the infinity puzzle quantum field theory and the hunt for an orderly universe

#quantum field theory #infinity puzzle physics #theoretical physics concepts #renormalization group #quest for cosmic order

Unravel the profound 'infinity puzzle' at the heart of quantum field theory, and join the historic scientific quest for an orderly universe. This deep dive explores how theoretical physicists confront fundamental challenges, from the intricacies of particle physics to groundbreaking concepts like renormalization, as they strive to reconcile our understanding of the cosmos and reveal its underlying structure.

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The Electroweak Theory
Peter Higgs
The Heart of Matter
Neutrino
Peterborough Cathedral
Hidden Symmetry
The Multiverse
The Higgs Mechanism
The Particle Data Tables
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Cartoons the Large Hadron Collider
Complete Quantum Theory
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The standard model
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The Fireball of the Big Bang
What quantum field are we seeing here?
Meanwhile, back on Earth
Ideas of unification
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PATH
PRINCIPLE OF LEAST ACTION
PROBABILITY AMPLITUDE
ADD UP ALL POSSIBLE HISTORIES OF QUANTUM FIELDS
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Introduction
The Fifth Dimension
A Theory of Strings
Visualizing The Invisible (Calabi-yau Manifolds)
Where Are The Hidden Dimensions?
Hunting For Evidence At The Beginning Of Time
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Einstein’s most important equation
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The two kinds of relativity
Why is it the geometry of spacetime that matters?
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Interstellar and time and space twisting
The Riemann tensor
A physical theory of gravity
How to solve Einstein’s equation
Using the equation to make predictions
How its been used to find black holes
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STRONG FORCE
ASYMPTOTIC FREEDOM
HOW CAN WE TEST THE THEORY?
FEYNMAN PATH INTEGRAL
MONTE CARLO SAMPLING
KORNHABER BROWN
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Intro
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Mass as a Direction
Mass as Energy
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Introduction
The Impossible Lights
Our Quasar
The Infernal Engine
The Quasar Mystery
Quantum Field Theory and the Limits of Knowledge - Sean Carroll - 12/7/22 - Quantum Field Theory and the Limits of Knowledge - Sean Carroll - 12/7/22 by caltech 26,003 views 10 months ago 1 hour, 7 minutes - Learn more about the series: www.tauceti.caltech.edu/kunal/consciousness-and-reality-colloquium-series ©2022 California ...
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Visualization of Quantum Physics
Free Particle
The Observer Effect
Velocity
Uncertainty Principle
Momentum and Units of Measurement
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Particles are excitations in Fields
How Mass comes from interaction with Higgs
Why do some particles interact and others don't?
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Scalar Field
The Graviton
Bicep Experiment
Quantum Field Theory visualized - Quantum Field Theory visualized by ScienceClic English 1,887,019 views 3 years ago 15 minutes - How to reconcile relativity with **quantum mechanics**, ? What is spin ? Where does the electric charge come from ? All these ...
Introduction
Field and spin
Conserved quantities
Quantum field
Standard model
Interactions
Conclusion
What Is (Almost) Everything Made Of? - What Is (Almost) Everything Made Of? by History of the Universe 1,509,184 views 2 months ago 1 hour, 25 minutes - Galaxies, space videos from NASA, ESA and ESO. Music from Epidemic Sound, Artlist, Silver Maple And Yehezkel Raz.
Introduction
Rise Of The Field
The Quantum Atom
Quantum Electrodynamics
Quantum Flavordynamics
Quantum Chromodynamics
Quantum Gravity
Quantum Fields: The Most Beautiful Theory in Physics! - Quantum Fields: The Most Beautiful Theory in Physics! by Arvin Ash 833,157 views 1 year ago 14 minutes, 31 seconds - CHAPTERS: 0:00 - Historical perspective of modern physics 1:50 - The advent of **Quantum Mechanics**, 5:00 - The problems with ...
Historical perspective of modern physics
The advent of Quantum Mechanics
The problems with quantum mechanics
What is Quantum Field Theory?
How QFT explains force mediation and decay
How QFT is also incomplete
The most beautiful theory in the universe!
Further study with Brilliant
Solving the Impossible in Quantum Field Theory - Solving the Impossible in Quantum Field Theory by PBS Space Time 977,746 views 6 years ago 15 minutes - The equations of **quantum field theory**, allow us to calculate the behaviour of subatomic particles by expressing them as vibrations ...
DIRAC EQUATION
PERTURBATION THEORY
SELF ENERGY
Particles, Fields and The Future of Physics - A Lecture by Sean Carroll - Particles, Fields and The Future of Physics - A Lecture by Sean Carroll by Fermilab 1,733,443 views 10 years ago 1 hour, 37 minutes - Sean Carroll of CalTech speaks at the 2013 Fermilab Users Meeting. Audio starts at 19 sec, Lecture starts at 2:00.
Intro
PARTICLES, FIELDS, AND THE FUTURE OF PHYSICS
July 4, 2012: CERN, Geneva
three particles, three forces
four particles (x three generations), four forces
19th Century matter is made of particles, forces are carried by fields filling space.
Quantum mechanics: what we observe can be very different from what actually exists.
Energy required to get field vibrating - mass of particle. Couplings between different fields = particle interactions.
Journey to the Higgs boson. Puzzle: Why do nuclear forces have such a short range, while electro-magnetism & gravity extend over long distances?

Two very different answers for the strong and weak nuclear forces.
Secret of the weak interactions: The Higgs field is nonzero even in empty space.
Bonus! Elementary particles like electrons & quarks gain mass from the surrounding Higgs field. (Not protons.) Without Higgs
How to look for new particles/fields? Quantum field theory suggests two strategies: go to high energies, or look for very small effects.
The Energy Frontier Tevatron & the Large Hadron Collider
Smash protons together at emormous energies. Sift through the rubble for treasure.
$9 billion plots number of collisions producing two photons at a fixed energy
Bittersweet reality Laws of physics underlying the experiences of our everyday lives are completely known
Here at Fermilab: pushing the Intensity Frontier forward Example: the Muong-2 Experiment.
Brookhaven National Lab on Long Island has a wonderful muon storage ring. But Brookhaven can't match the luminosity Fermilab could provide.
Long-term goal for worldwide particle physics: International Linear Collider
QFT: What is the universe really made of? Quantum Field Theory visualized - QFT: What is the universe really made of? Quantum Field Theory visualized by Arvin Ash 1,013,054 views 4 years ago 14 minutes, 57 seconds - Many thanks and shout-out to David Tong's lecture on **Quantum Fields**, for inspiring this video. I highly recommend his free lecture ...
QM in tadpole-Frog metamorphosis
Excitations of four fields are visible
Standard Model of Elementary Particles
Electron Field
Sidney Coleman (Harvard) - Quantum Field Theory lecture 01 [1975] - Sidney Coleman (Harvard) - Quantum Field Theory lecture 01 [1975] by Graduate Mathematics 69,686 views 8 years ago 1 hour, 35 minutes - Physics 253: **Quantum Field Theory**, Lectures by Sidney R. Coleman Recorded in 1975-1976. Full Playlist available here: ...
Relativistic Quantum Mechanics
Four Vectors
Metric Tensor
Einstein Summation Convention
Operation of Lowering Indices
The Inverse Matrix of the Metric Tensor
Lorentz Transformations
Differentiation and Integration
Derivative Operator
Dalembert Operator
The Four Dimensional Delta Function
Fourier Theorem
The Theta Function
Example of a Relativistic Quantum System
What Is Rotational Invariance
Rotation Operator
Rotational Invariance
Multiplication Rule for How To Multiply Rotations and Translations
Unitarity
Changing the Phases
Angular Part of the Integral
Angular Integrals
The discovery of the Higgs boson - The discovery of the Higgs boson by Oxford Academic (Oxford University Press) 324 views 11 years ago 1 minute, 59 seconds - Author Frank Close discusses the 2012 discovery of the Higgs boson. http://ukcatalogue.oup.com/product/9780199593507.do.
Sean Carroll - The Particle at the End of the Universe - Sean Carroll - The Particle at the End of the Universe by The Royal Institution 1,756,427 views 11 years ago 58 minutes - It was the **universe's**, most elusive particle, the linchpin for everything scientists dreamed up to explain how stuff works. It had to be ...
Introduction
Democritus
The Magnet

Gravity
Nuclear Forces
Strong and Weak Nuclear Forces
The Higgs Field
No Higgs Field
The Large Hadron Collider
Parenthetical
Large Hadron Collider
CMS ATLAS
Higgs Boson
New Particle
HiggsBoson
Supersymmetry
Conclusion
Frank Close: "The Infinity Puzzle: from Abdus Salam to the Higgs boson" - Frank Close: "The Infinity Puzzle: from Abdus Salam to the Higgs boson" by Scuola Internazionale Superiore di Studi Avanzati 3,259 views 11 years ago 1 hour, 1 minute - The English scientist Frank Close told a fifty-year history of physics in a public lecture at the International School for Advanced ...
Intro
Time Magazine
Nomination
Message
No Higgs
No Chemistry
Peter Higgs
Size of the enterprise
Geiger Rutherford
Electromagnetic in the Weak
Transit of Venus
The Sun
Electroweak force
The trick
The Nobel Prize
Gang of Six
Three Faces
Electromagnetic Force
Dyson Schwinger
Shelley Glazier
John Ward
Lewis Johnson
Guralnik
How for became free
Anderson
Massless photons
Plasma excited
Electroweak plasma
Buridan
Goldstone
Asymmetry
Electric charge
Rotational modes
Who gets credits
Jeffrey Goldstone
The boson
Walter Gilbert
Blair
Kibble
Weinberg in 1967
He was wrong

Why manuscripts carry messages
Higgs is name
The Gang of Six
Higgs is correct
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of the universe. In The Infinity Puzzle: Quantum Field Theory and the Hunt for an Orderly Universe (2013), Close focuses on the discovery of the mass... 14 KB (1,272 words) - 22:30, 9 November 2023
1016/0550-3213(75)90215-1. Close, Frank (2011). The Infinity Puzzle: Quantum field theory and the hunt for an orderly universe. Oxford, UK: Oxford University Press... 55 KB (6,686 words) - 21:18, 21 February 2024
from the original on 25 January 2022. Retrieved 28 December 2011. Close, Frank (2011). The Infinity Puzzle: Quantum Field Theory and the Hunt for an Orderly... 239 KB (26,216 words) - 16:38, 7 March 2024
28 December 2011. Close, F. (2011). The Infinity Puzzle: Quantum Field Theory and the Hunt for an Orderly Universe. Oxford University Press. ISBN 978-0-19-959350-7... 36 KB (4,026 words) - 00:08, 4 January 2024
beginning of the universe. The violation could help explain why matter is now far more abundant than antimatter. Quantum loop theory: the Italian theoretical... 237 KB (25,903 words) - 01:49, 26 February 2024