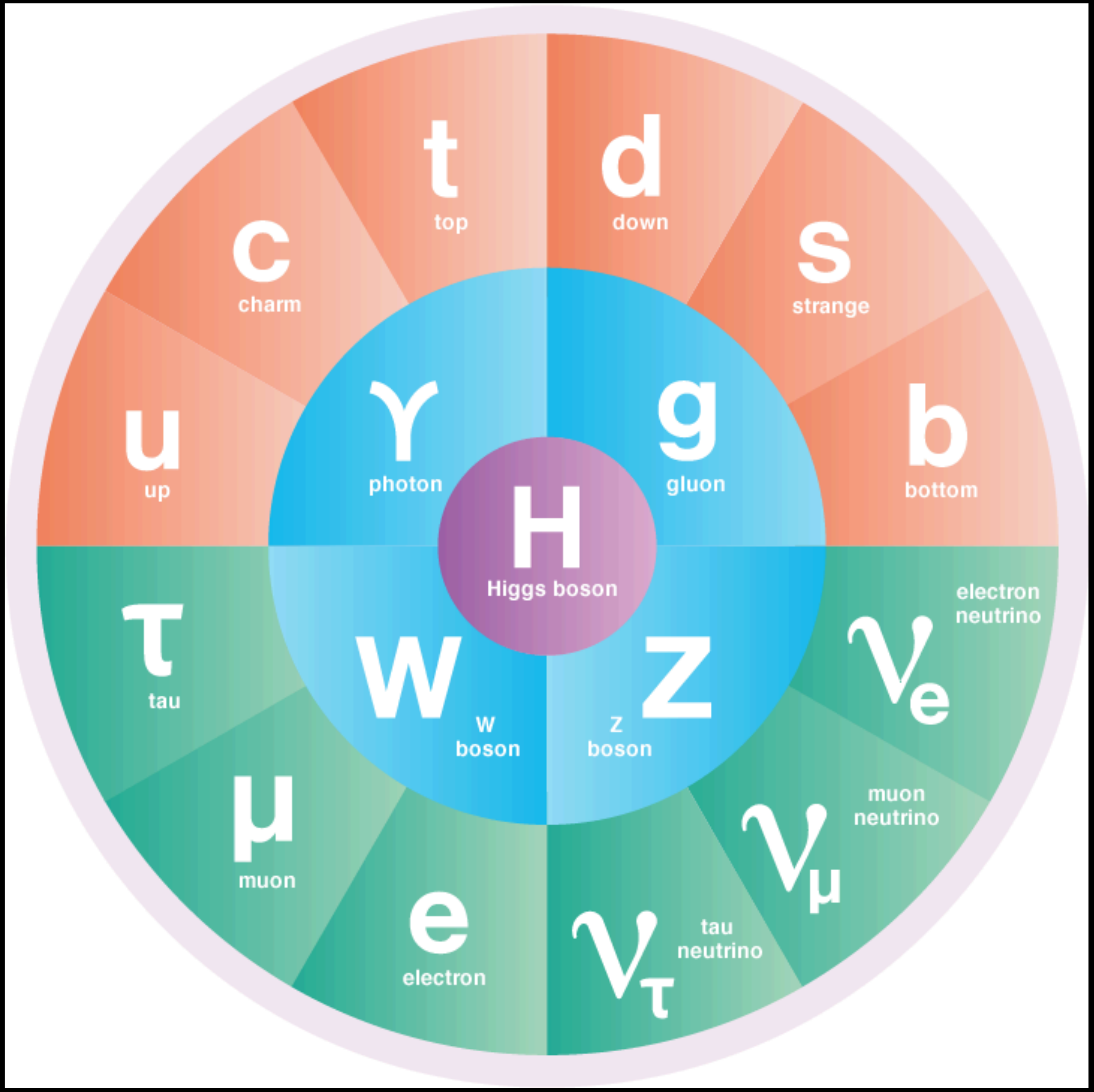
PARTICLE THEORY



DANIEL STOLARSKI

Grad Recruitment Event   Oct 26, 2020

Carleton UNIVERSITY

THEORY FACULTY

Bruce Campbell

Steve Godfrey

Thomas Grégoire

Heather Logan

Daniel Stolarski

Yue Zhang

Seyda Ipek

THE BIG QUESTIONS

The Standard Model explains the results of many experiments on Earth and in space.

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BUT! The SM cannot explain:

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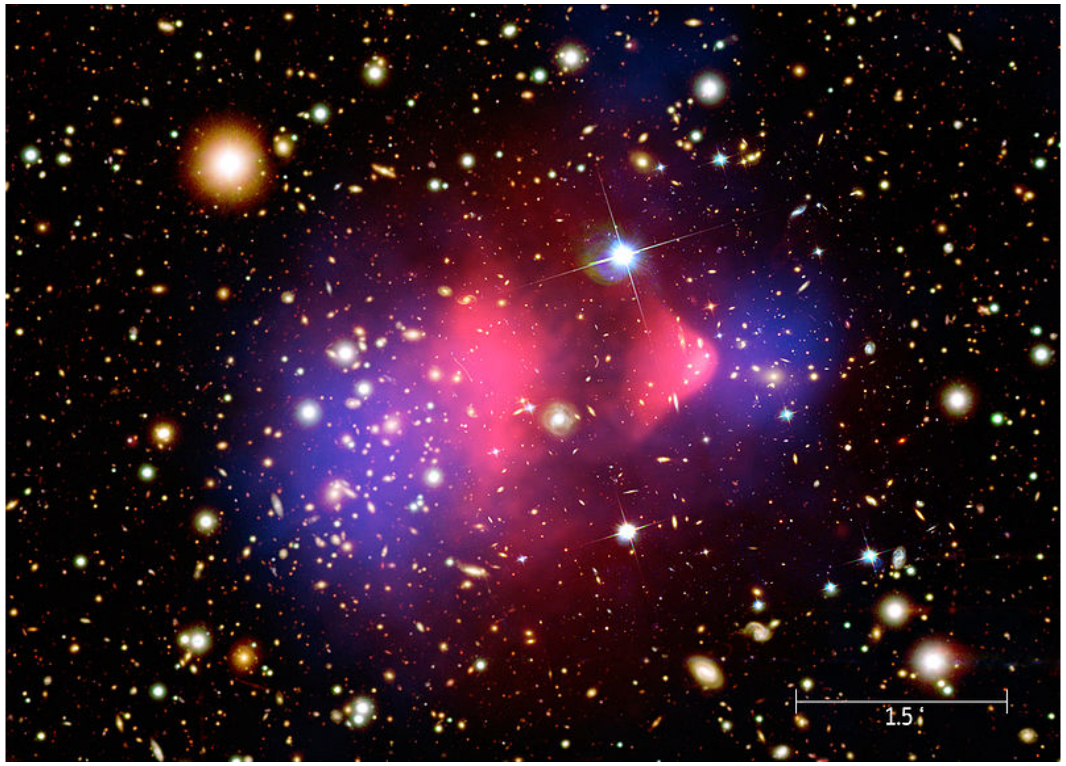

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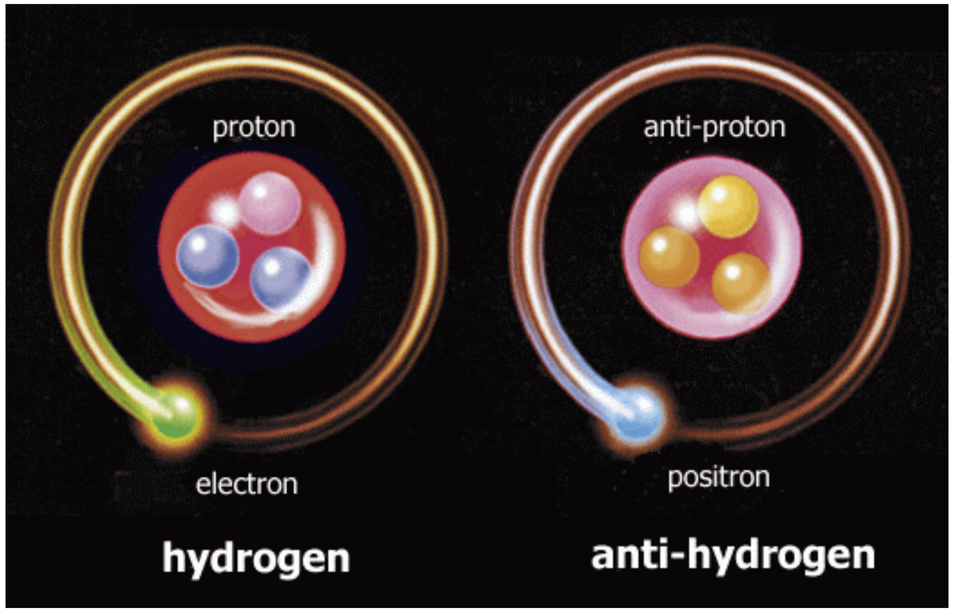

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- Inflation
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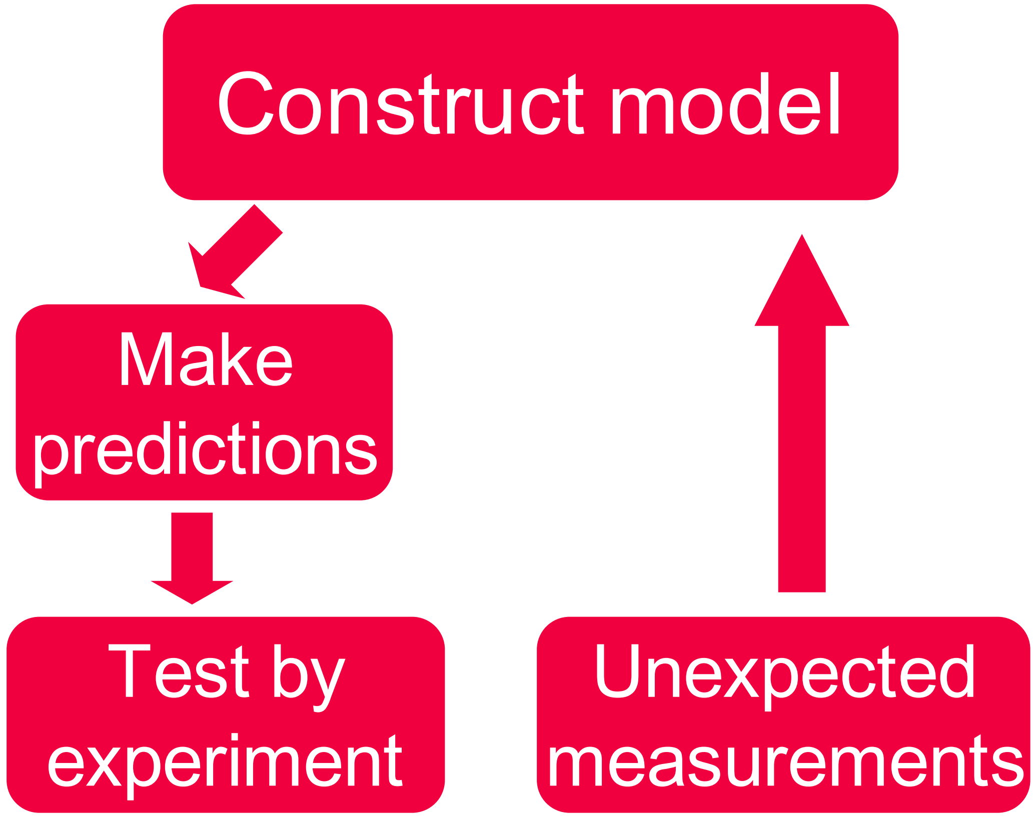
BUT! The SM cannot explain:

- Dark Matter
- Baryon asymmetry of the universe
- Neutrino mass
- Inflation
- Unification of forces
- Unknown unknowns?

PHENOMENOLOGY

What we do:

- Predict experimental signals and propose new experiments
- Build theoretical models to answer fundamental questions
- Interpret experimental results and build theories to explain unexpected results



MIRROR LEPTOGENESIS

arXiv.org > hep-ph > arXiv:1903.12192

High Energy Physics – Phenomenology

Mirror Dirac leptogenesis

Kevin Earl, Chee Sheng Fong, Thomas Gregoire, Alberto Tonero

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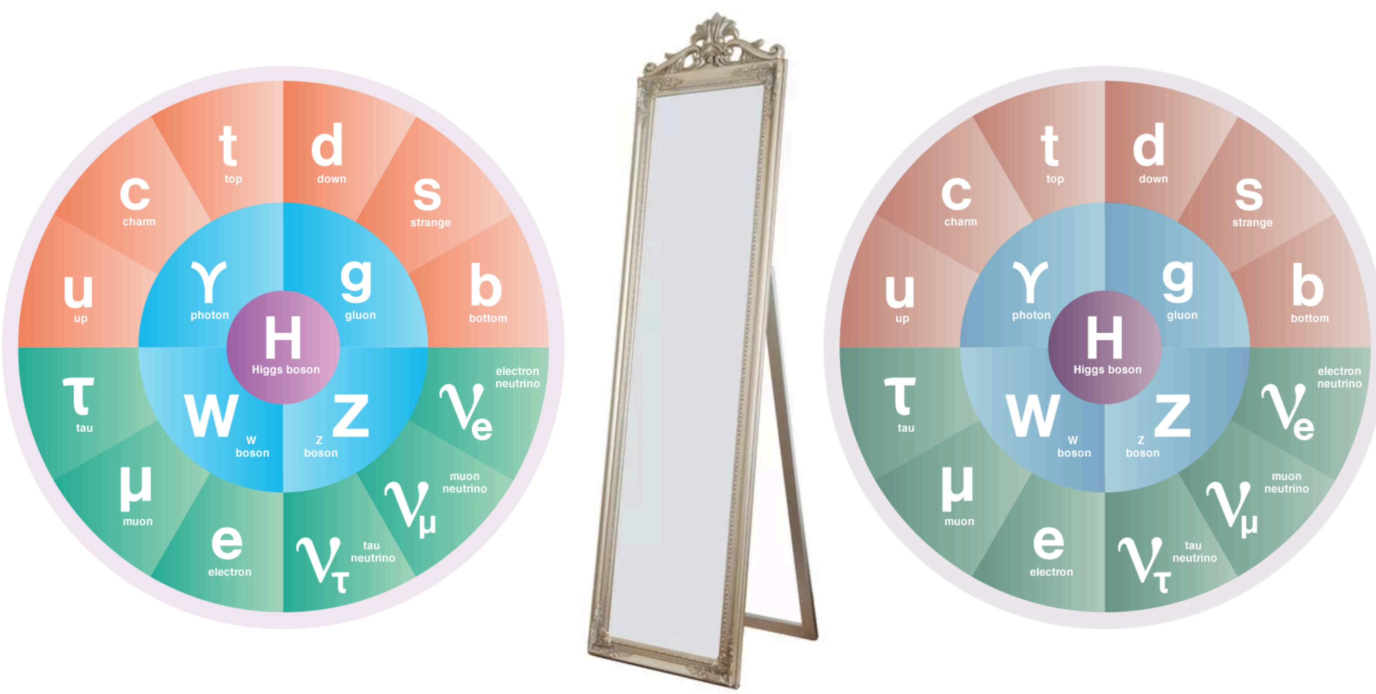

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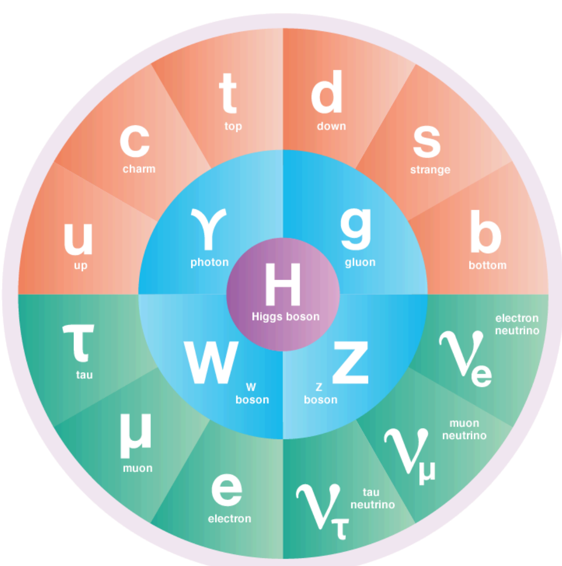

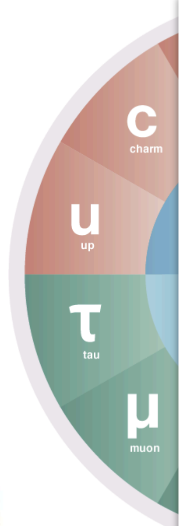

$$
\begin{aligned}
sHz\frac{dY_{\Sigma N_1}}{dz} &= -\gamma_{N_1}\left(\frac{Y_{\Sigma N_1}}{Y^{\mathrm{eq}}_{N_1}} - 2\right) \\
sHz\frac{dY_{\Delta N_1}}{dz} &= P_1\gamma_{N_1}\left(\frac{Y_{\Delta l}}{Y^{\mathrm{nor}}_{l}} + \frac{Y_{\Delta \Phi}}{Y^{\mathrm{nor}}_{\Phi}} - \frac{Y_{\Delta N_1}}{Y^{\mathrm{eq}}_{N_1}}\right) - P_1'\gamma_{N_1}\left(\frac{Y_{\Delta l'}}{Y^{\mathrm{nor}}_{l'}} + \frac{Y_{\Delta \Phi'}}{Y^{\mathrm{nor}}_{\Phi'}} + \frac{Y_{\Delta N_1}}{Y^{\mathrm{eq}}_{N_1}}\right) \\
sHz\frac{dY_{\Delta}}{dz} &= -\epsilon_1\gamma_{N_1}\left(\frac{Y_{\Sigma N_1}}{Y^{\mathrm{eq}}_{N_1}} - 2\right) + P_1\gamma_{N_1}\left(\frac{Y_{\Delta l}}{Y^{\mathrm{nor}}_{l}} + \frac{Y_{\Delta \Phi}}{Y^{\mathrm{nor}}_{\Phi}} - \frac{Y_{\Delta N_1}}{Y^{\mathrm{eq}}_{N_1}}\right) \\
sHz\frac{dY_{\Delta'}}{dz} &= -\epsilon_1'\gamma_{N_1}\left(\frac{Y_{\Sigma N_1}}{Y^{\mathrm{eq}}_{N_1}} - 2\right) + P_1'\gamma_{N_1}\left(\frac{Y_{\Delta l'}}{Y^{\mathrm{nor}}_{l'}} + \frac{Y_{\Delta \Phi'}}{Y^{\mathrm{nor}}_{\Phi'}} + \frac{Y_{\Delta N_1}}{Y^{\mathrm{eq}}_{N_1}}\right)
\end{aligned}
$$

GRAVITATIONAL WAVES

arXiv.org > hep-ph > arXiv:1910.02083

High Energy Physics – Phenomenology

Gravitational Wave Signals from Multiple Hidden Sectors

Paul Archer-Smith, Dylan Linthorne, Daniel Stolarski

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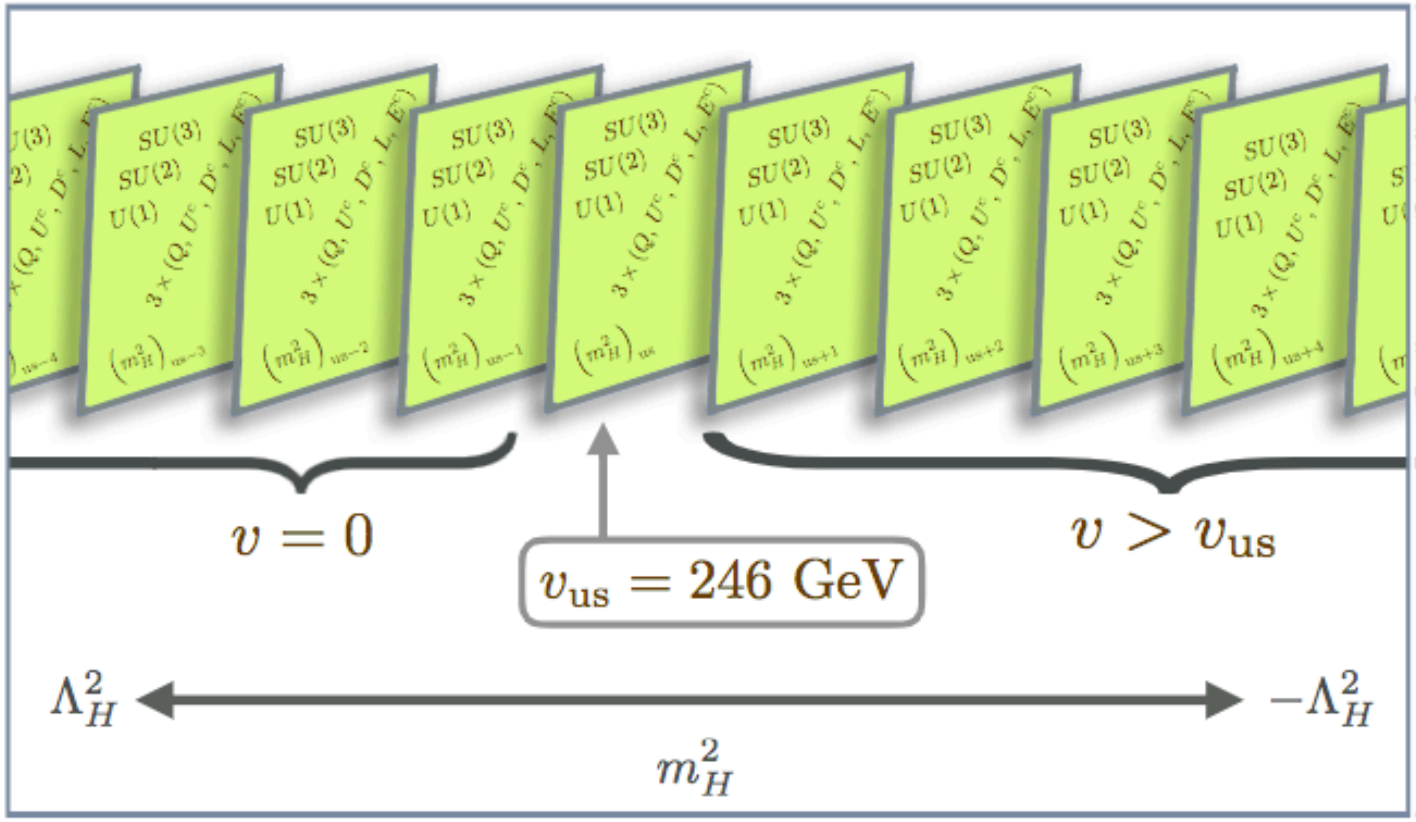

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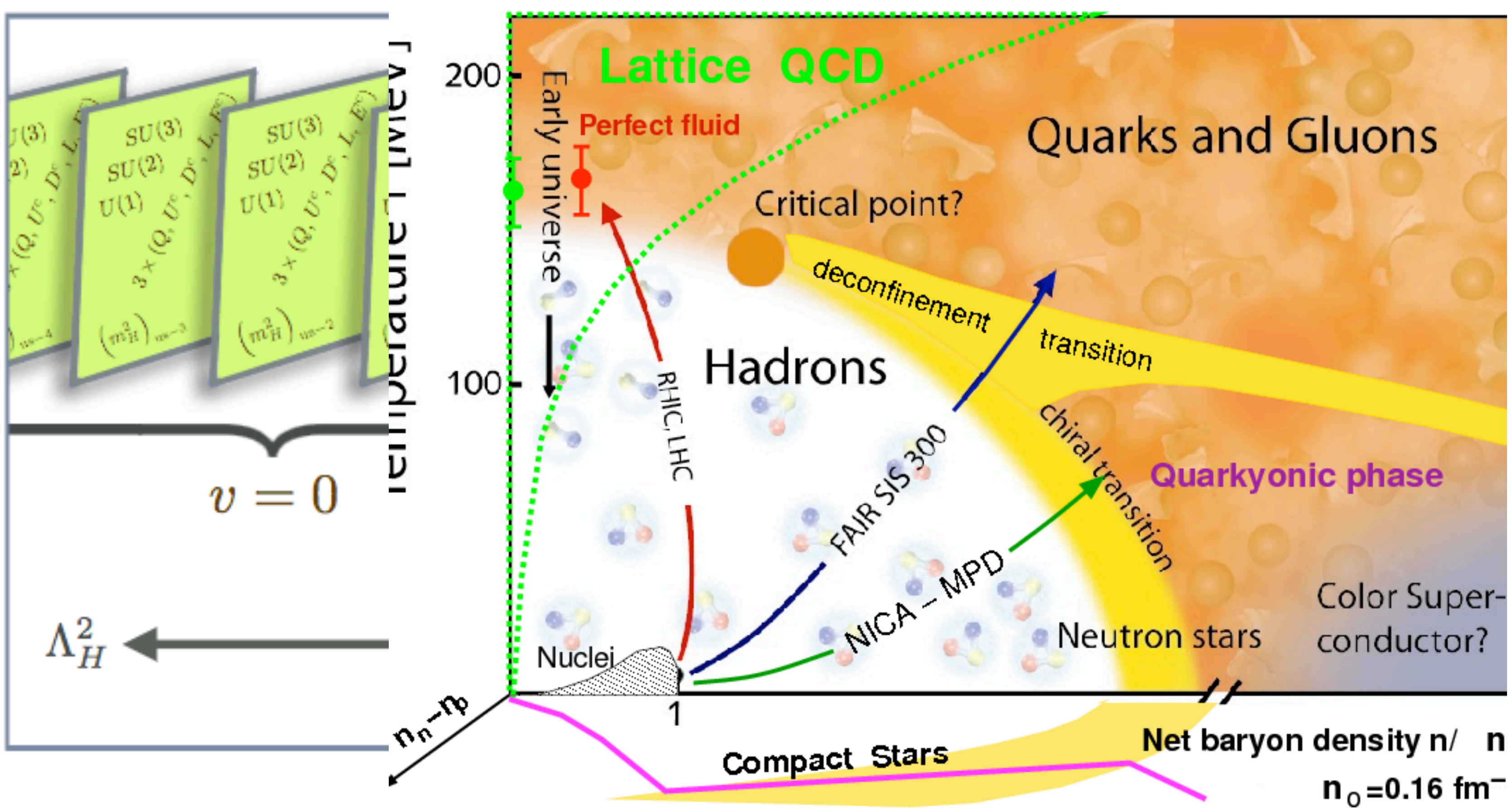

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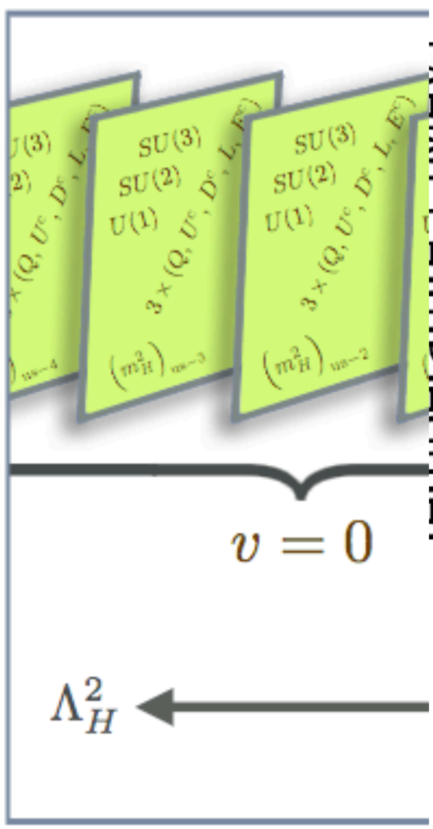

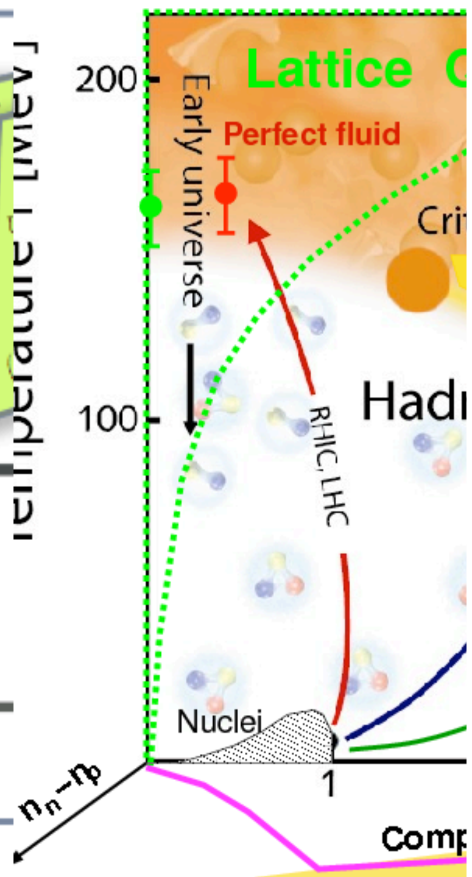

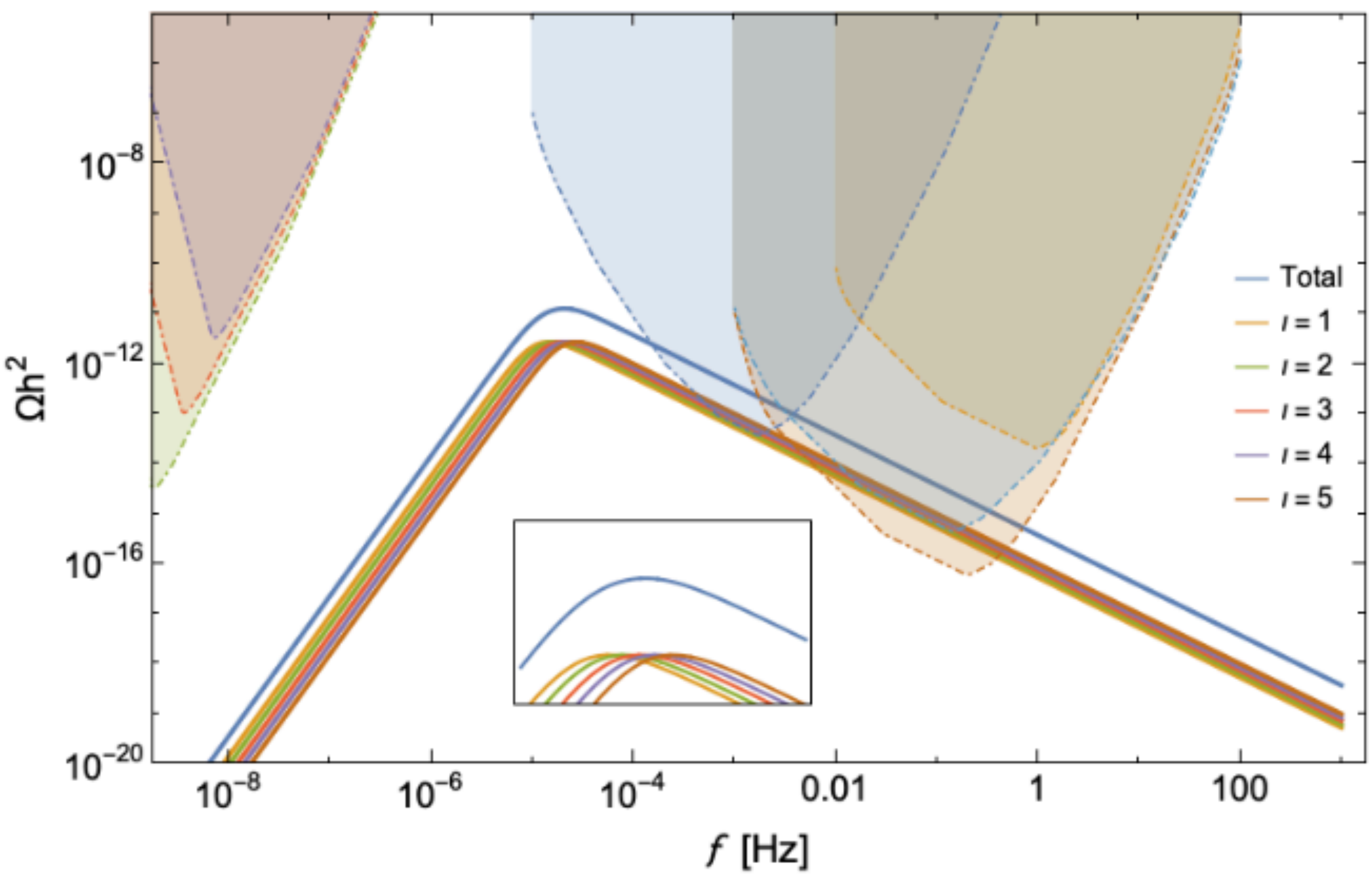

QCD BARYOGENESIS

arXiv.org > hep-ph > arXiv:1911.01432

High Energy Physics – Phenomenology

[Submitted on 4 Nov 2019 (v1), last revised 31 Mar 2020 (this version, v2)]

QCD Baryogenesis

Djuna Croon, Jessica N. Howard, Seyda Ipek, Timothy M.P. Tait

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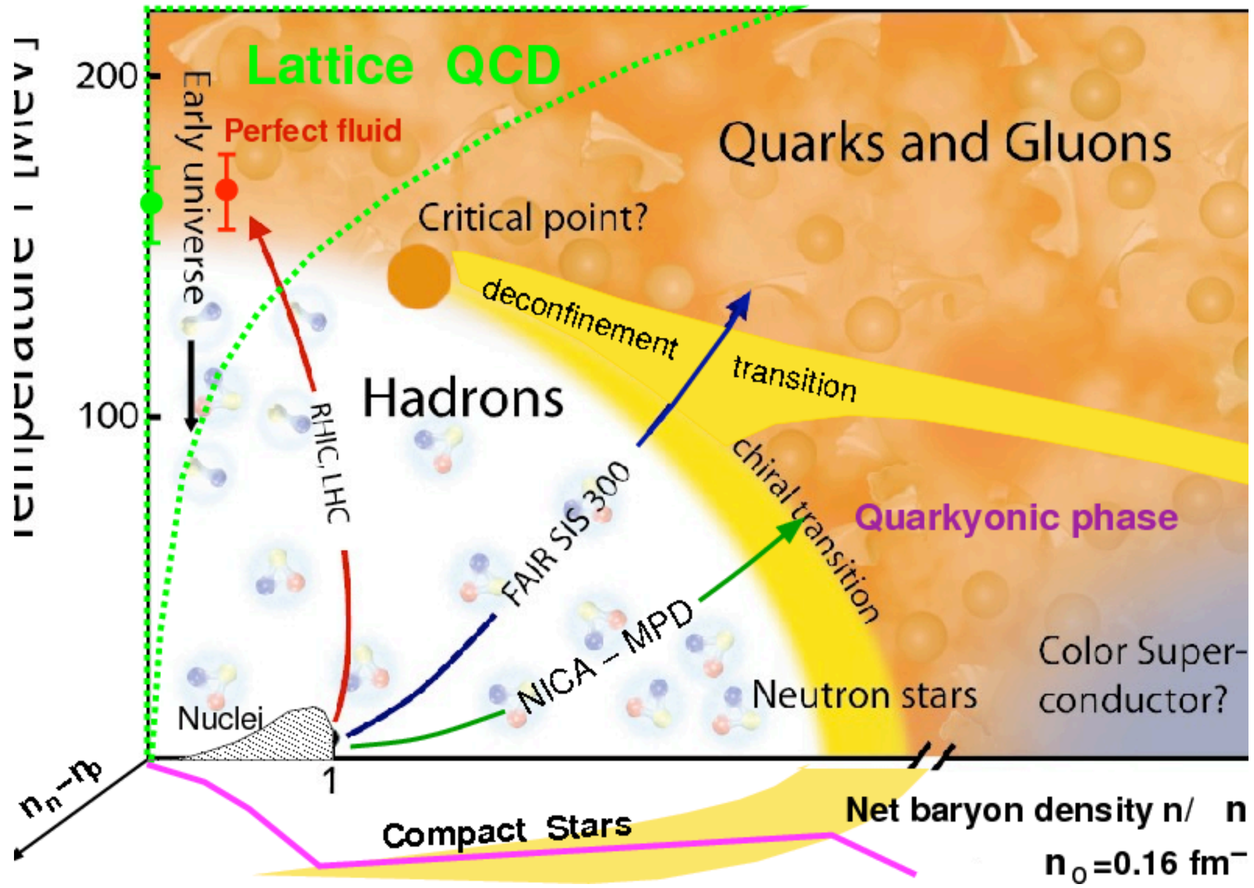

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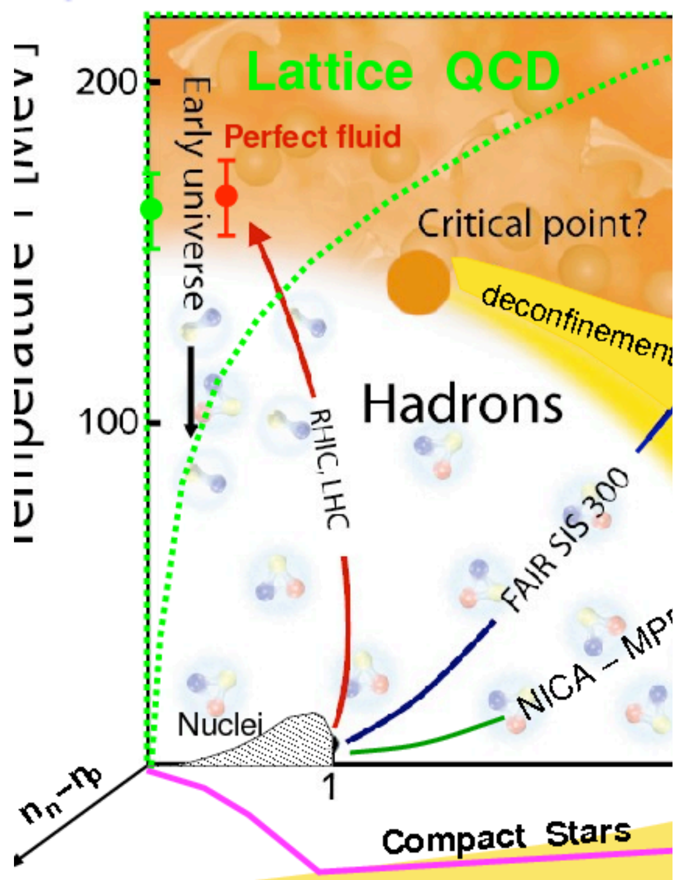

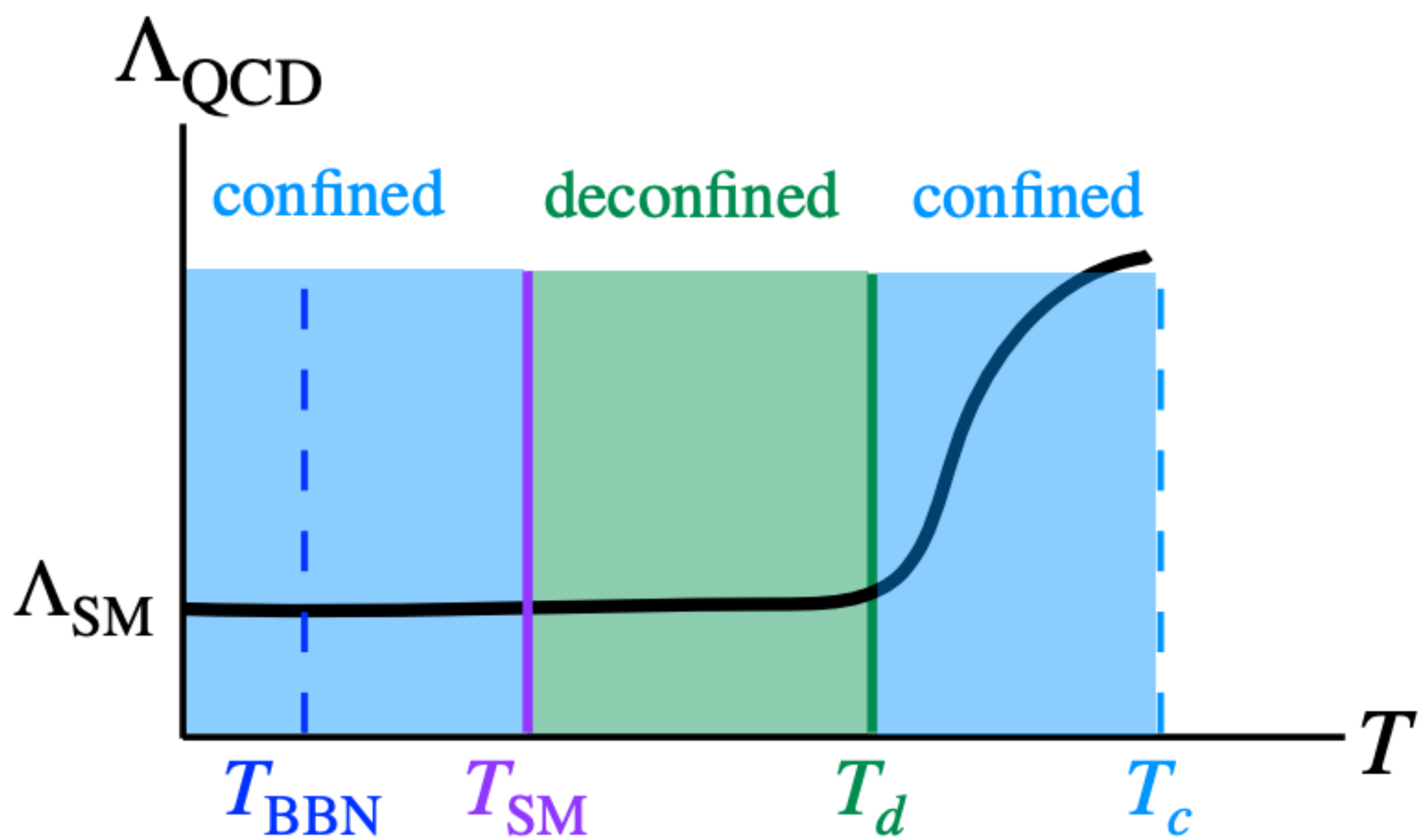

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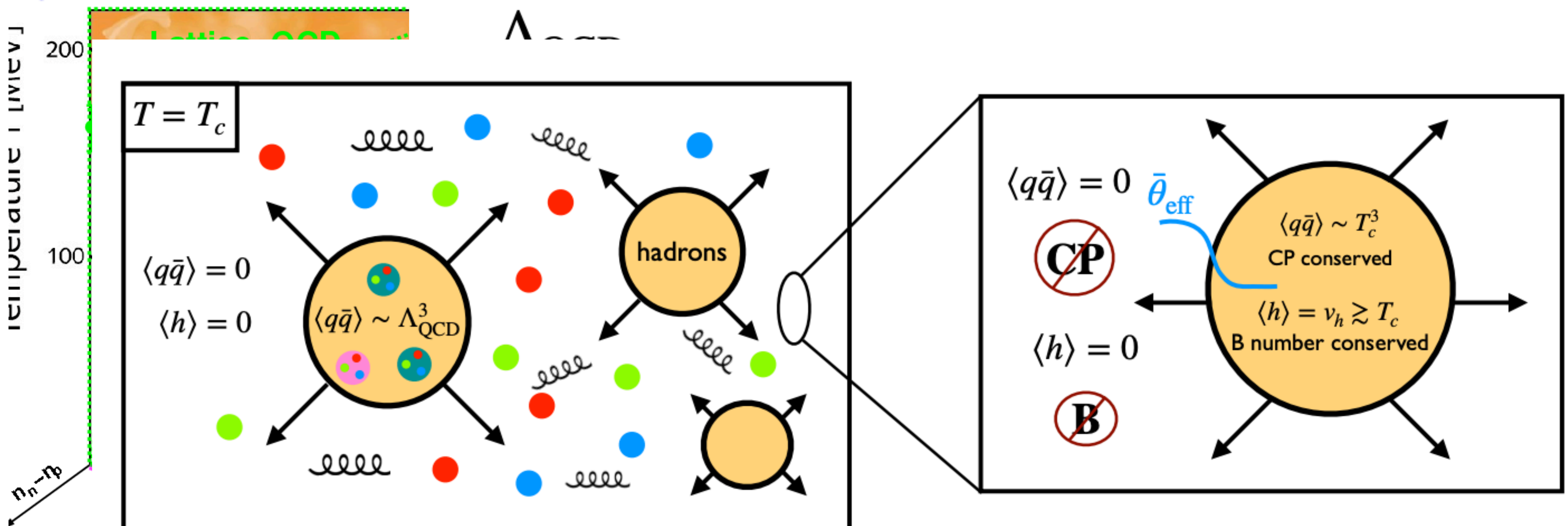

GEORGI-MACHACEK

arXiv.org > hep-ph > arXiv:1807.11511

High Energy Physics – Phenomenology

Custodial symmetry violation in the Georgi-Machacek model

Ben Keeshan, Heather E. Logan, Terry Pilkington (Carleton U.)

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$$
\begin{tikzcd}
 & H_1 \\
H \arrow[ur] \arrow[r] \arrow[dr] & H_2 \\
 & H_3
\end{tikzcd}
$$

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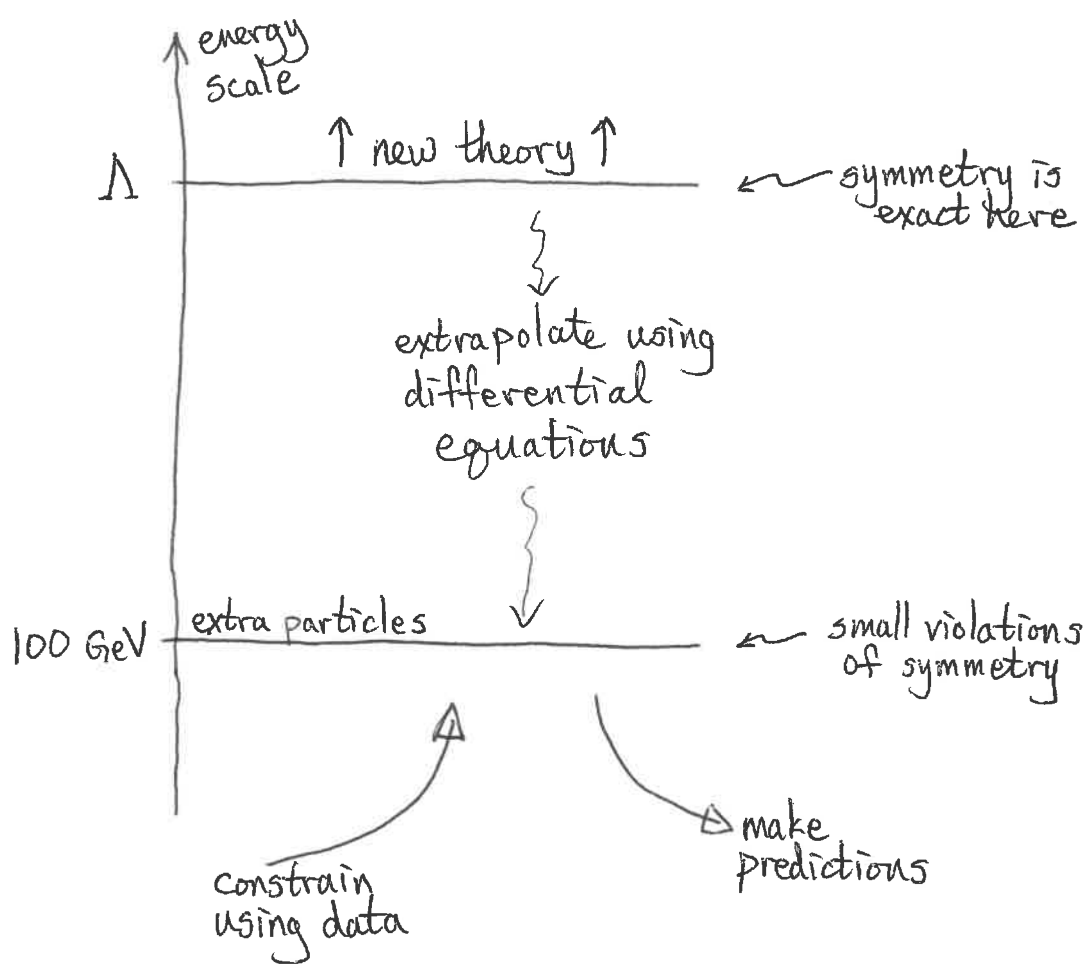

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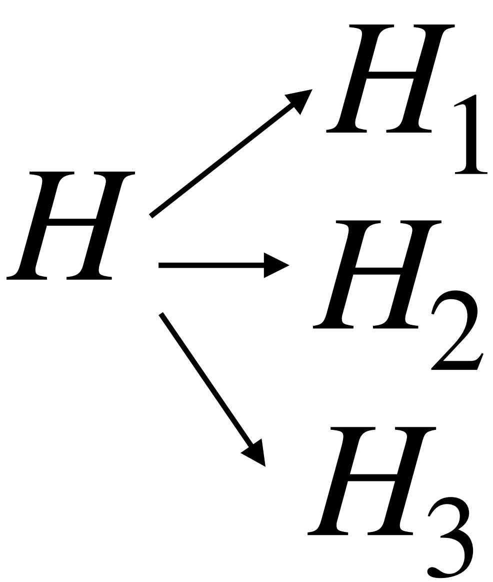

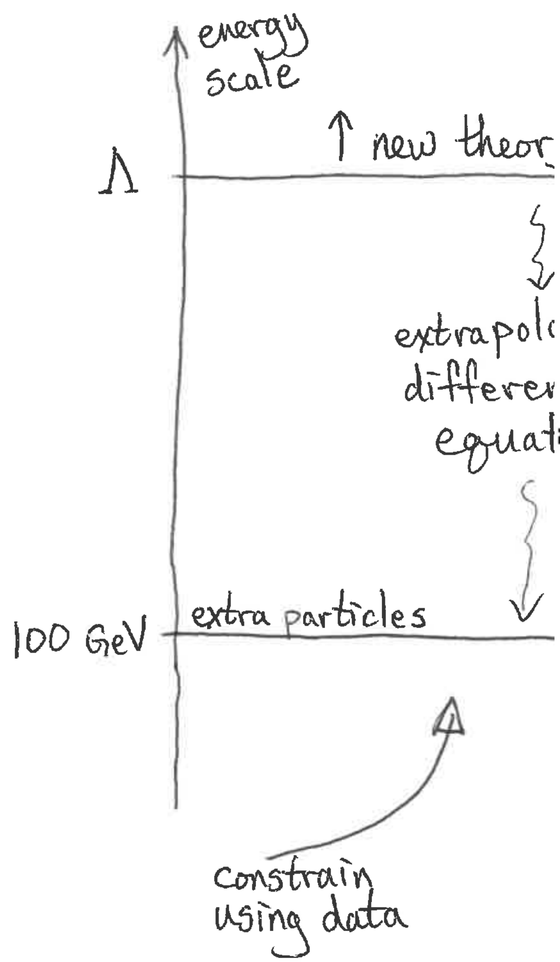

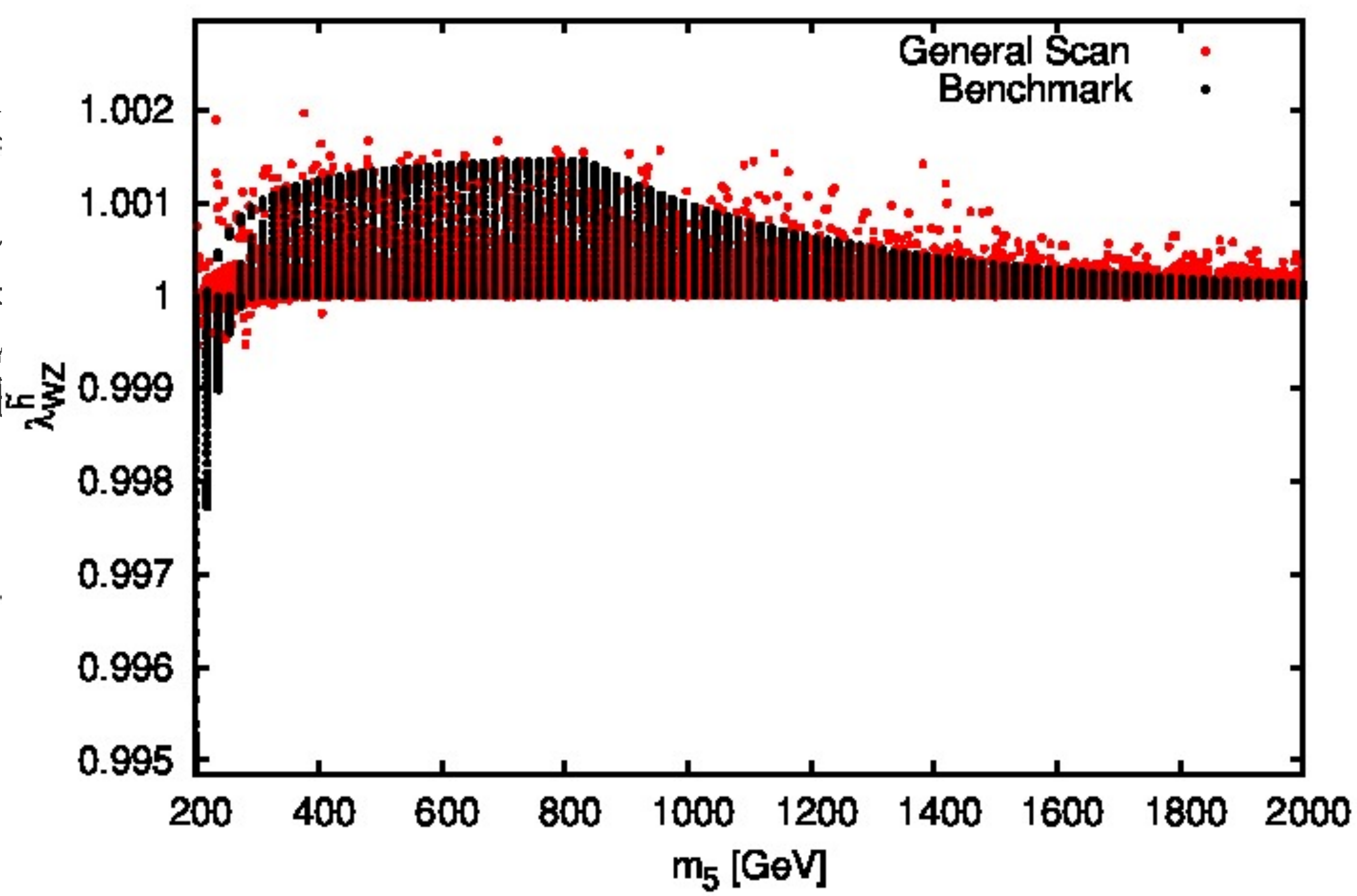

NEUTRINOS

arXiv.org > hep-ph > arXiv:1910.04901

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Dodelson–Widrow Mechanism In the Presence of Self-Interacting Neutrinos

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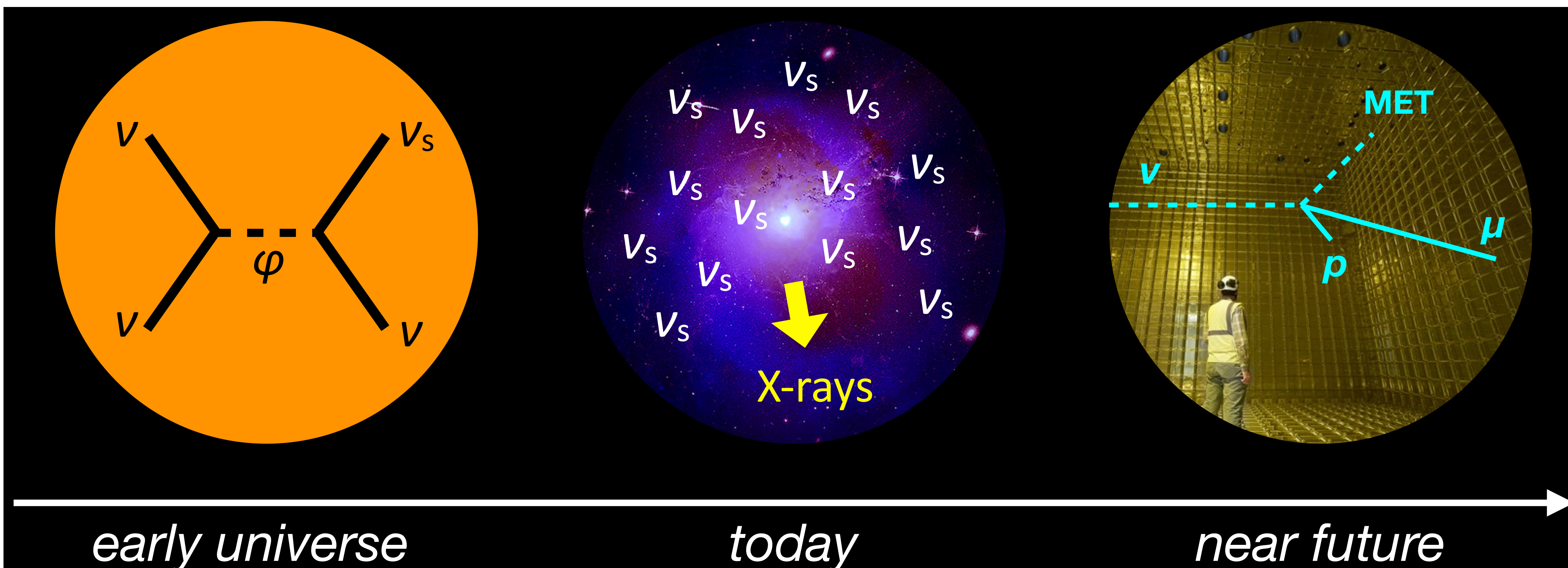

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MULTI-DARK MATTER

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High Energy Physics – Phenomenology

Multi-component dark matter from a hidden gauged SU(3)

Alexandre Poulin, Stephen Godfrey

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$$\chi \to \chi_1$$
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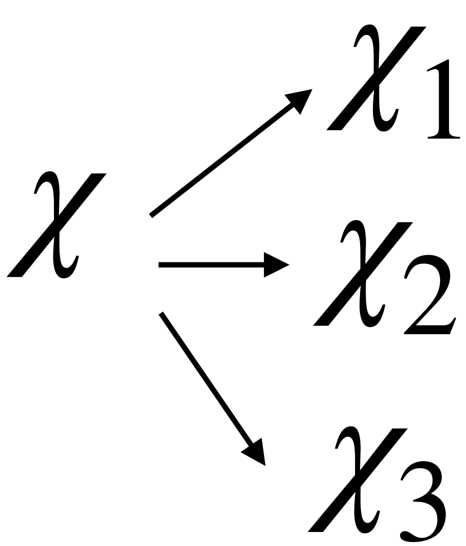

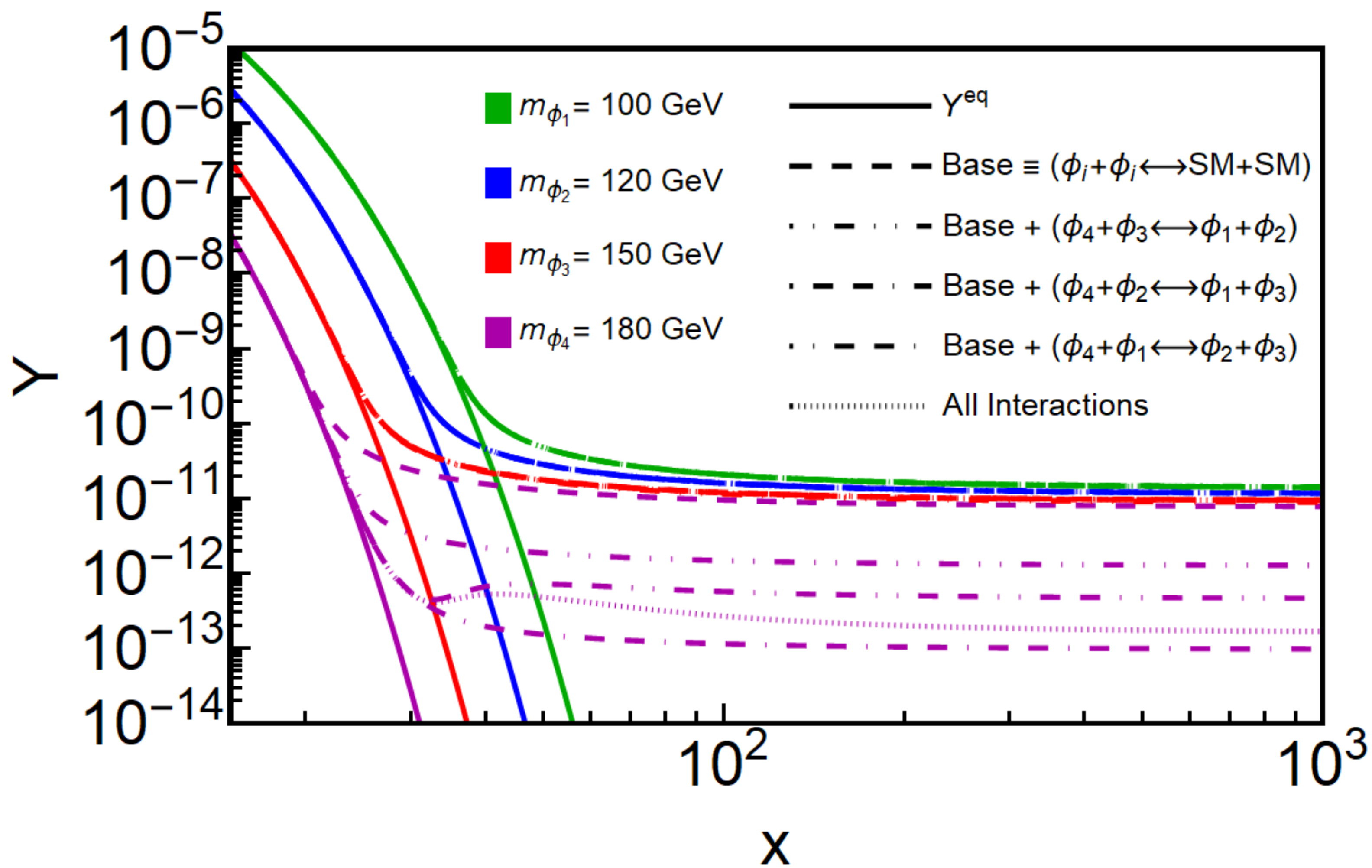

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