

# **The Subatomic Zoo: The Standard Model of Physics in Rhyme**

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## **Abstract**

A story is told using illustrations and rhyme to help readers learn and remember the key elements of the Standard Model of Physics. The classic “subatomic/particle zoo” metaphor<sup>1 2 3 4</sup> is used—in this case casting monkeys as fermions, bananas as bosons, and teams of boson-sharing monkeys as composite particles.

**Keywords:** standard model, particle physics, mnemonic device, fermions, bosons, quarks, leptons, photons, Higgs

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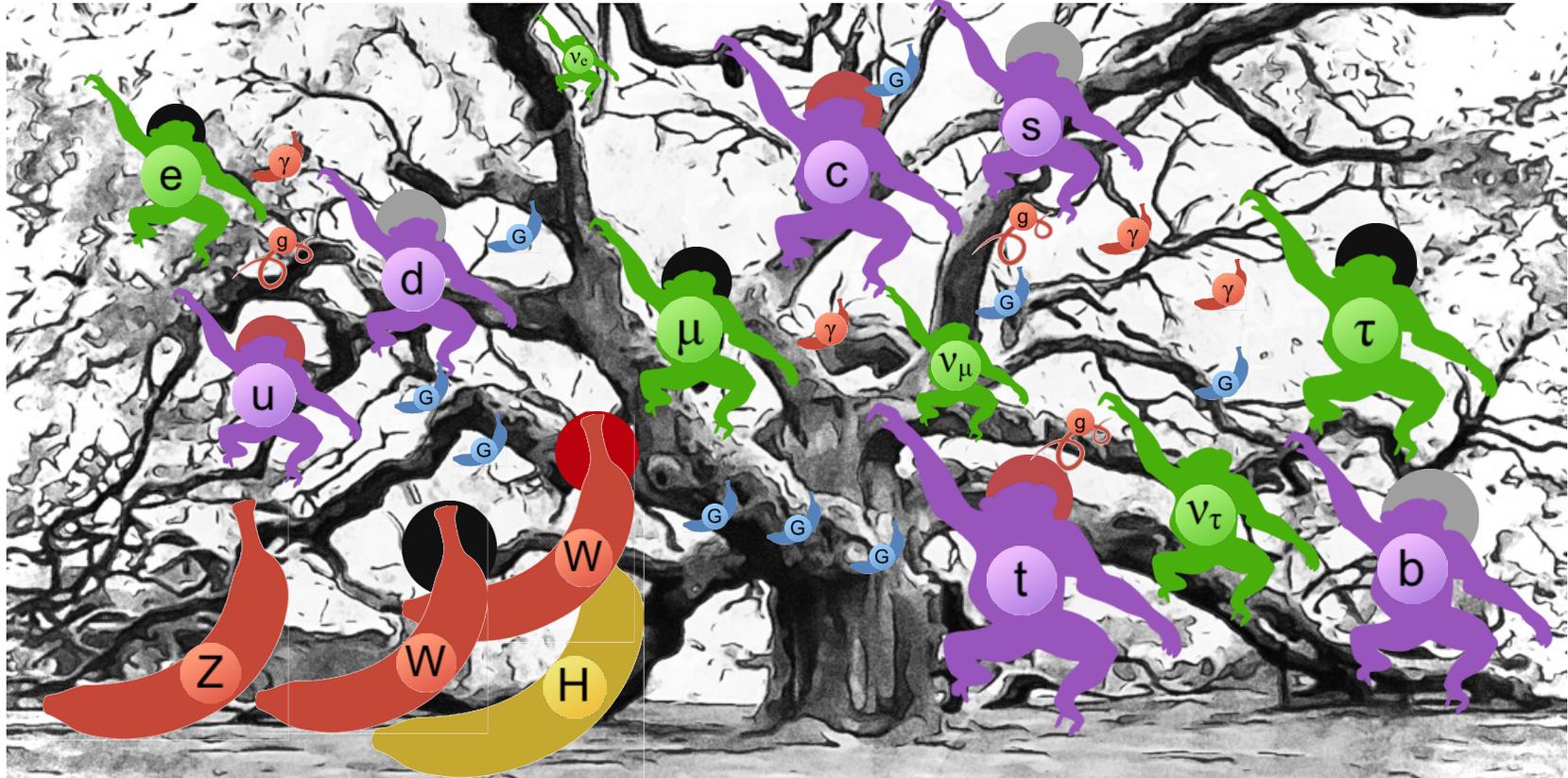
<sup>1</sup> Whimsical footnotes are included on some pages. Formal references are provided at the end.

<sup>2</sup> Ibid.

<sup>3</sup> Ibid.

<sup>4</sup> Ibid.

Twelve Fermion monkeys playing in a tree sharing Boson bananas when they're hungry.<sup>5,6</sup>



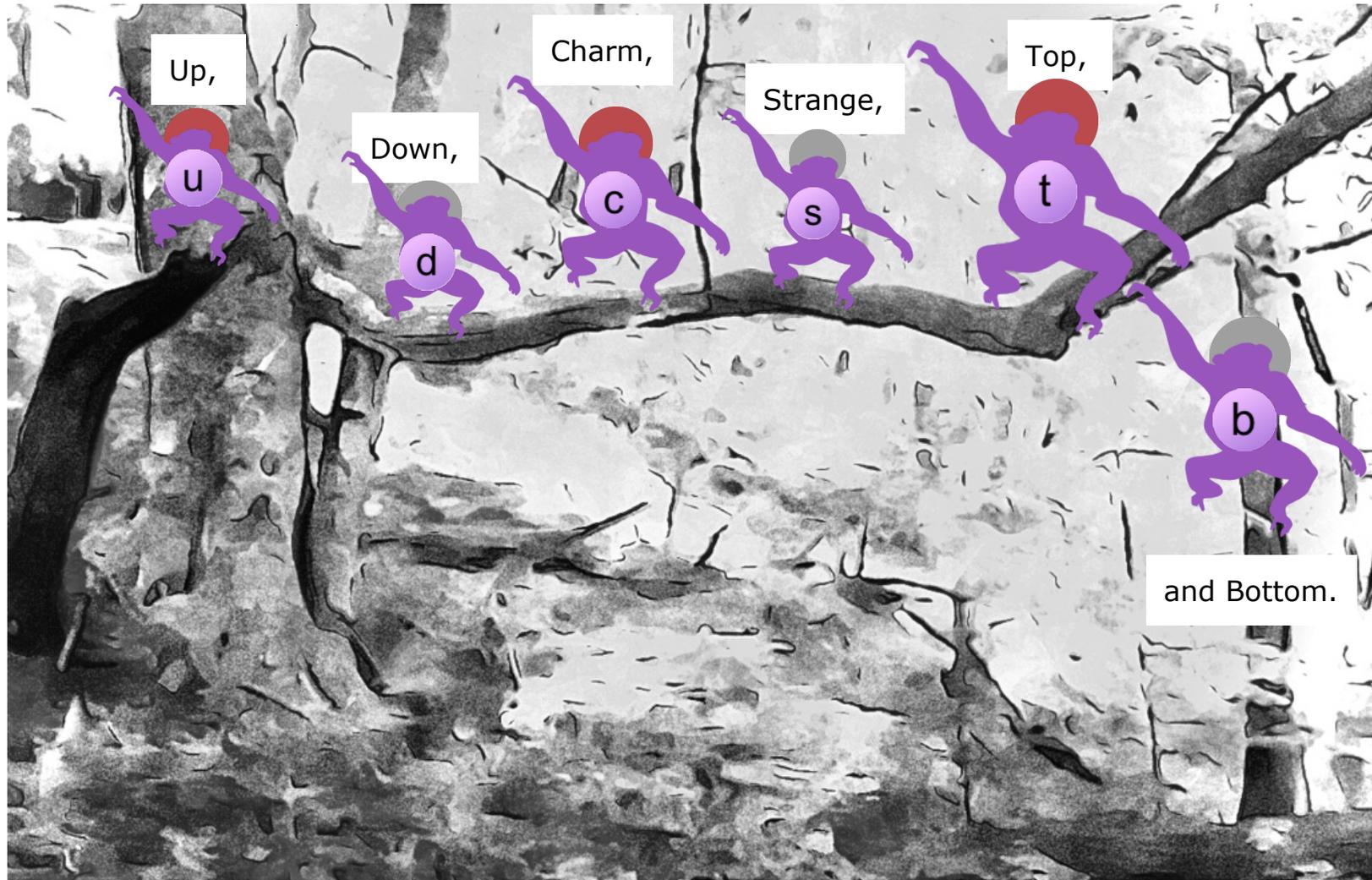
5. Some carry a charge around their head—negative is black and positive is red.

6. Sizes are shown through a trillion-x prism—the differences so great, we use a logarithm.

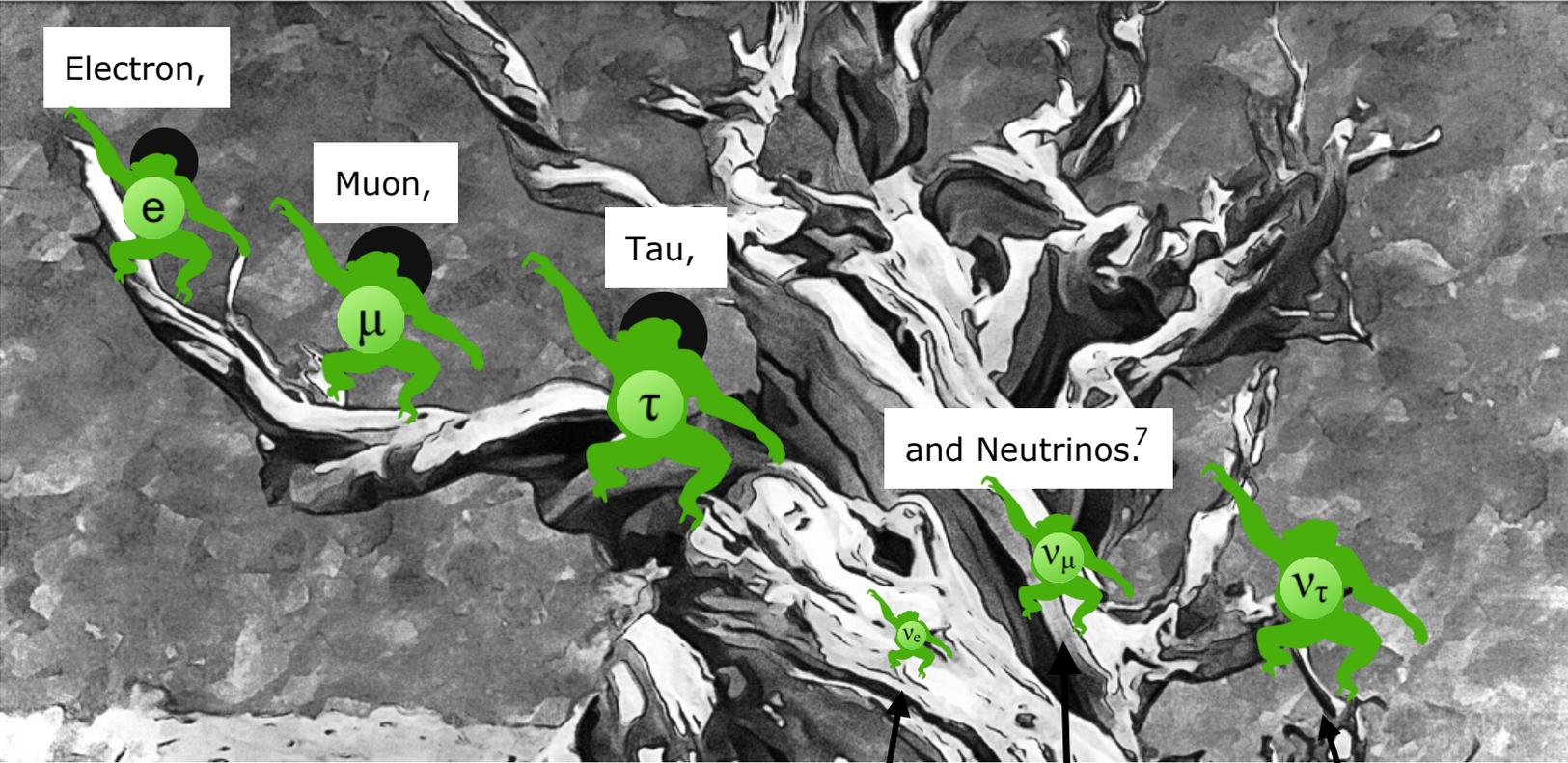
Three generations of monkeys scale



Six monkeys come from the Quark kingdom:



The other six are the Lepton bros:



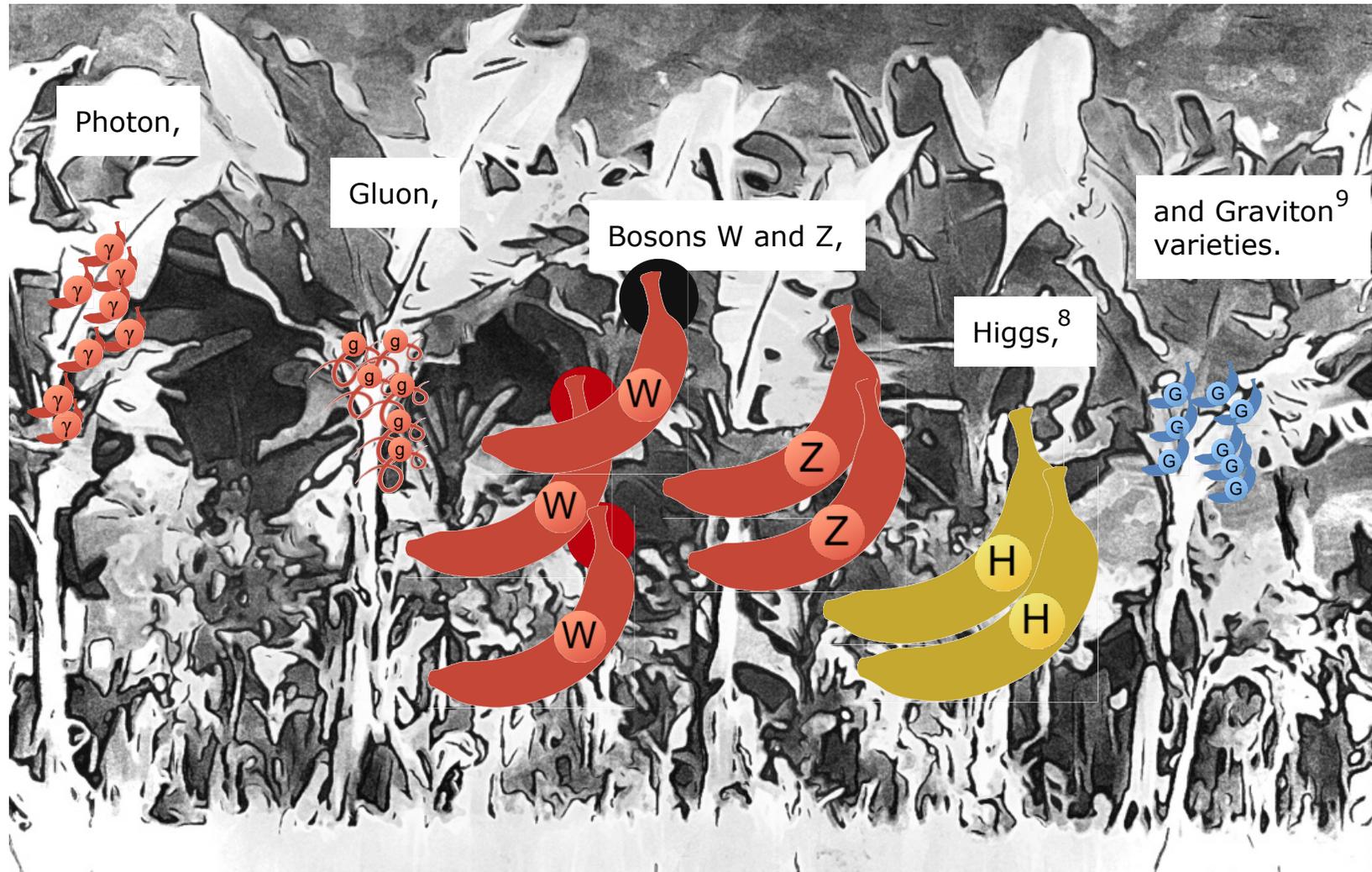
7. Neutrino monkeys are named like so:

Electron

and Muon

and Tau Neutrino.

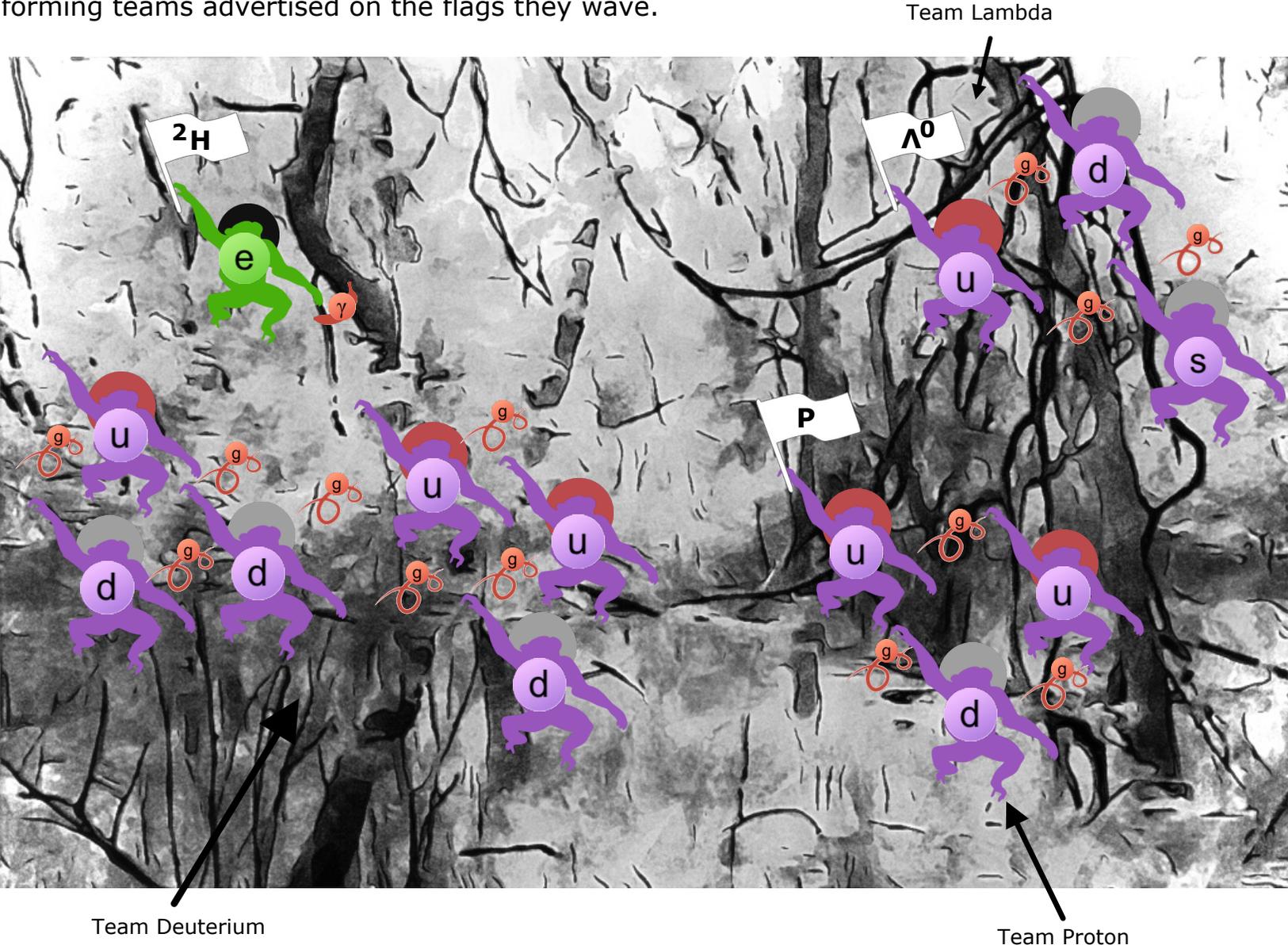
Bananas come in



8. Higgs is more like a banana seed that gives W and Z the start they need.

9. Graviton bananas are shared far and near but what they are like is not very clear.

Monkeys get together based on bananas they crave forming teams advertised on the flags they wave.

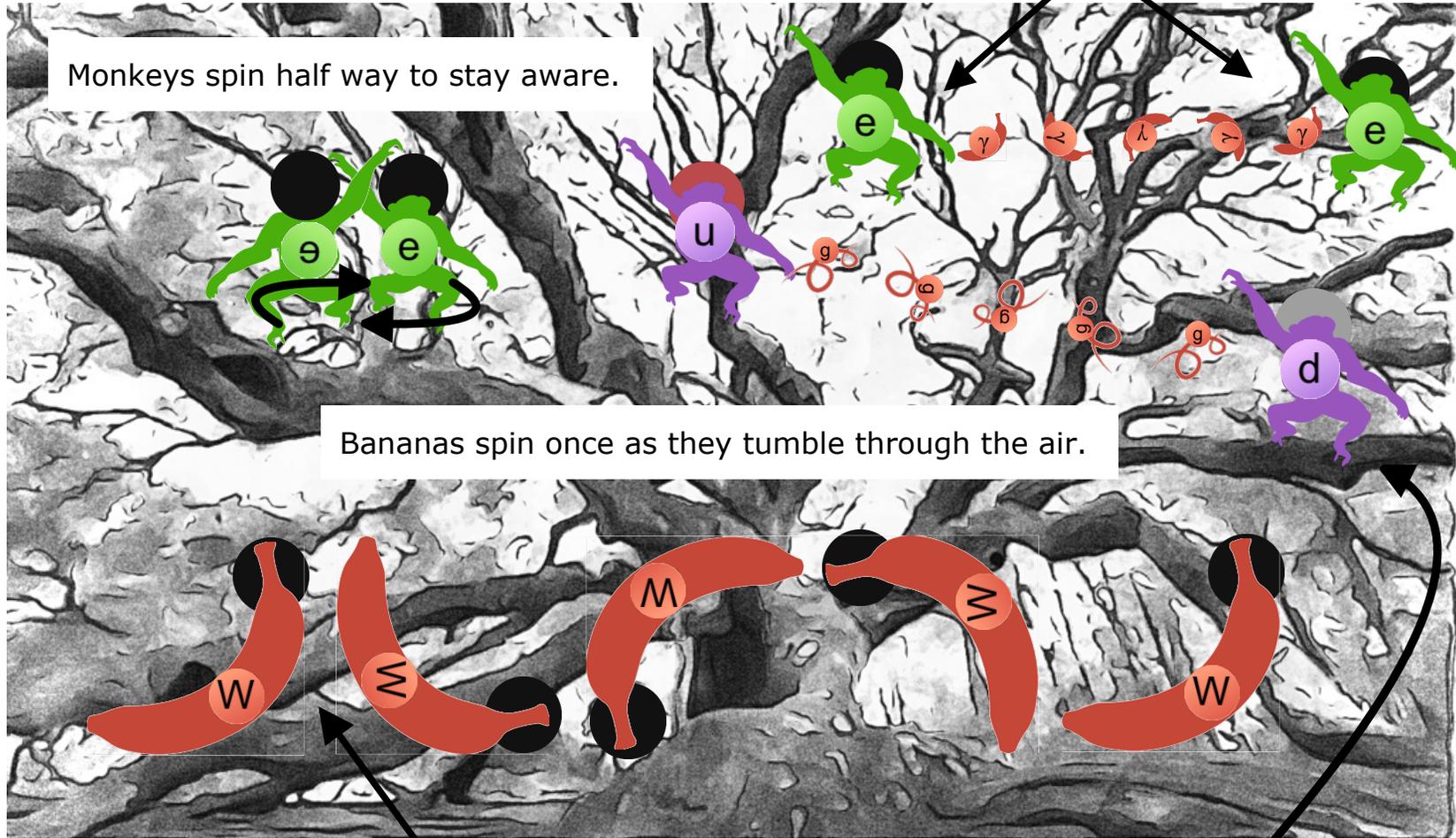


A lot is happening up in the tree  
as monkeys and bananas move distinctively.

Two Electrons nearly meet  
but are driven apart by a Photon treat.

Monkeys spin half way to stay aware.

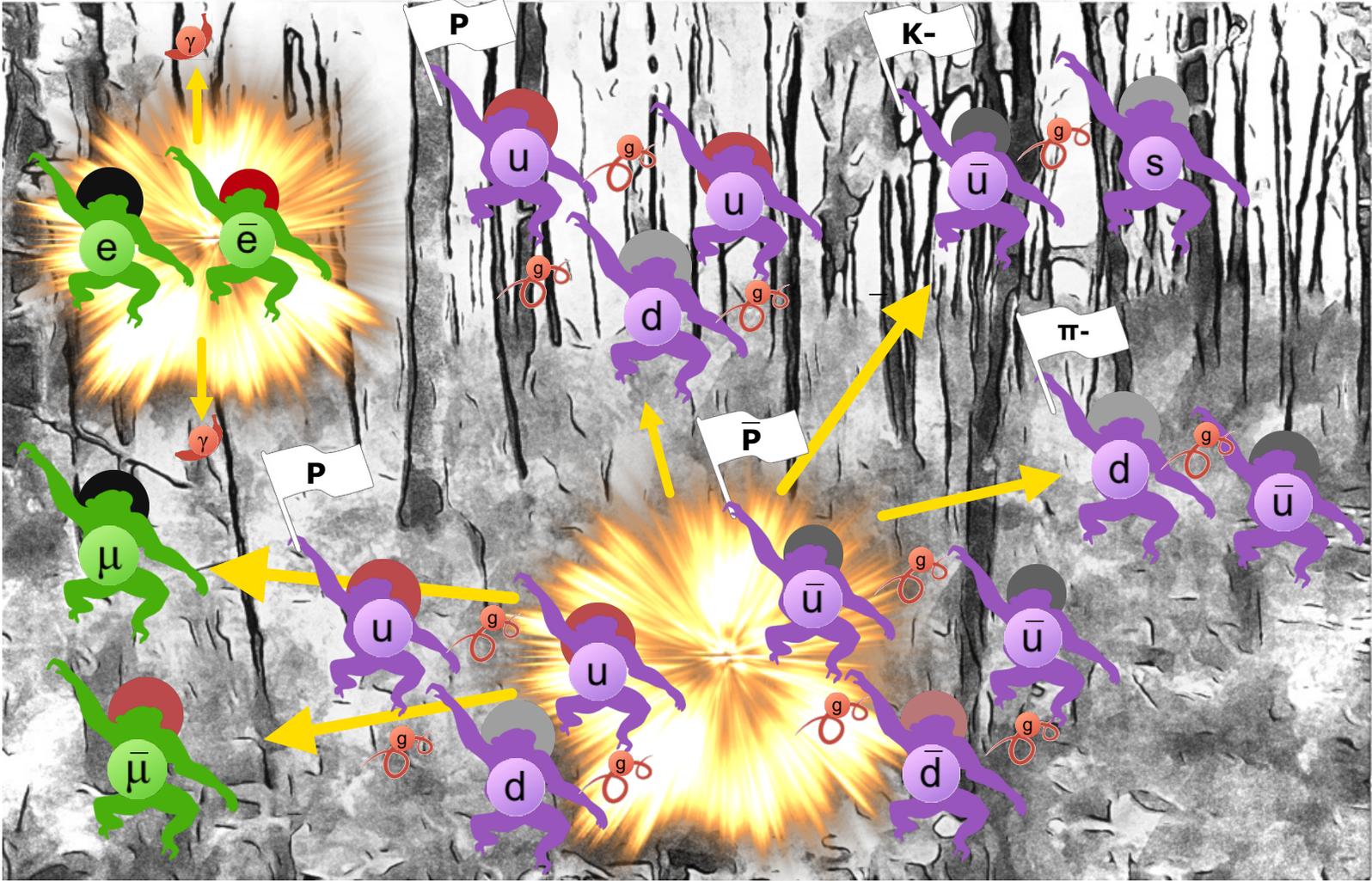
Bananas spin once as they tumble through the air.



Here comes a negatively-charged W Boson!

Up and Down monkeys share a Gluon.

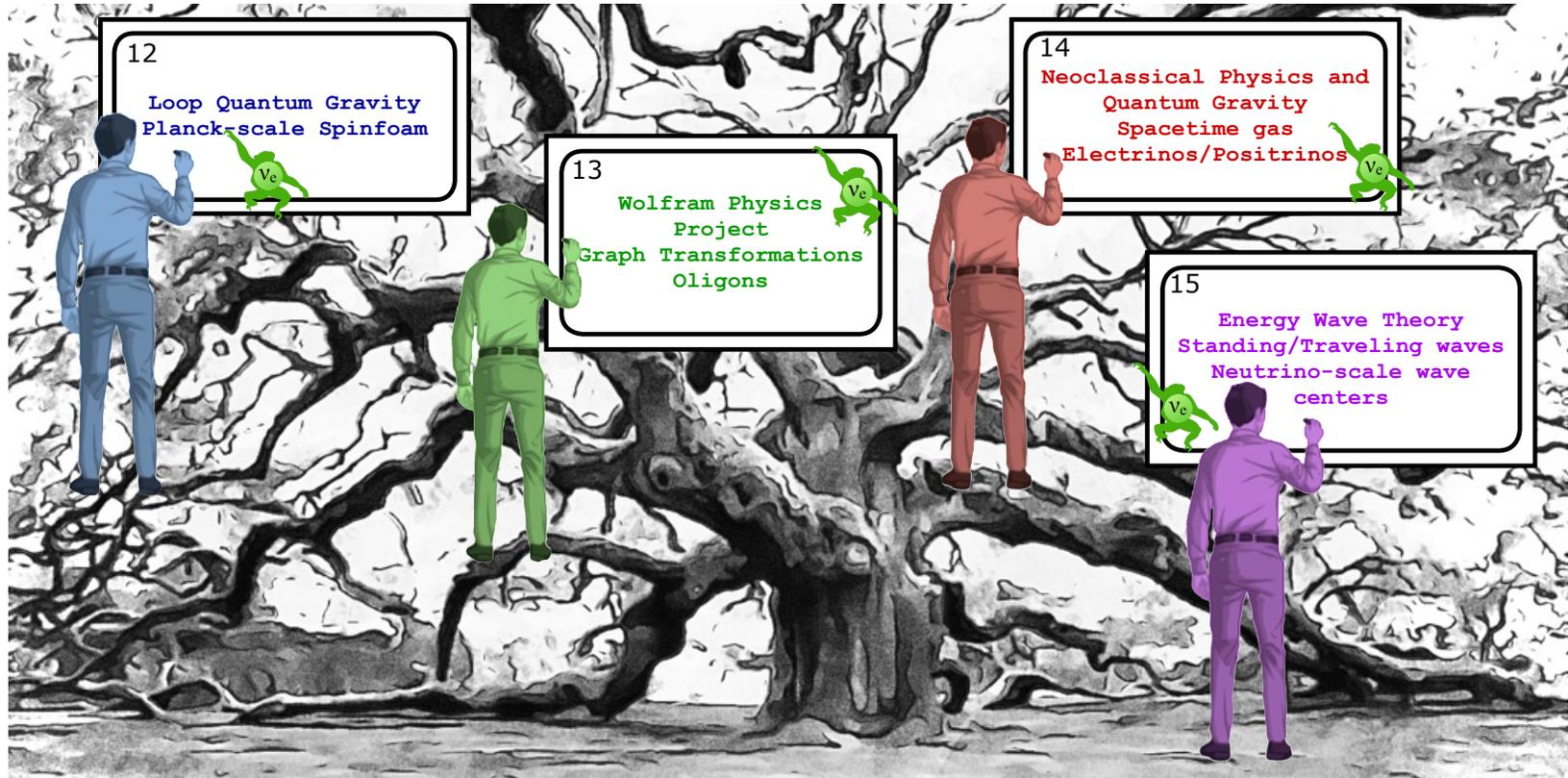
Monkeys have twins they best avoid. <sup>10, 11</sup>  
If the two should meet, both are destroyed!



10. In the upper left, an Electron meets its evil twin.  
11. Below, Teams Proton and Antiproton create quite a din!

This version of the subatomic zoo  
may soon give way to something new.

People like Rovelli<sup>12</sup>, Wolfram<sup>13</sup>, Morris<sup>14</sup>, and Yee<sup>15</sup>  
are trying to tell a better<sup>16</sup> story.

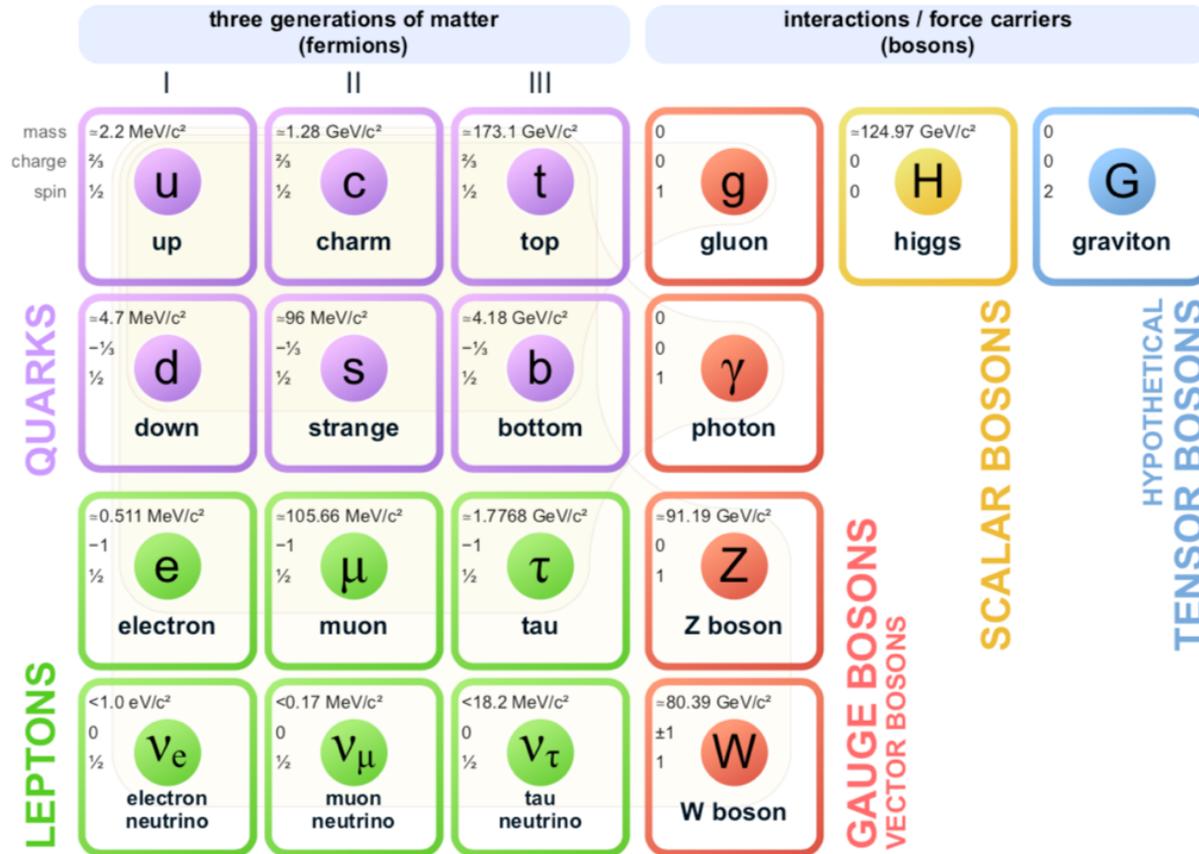


So, dear reader, please stay tuned.  
The monkey-banana tree will likely be pruned.

## Appendix

The colors and symbols used herein are based on the following graphic by MissMJ/Cush from references 3, 4, and 9, reproduced under CC Attribution 3.0 Unported and CC0 1.0 Public Domain licenses.

### Standard Model of Elementary Particles and Gravity



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