Project Review 2018: String Theory group

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MAX-PLANCK-GESELLSCHAFT

MPI, Dec 2018

String Theory Group

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Daniel Panea

Pouria Mazloumi

Riko Schadow

Benjamin Schulz

Max Brinkmann

Non-Geometric and Massive Supergravities

(Dieter Lüst, Felix Rudolph)

Super-gravities in 4-dimensions known for $N = 1,2,3,4,5,6,8$

Spin-four $\mathcal{N} = 7$ W-Supergravity:
S-fold and Double Copy Construction

Sergio Ferrara[a,b,c], Dieter Lüst[a,d,e]

Graviton is massive! Supersymmetry + massive and bi-metric gravity:

Bimetric, Conformal Supergravity and its Superstring Embedding

Sergio Ferrara[a,b,c], Alex Kehagias[d], Dieter Lüst[e,f]

Aspects of Weyl Supergravity

Sergio Ferrara[a,b,c], Alex Kehagias[d], Dieter Lüst[a,e,f]

Non-geometric metric structures:

A Unique Connection for Born Geometry

Laurent Freidel[*1], Felix J. Rudolph[†2], David Svoboda[*3]

L_∞- Algebras and Gauge Theories

(Ralph Blumenhagen, Dieter Lüst, Vladislav Kupriyanov)

Max Brinkmann, Matthias Traube

Gauge theories are based on Lie algebras $A_\mu = A_\mu^i t_i$

$$[t_i, t_j] = f_{ij}^k t_k$$

String Field Theories have a more general structure of L_∞-Algebras

$$[t_i, t_j, \ldots, t_s] \qquad \big[[t_i, t_j], t_k\big] + \big[[t_k, t_i], t_j\big] + \big[[t_j, t_k], t_i\big] \neq 0$$

On the Existence of an L_∞ structure for Classical Super $\mathcal{W}$-algebras

Ralph Blumenhagen and Max Brinkmann[1]

Bootstrapping Non-commutative Gauge Theories from L_∞ algebras

Ralph Blumenhagen[1], Ilka Brunner[2], Vladislav Kupriyanov[1,3,4], Dieter Lüst[1,2]

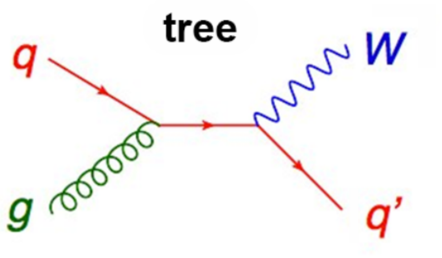
On the Uniqueness of L_∞ bootstrap: Quasi-isomorphisms are Seiberg-Witten Maps

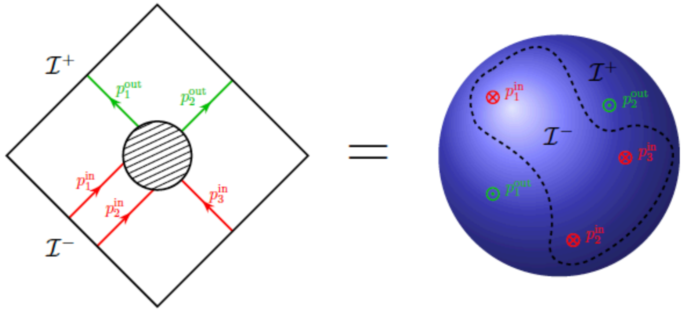
Ralph Blumenhagen[1], Max Brinkmann[1], Vladislav Kupriyanov[1,2,3], Matthias Traube[1]

Strings on Celestial Sphere

(Stephan Stieberger)

New way to write particle scattering amplitudes in Minkowski space in terms of correlators on the celestial sphere





Application of the techniques to String Theory scattering amplitudes

Strings on Celestial Sphere

Stephan Stieberger[a,b] , Tomasz R. Taylor[c,d]

Symmetries of Celestial Amplitudes

Stephan Stieberger[a] , Tomasz R. Taylor[b]

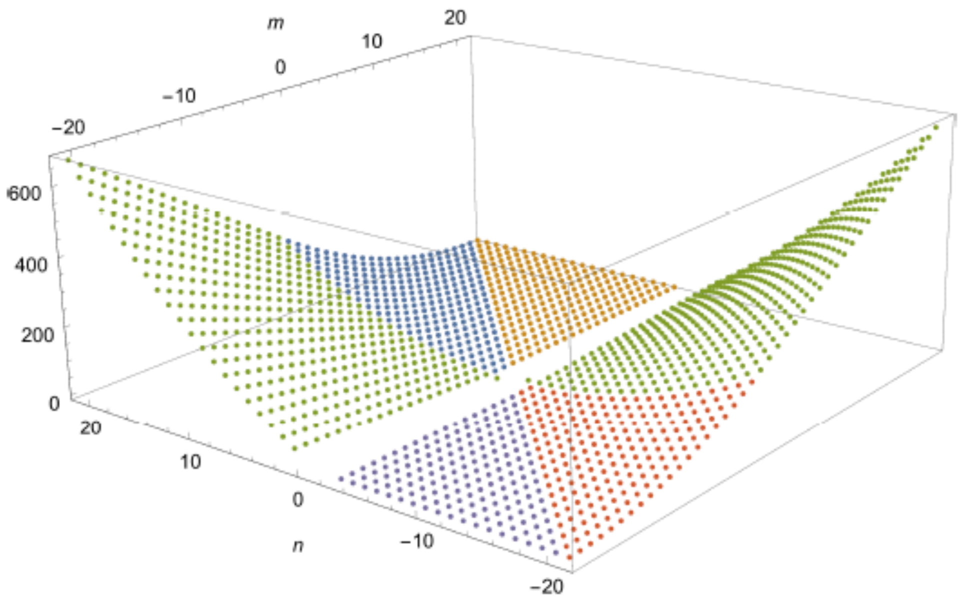
Machine Learning Geometry

Daniel Klaewer, Lorenz Schlechter

Machine Learning Line Bundle Cohomologies of Hypersurfaces in Toric Varieties

Daniel Klaewer, Lorenz Schlechter
Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, 80805, München, Germany

Supervised learning by computer to compute difficult algebraic geometric quantities, relevant for particle physics model building in string theory



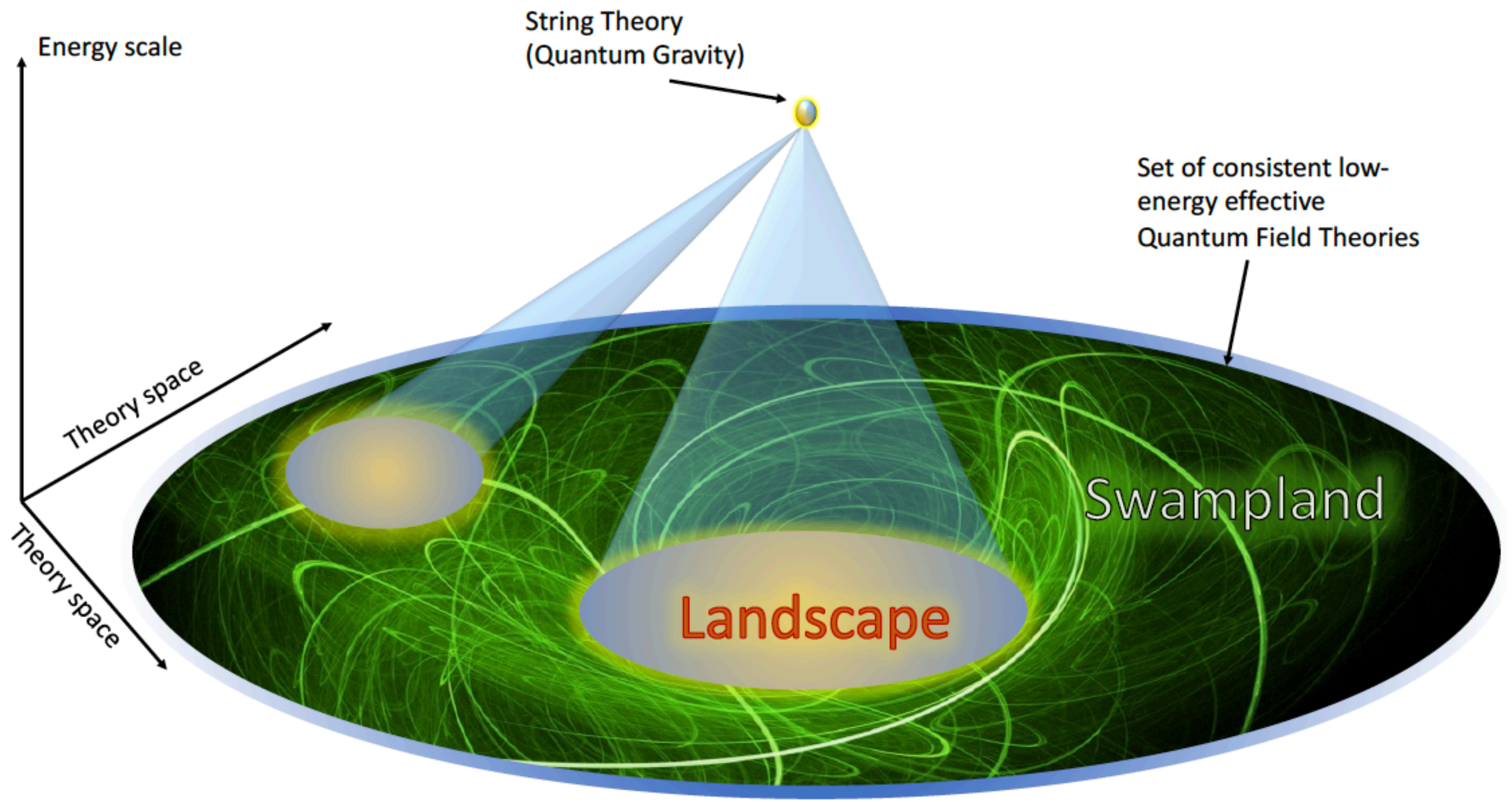
Heterotic Line Bundle Standard Models

Lara B. Anderson[1], James Gray[2], Andre Lukas[3], Eran Palti[4]

String Theory Swampland

(Dieter Lüst, Ralph Blumenhagen, Eran Palti)

Daniel Klaewer, Lorenz Schlechter, Florian Wolf



The String Theory Swampland has been a hot topic this year

De Sitter Space and the Swampland

Georges Obied (Harvard U., Phys. Dept.), Hirosi Ooguri (Caltech & Tokyo U., IPMU), Lev Spodyneiko (Caltech), Cumrun Vafa (Harvard U., Phys. Dept.). Jun 21, 2018. 21 pp.

CALT-TH-2018-020, IPMU18-0100
e-Print: arXiv:1806.08362 [hep-th] | PDF

References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
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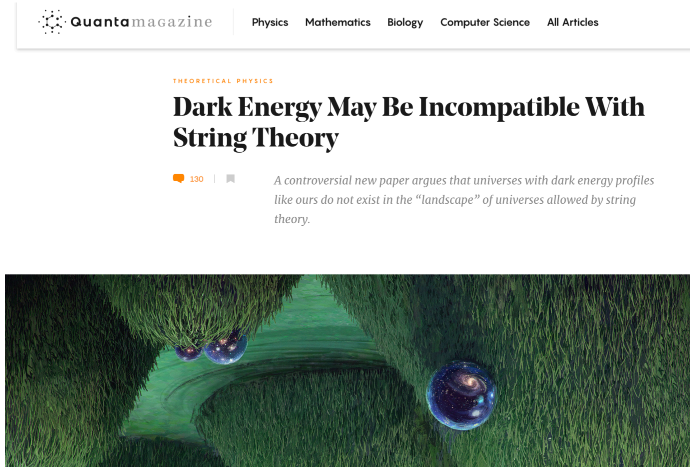
Verdacht eines Physikers

Ist es möglich, dass es unser Universum gar nicht gibt?

SPIEGEL+ Exklusiv für Abonnenten

Ein hochgeachteter Physiker der Harvard-Universität äußert eine verwegene Hypothese - und erschüttert damit die Fachwelt. *Von Johann Grolle*

31. August 2018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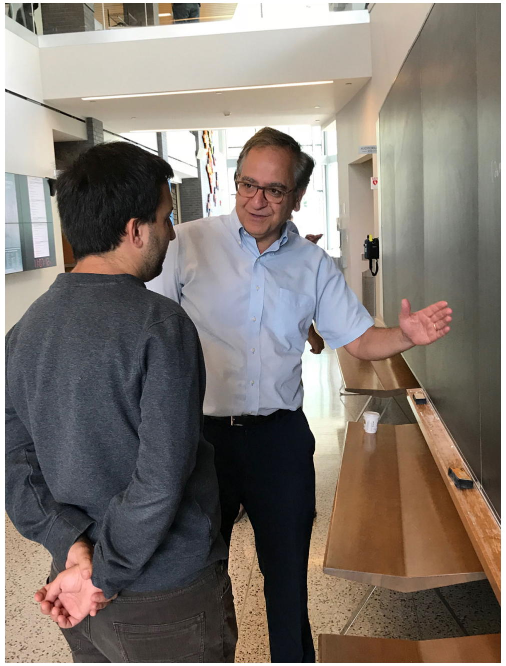
THEORETICAL PHYSICS

Dark Energy May Be Incompatible With String Theory

130

A controversial new paper argues that universes with dark energy profiles like ours do not exist in the "landscape" of universes allowed by string theory.

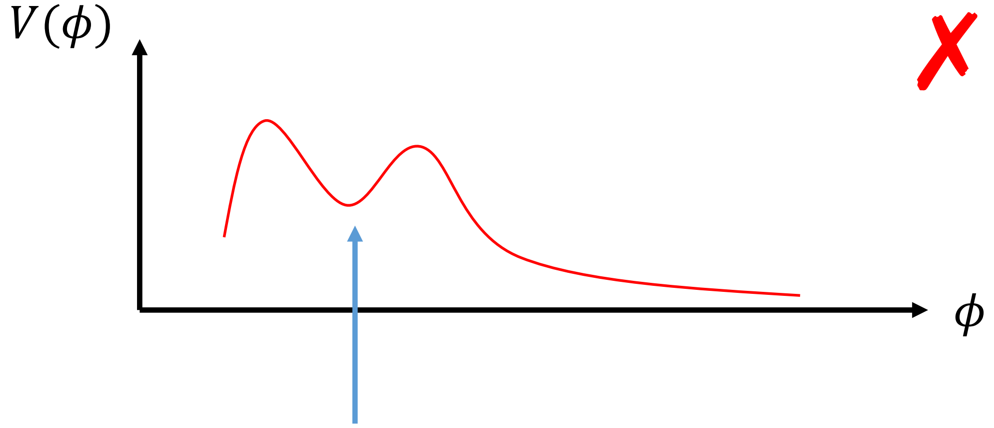


Distance and de Sitter Conjectures on the Swampland

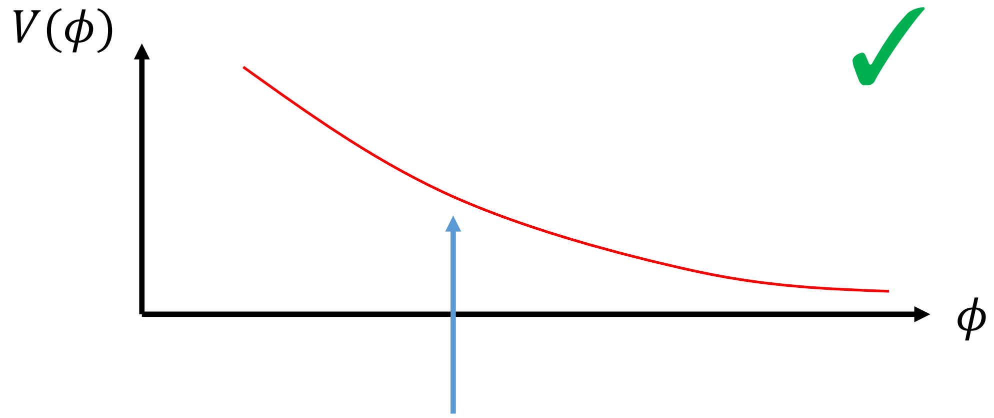
Hirosi Ooguri,[1,2] Eran Palti,[3] Gary Shiu,[4] and Cumrun Vafa[5]

The refined de Sitter conjecture*

$$|\nabla V(\phi)| > c\, V(\phi) \qquad \textbf{or} \qquad \min(\nabla_i \nabla_j V) \leq -\frac{c'}{M_p^2}\, V$$



Cosmological Constant



Dynamical Dark Energy
(quintessence)

*Arguments apply at weak coupling

Distance and de Sitter Conjectures on the Swampland

Hirosi Ooguri,[1,2] Eran Palti,[3] Gary Shiu,[4] and Cumrun Vafa[5]

Distance conjecture states that when a scalar field changes its expectation value by more than the Planck mass, an infinite tower of states becomes exponentially light

$$\Lambda \sim M_p e^{-\frac{\Delta\phi}{M_p}}$$

The Refined Swampland Distance Conjecture in Calabi-Yau Moduli Spaces

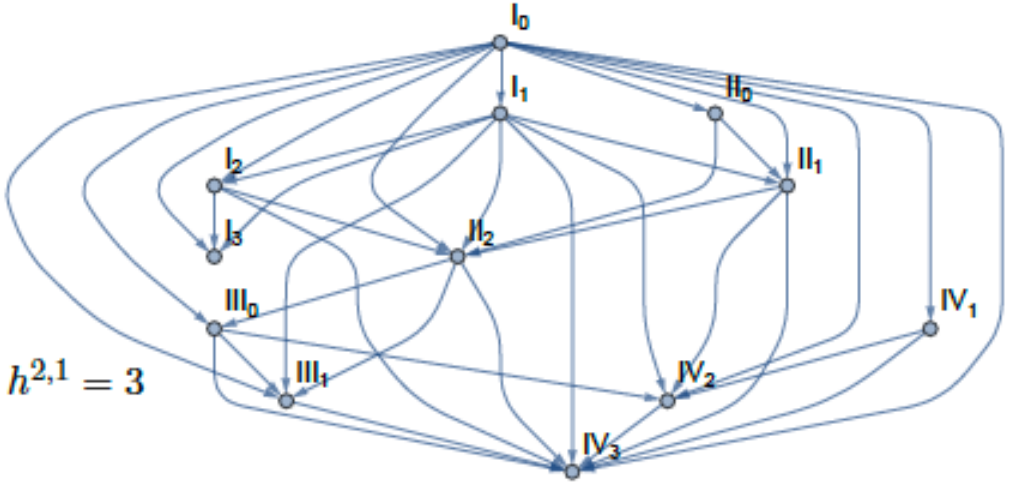
Ralph Blumenhagen[1], Daniel Klaewer[1], Lorenz Schlechter[2,1], Florian Wolf[1]

Infinite Distances in Field Space and Massless Towers of States

Thomas W. Grimm[1], Eran Palti[2], Irene Valenzuela[1]

Infinite Distance Networks in Field Space and Charge Orbits

Thomas W. Grimm[1], Chongchuo Li[1], Eran Palti[2]



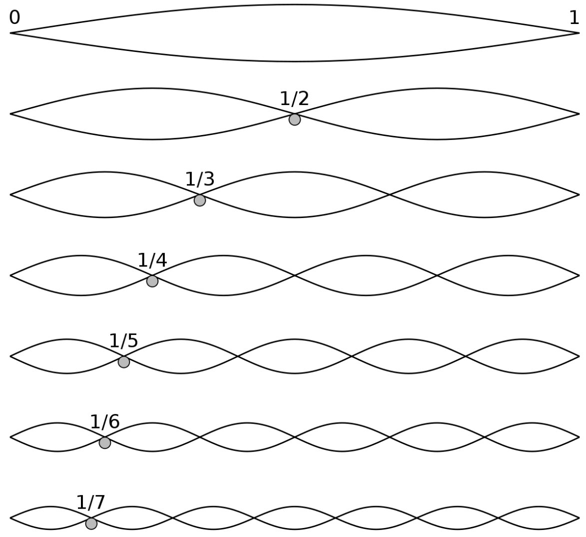
Most recently proposed a new Swampland Constraint

A Spin-2 Conjecture on the Swampland

Daniel Klaewer,[1] Dieter Lüst,[2,1] and Eran Palti[1]
[1] *Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, 80805, München, Germany*
[2] *Arnold-Sommerfeld-Center for Theoretical Physics, Ludwig-Maximilians-Universität, 80333 München, Germany*

A massive Spin-2 field, with mass m, and interaction scale M_w, coupled to gravity implies an infinite tower of states at the scale

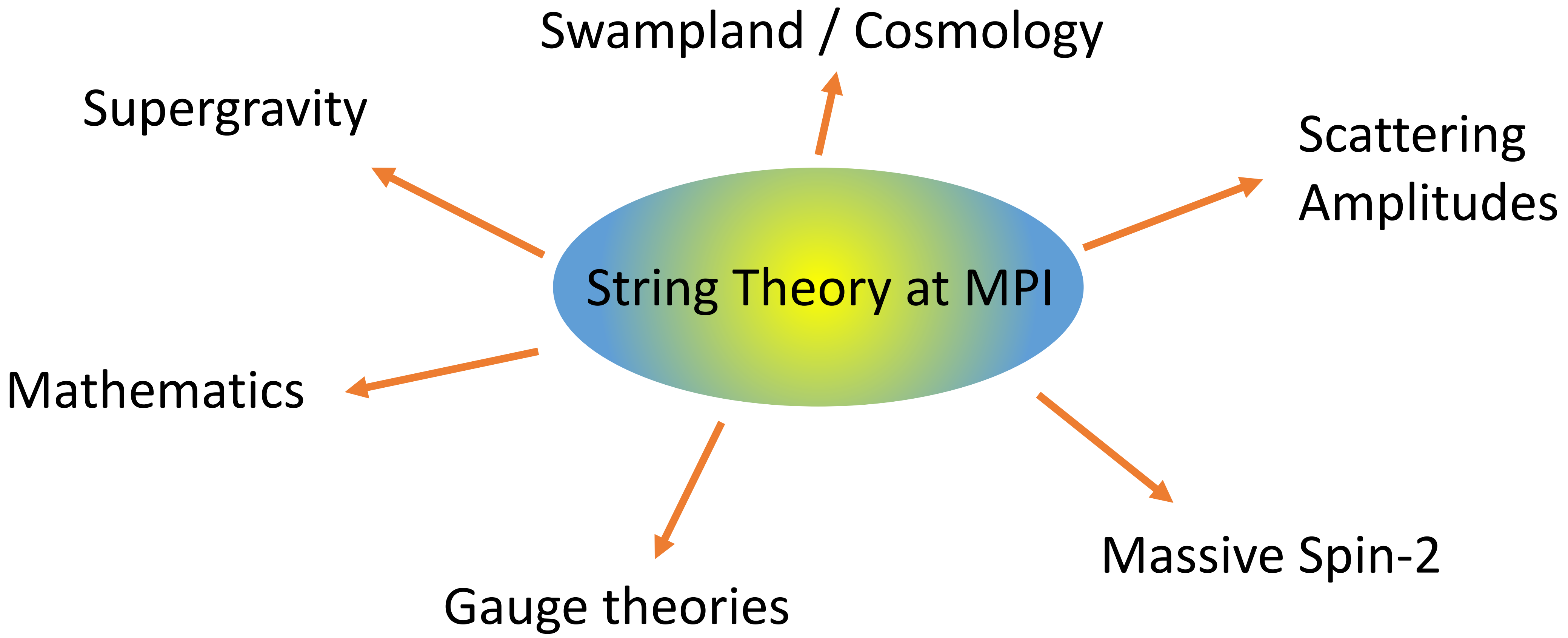
$$\Lambda \sim \frac{m\, M_p}{M_w}$$



Captures behaviour in string theory of Kaluza-Klein/Oscillator modes

Summary of 2018

String theory is central to theoretical physics, and is constantly expanding its reach



Thank You