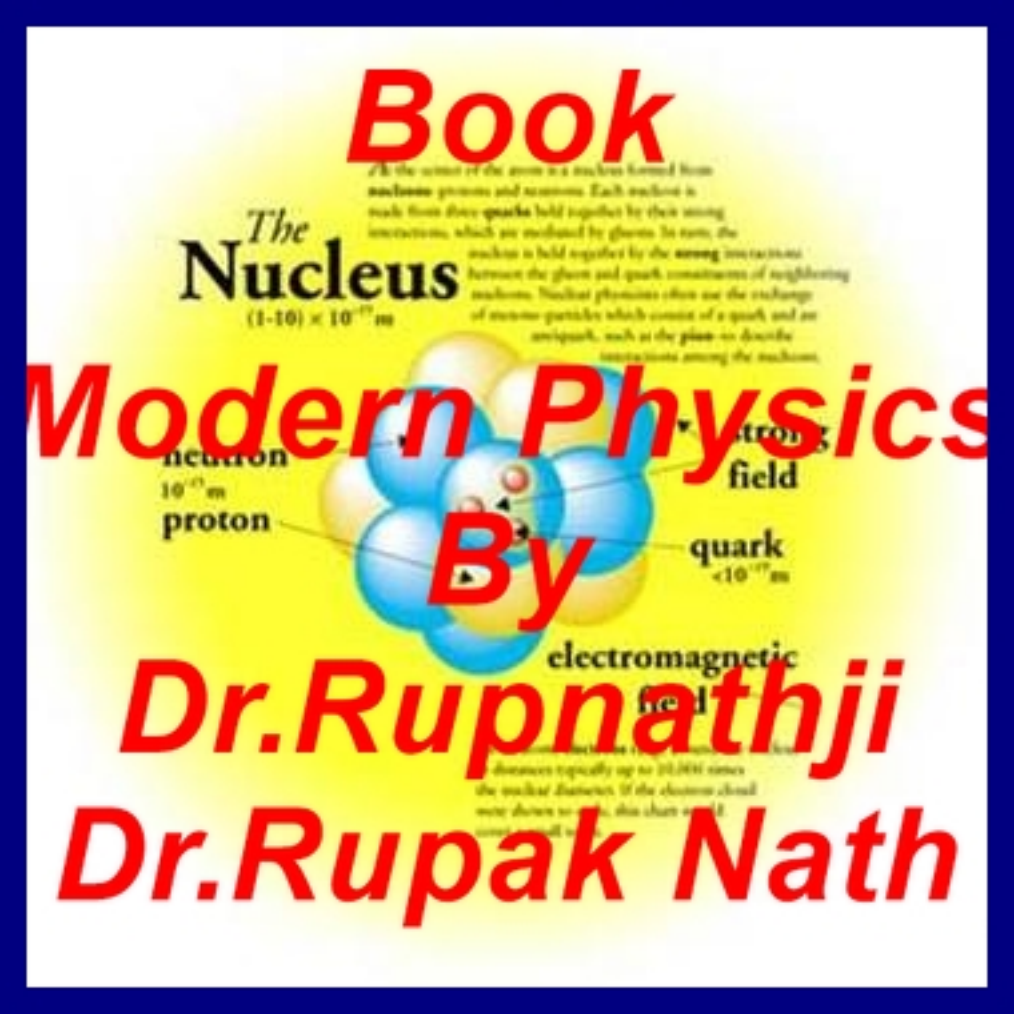
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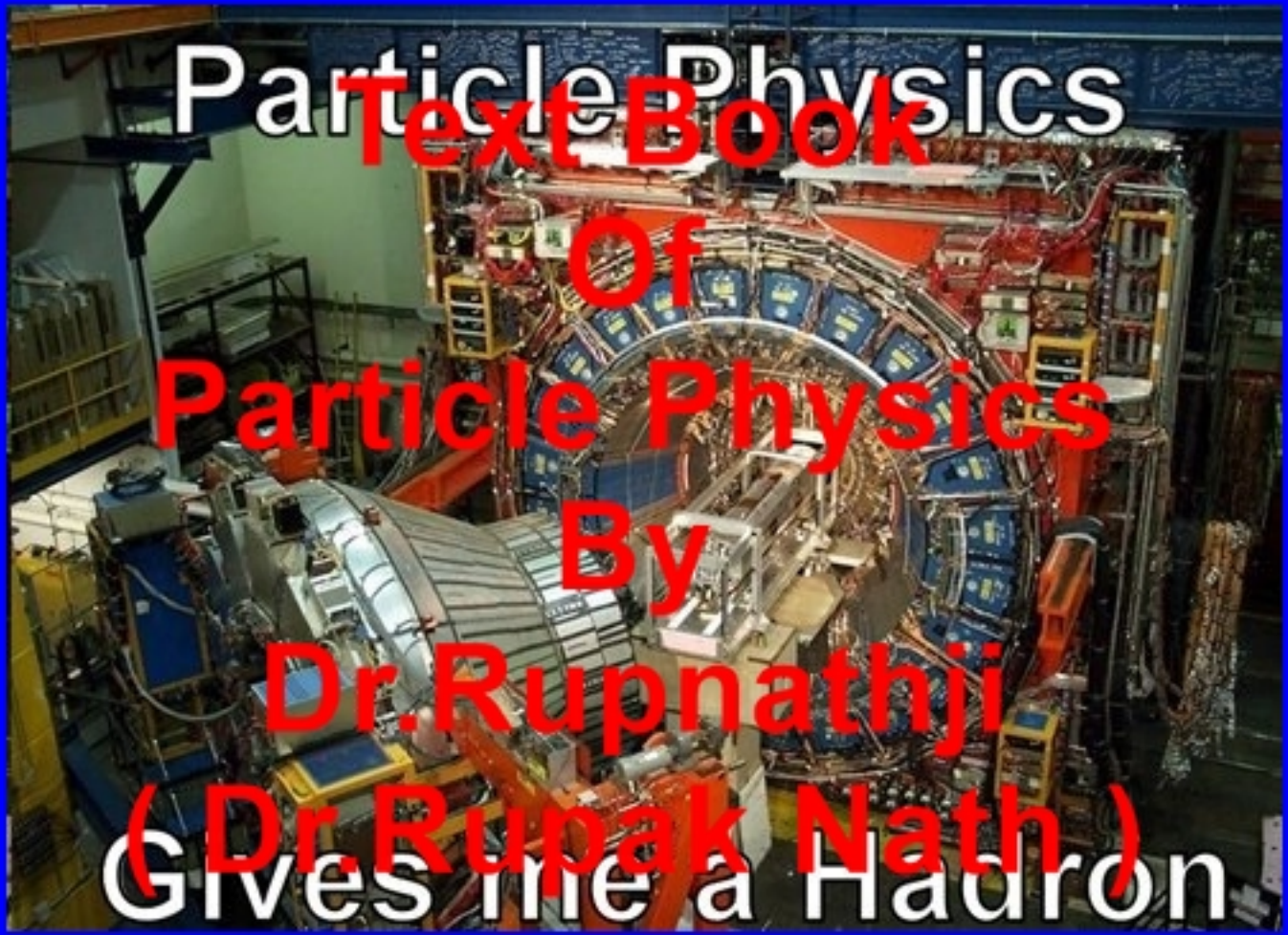
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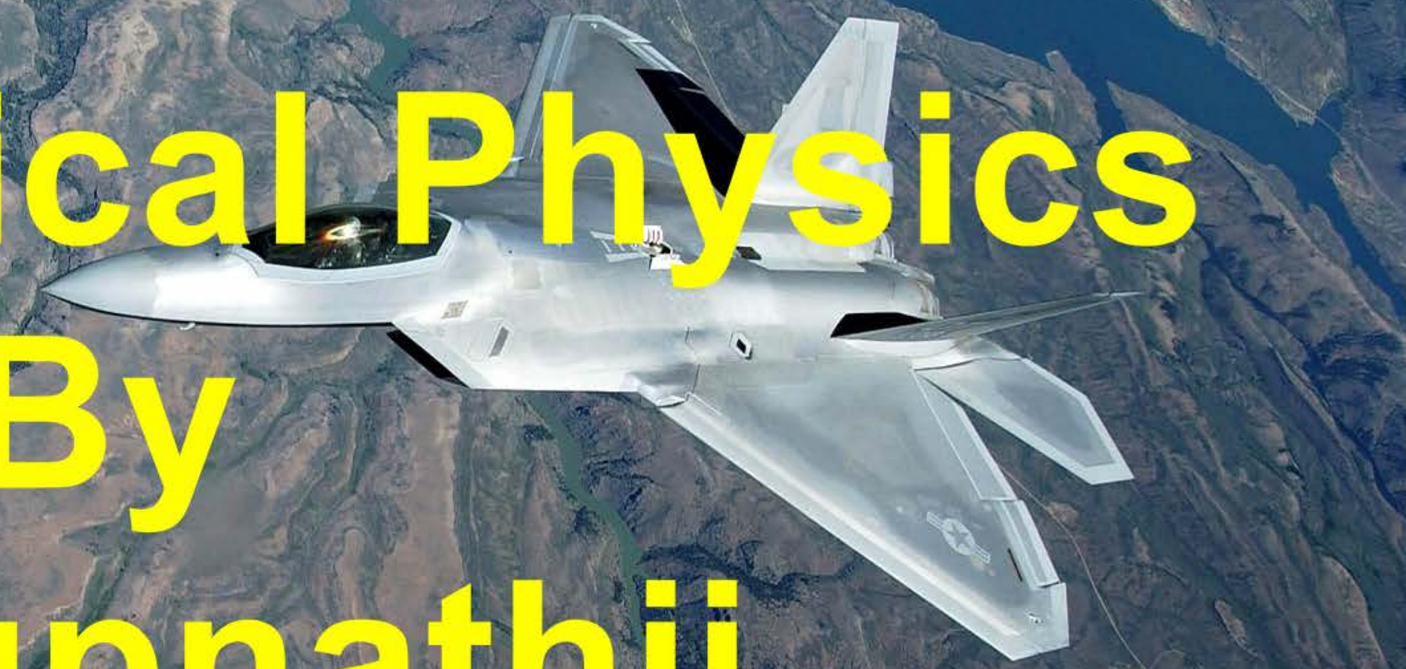

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