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What you need to know before learning
Why you should learn Differential Geometry
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49:33 - Resources
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Langlands, and All That - Edward Witten by Viktór 22,447 views 3 years ago 1 hour, 5 minutes - 22/03/2018 Conference: **Gauge Theory**,, Geometric Langlands and Vertex Operator Algebras - 03.22.2018 - 03.24.2018 Perimeter ...
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Two Dimensional Defects
TwoDimensional Defects
GeometricLanglands
Boundary Conditions
Universal Boundary Conditions
What are Geometric Langlands
Principle Embedding
Dual Boundary Conditions
Nonclassical Boundary Conditions
SuperConformal Field Theories
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Introduction
Experimental vs Theoretical Physics
Theoretical Physics Job
Research
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Mathematics
Theory Development
Conclusion
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What is symmetry?
Intro to Group Theory
Noether's Theorem
U(1) symmetry simplified
Dirac equation transformation
How QED comes from U(1) symmetry
U(1) SU(2) SU(3) explained simply
Symmetry is the foundation of the universe
Further study on Wondrium
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Intro

Gauge Theory
Schrodinger Equation
Wave Function
Local Phase Shift
Momentum Operator
Electromagnetic Field
Gauge Symmetries
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Quarks and Leptons
Leptonic Tensor
Hadronic Tensor
My Understanding of the Manifold Hypothesis - structure in real world data - Generative Modeling - My Understanding of the Manifold Hypothesis - structure in real world data - Generative Modeling by Kartik Chincholikar 28,631 views 3 years ago 6 minutes, 29 seconds - If you think I've misunderstood something, please let me know in the comments! Below is the mash up of quotes which motivate ...
Not smooth
Anime-Girl Manifold
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What is a manifold? - What is a manifold? by GeometryForPhysicists 191,994 views 8 years ago 3 minutes, 51 seconds - A visual explanation and definition of manifolds are given. This includes motivations for topology, Hausdorffness and ...
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Good physicists were good mathematicians
Mechanics
Philosophy of mechanics
Electromagnetism and multivariable calculus
Quantum mechanics
General relativity and geometry
Particle physics and group theory
Particle Physics 5: Basic Introduction to Gauge Theory, Symmetry & Higgs - Particle Physics 5: Basic Introduction to Gauge Theory, Symmetry & Higgs by DrPhysicsA 205,306 views 10 years ago 59 minutes - Part 5 of a series: covering Guage **Theory**,, Symmetry and the Higgs.
Introduction
Electromagnetic Force
Weak Nuclear Force
Proton to Neutron
Strong Nuclear Force
Gauge Theory
Symmetry Breaking
Experimental Fact
Potential Energy
The Four Forces
quark confinement
time
Geometry of Mathematical Physics - Lecture 22 - Geometry of Mathematical Physics - Lecture 22 by Stefano Cremonesi 305 views 2 years ago 51 minutes - 0:24 5.3 **Gauge**, symmetry and **gauge**, fixing 19:56 Examples 31:00 5.4 U(1) Wilson line and Wilson loop.
5.3 Gauge symmetry and gauge fixing

Examples
5.4 U(1) Wilson line and Wilson loop
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Do I need to study real analysis?
Differential geometry without topology (Book suggestion)
Road to differential geometry (Extending Pythagoras' theorem)
Generalization of the Pythagoras' theorem, metric and coordinates
Other coordinate systems
Exterior calculus & Differentiable form
Tensor calculus
Quadric surfaces
Change of coordinate system
Vector algebra, Geometric algebra, Geometric calculus
Geometry of surfaces
Riemannian geometry
Summary and recap
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Flavor Symmetry
Global Symmetry
Parallel Transport the Quarks
Forces of Nature
Strong Force
Gluon Field
Weak Interactions
Gravity
The Gauge Group

Lorentz Group
Kinetic Energy
The Riemann Curvature Tensor
Electron Field Potential Energy
- this Gives Mass to the Electron X Squared or Phi Squared or Size Squared Is Where the Is the Term in the Lagrangian That Corresponds to the Mass of the Corresponding Field Okay There's a Longer Story Here with the Weak Interactions Etc but this Is the Thing You Can Write Down in Quantum Electrodynamics There's no Problem with Electrons Being Massive Generally the Rule in Quantum Field Theory Is if There's Nothing if There's no Symmetry or Principle That Prevents Something from Happening Then It Happens Okay so if the Electron Were Massless You'D Expect There To Be some Symmetry That Prevented It from Getting a Mass
Point Is that Reason Why I'M for this Is a Little Bit of Detail Here I Know but the Reason Why I Wanted To Go over It Is You Get a Immediate Very Powerful Physical Implication of this Gauge Symmetry Okay We Could Write Down Determine the Lagrangian That Coupled a Single Photon to an Electron and a Positron We Could Not Write Down in a Gauge Invariant Way a Term the Coupled a Single Photon to Two Electrons All by Themselves Two Electrons All by Themselves Would Have Been this Thing and that Is Forbidden Okay So Gauge Invariance the Demand of All the Terms in Your Lagrangian Being Gauge Invariant Is Enforcing the Conservation of Electric Charge Gauge Invariance Is the Thing That Says that if You Start with a Neutral Particle like the Photon
There Exists Ways of Having Gauge Theory Symmetries Gauge Symmetries That Can Separately Rotate Things at Different Points in Space the Price You Pay or if You Like the Benefit You Get There's a New Field You Need the Connection and that Connection Gives Rise to a Force of Nature Second Thing Is You Can Calculate the Curvature of that Connection and Use that To Define the Kinetic Energy of the Connection Field so the Lagrangian the Equations of Motion if You Like for the Connection Field Itself Is Strongly Constrained Just by Gauge Invariance and You Use the Curvature To Get There Third You Can Also Constrain the the Lagrangian Associated with the Matter Feels with the the Electrons or the Equivalent
So You CanNot Write Down a Mass Term for the Photon There's no There's no Equivalent of Taking the Complex Conjugate To Get Rid of It because It Transforms in a Different Way under the Gauge Transformation so that's It that's the Correct Result from this the Answer Is Gauge Bosons as We Call Them the Particles That Correspond to the Connection Field That Comes from the Gauge Symmetry Are Massless that Is a Result of Gauge Invariance Okay That's Why the Photon Is Massless You'Ve Been Wondering since We Started Talking about Photons Why Are Photons Massless Why Can't They Have a Mass this Is Why because Photons Are the Gauge Bosons of Symmetry
The Problem with this Is that It Doesn't Seem To Hold True for the Weak and Strong Nuclear Forces the Nuclear Forces Are Short-Range They Are Not Proportional to 1 over R Squared There's no Coulomb Law for the Strong Force or for the Weak Force and in the 1950s Everyone Knew this Stuff like this Is the Story I'Ve Just Told You Was Know You Know When Yang-Mills Proposed Yang-Mills Theories this We Thought We Understood Magnetism in the 1950s Qed Right Quantum Electrodynamics We Thought We Understood Gravity At Least Classically General Relativity the Strong and Weak Nuclear Forces
Everyone Could Instantly Say Well that Would Give Rise to Massless Bosons and We Haven't Observed those That Would Give Rise to Long-Range Forces and the Strong Weak Nuclear Forces Are Not Long-Range What Is Going On Well Something Is Going On in both the Strong Nuclear Force and the Weak Nuclear Force and Again because of the Theorem That Says Things Need To Be As Complicated as Possible What's Going On in those Two Cases Is Completely Different so We Have To Examine in Different Ways the Strong Nuclear Force and the Weak Nuclear Force
The Reason Why the Proton Is a Is About 1 Gev and Mass Is because There Are Three Quarks in It and each Quark Is Surrounded by this Energy from Gluons up to about Point Three Gev and There Are Three of Them that's Where You Get that Mass Has Nothing To Do with the Mass of the Individual Quarks Themselves and What this Means Is as Synthetic Freedom Means as You Get to Higher Energies the Interaction Goes Away You Get the Lower Energies the Interaction Becomes Stronger and Stronger and What that Means Is Confinement so Quarks if You Have Two Quarks if You Just Simplify Your Life and Just Imagine There Are Two Quarks Interacting with each Other
So When You Try To Pull Apart a Quark Two Quarks To Get Individual Quarks Out There All by Themselves It Will Never Happen Literally Never Happen It's Not that You Haven't Tried Hard Enough You Pull Them Apart It's like Pulling a Rubber Band Apart You Never Get Only One Ended Rubber Band You Just Split It in the Middle and You Get Two New Ends It's Much like the Magnetic Monopole Store You Cut a Magnet with the North and South Pole You Don't Get a North Pole All by Itself You

Get a North and a South Pole on both of Them so Confinement Is and this Is because as You Stretch Things Out Remember Longer Distances Is Lower Energies Lower Energies the Coupling Is Stronger and Stronger so You Never Get a Quark All by Itself and What that Means Is You Know Instead of this Nice Coulomb Force with Lines of Force Going Out You Might Think Well I Have a Quark
And Then What that Means Is that the Higgs Would Just Sit There at the Bottom and Everything Would Be Great the Symmetry Would Be Respected by Which We Mean You Could Rotate H1 and H2 into each Other Su 2 Rotations and that Field Value Would Be Unchanged It Would Not Do Anything by Doing that However that's Not How Nature Works That Ain't It That's Not What's Actually Happening So in Fact Let Me Erase this Thing Which Is Fine but I Can Do Better Here's What What Actually Happens You Again Are GonNa Do Field Space Oops That's Not Right
And this Is Just a Fact about How Nature Works You Know the Potential Energy for the Higgs Field Doesn't Look like this Drawing on the Left What It Looks like Is What We Call a Mexican Hat Potential I Do Not Know Why They Don't Just Call It a Sombrero Potential They Never Asked Me for some Reason Particle Physicists Like To Call this the Mexican Hat Potential Okay It's Symmetric Around Rotations with Respect to Rotations of H1 and H2 That's It Needs To Be Symmetric this this Rotation in this Direction Is the Su 2 Symmetry of the Weak Interaction
But Then It Would Have Fallen into the Brim of the Hat as the Universe Expanded and Cooled Down the Higgs Field Goes Down to the Bottom Where You Know Where along the Brim of the Hat Does It Live Doesn't Matter Completely Symmetric Right That's the Whole Point in Fact There's Literally no Difference between It Going to H1 or H2 or Anywhere in between You Can Always Do a Rotation so It Goes Wherever You Want the Point Is It Goes Somewhere Oops the Point Is It Goes Somewhere and that Breaks the Symmetry the Symmetry Is Still There since Symmetry Is Still Underlying the Dynamics of Everything
Geometry of Mathematical Physics - Lecture 21 - Geometry of Mathematical Physics - Lecture 21 by Stefano Cremonesi 749 views 2 years ago 41 minutes - Chapter 5. U(1) **gauge theory**, reloaded 0:55 5.1 - U(1) global symmetry 4:18 Remarks 10:10 5.2 - U(1) gauge symmetry 16:26 ...
5.1 - U(1) global symmetry
Remarks
5.2 - U(1) gauge symmetry
Remark 1
Remark 2
Remark 3
Remark 4
Remark 5
Remark 6
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What does the future hold for the general theory of relativity?
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