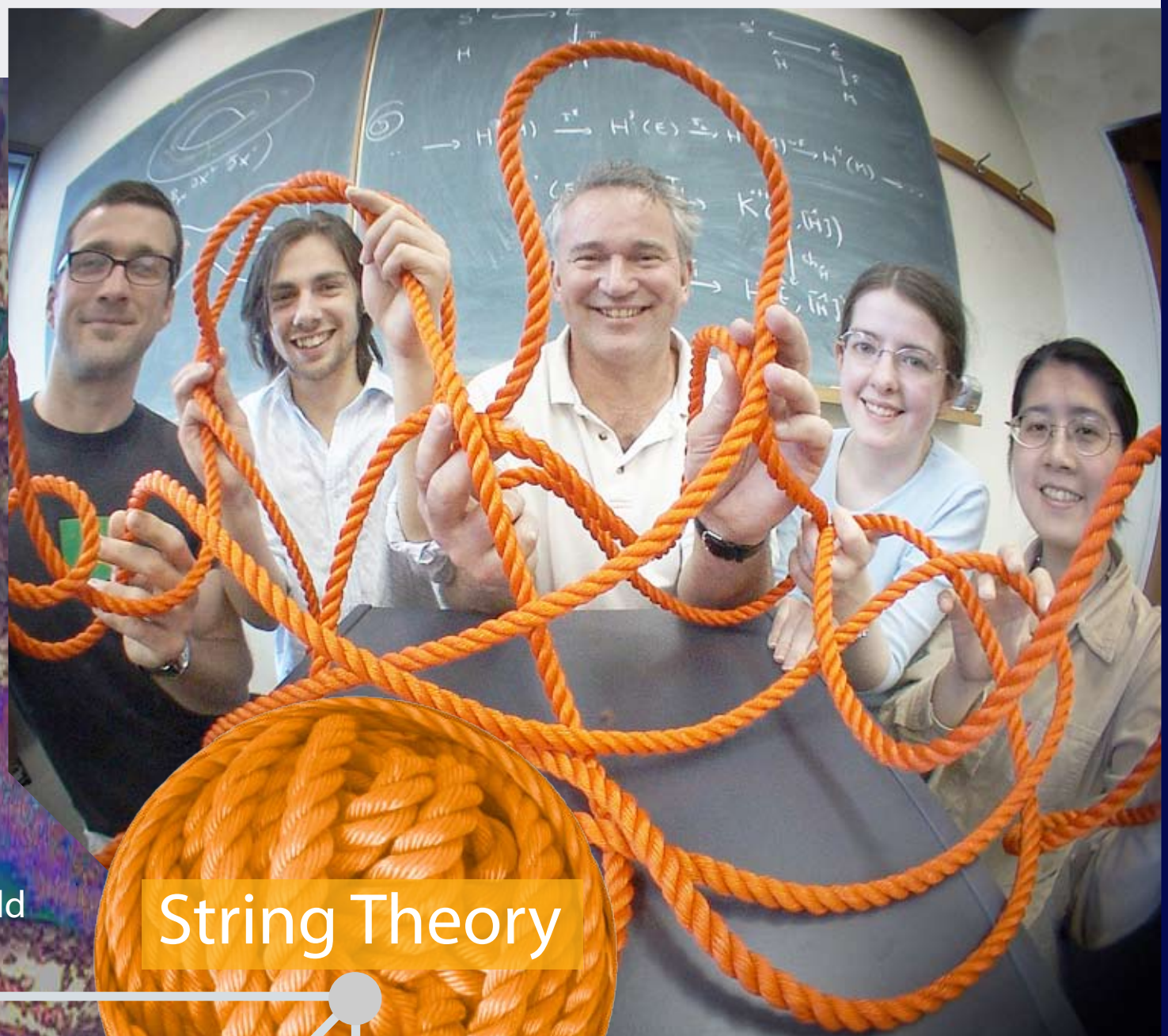


## Stringing Together Fundamental Forces

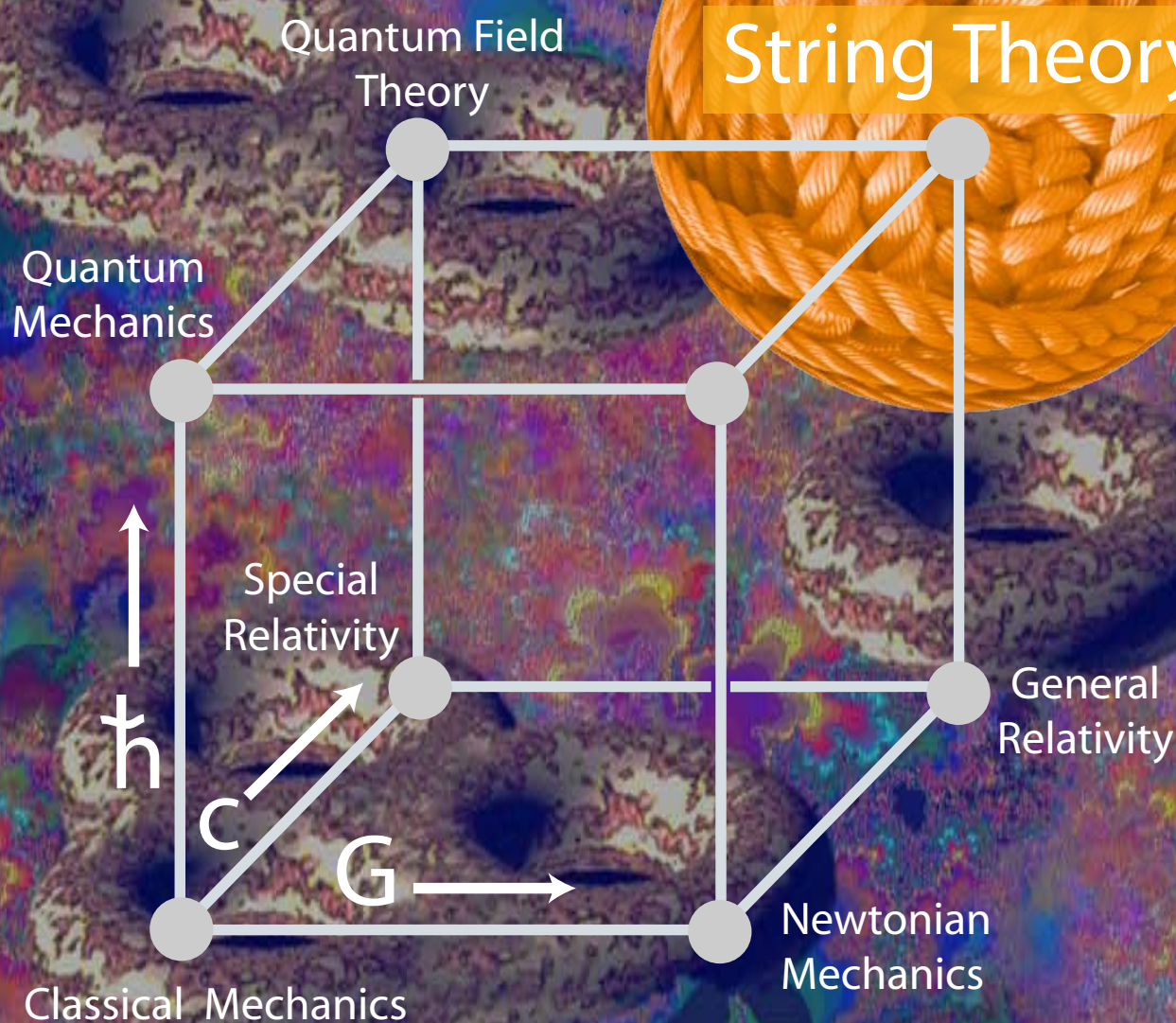
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String Theory is a consistent description of the physics of the very small (as described by Quantum Mechanics) and that of the very large (General Relativity), and thus is a candidate for the elusive "Theory of Everything". That is, a model of the universe that unifies the four known fundamental interactions into one coherent and consistent picture.

String Theory is based on the premise that the fundamental building blocks of matter are not point-like particles but are actually tiny pieces of vibrating string, which can be either open or closed. Surprisingly, the spectrum of such quantized strings contains both a massless spin-2 excitation, which can be identified with the graviton, (i.e. the force field of gravity) and massless spin-1 excitations, which ultimately need to be identified with the gauge bosons of the standard model. Hence one could



**String Theory**



*The Magic Cube of String Theory: String Theory, also known as M-Theory, generalises the main theoretical pillars of 20th century Theoretical Physics in that it is a consistent description in the case where all three fundamental constants of nature ( $G$ ,  $h$  and  $c$ ) are turned on.*

say that String Theory predicts both gravity and gauge theory! Other predictions of String Theory are that we live in a 10-dimensional spacetime, supersymmetry, the existence of a holographic principle, and the Bekenstein-Hawking black hole entropy formula.

Over the past 10-15 years a coherent picture has emerged in which the five previously thought to be distinct (super) String Theories are now understood to be just different manifestations of one underlying theory, known as M-theory, related by a web of so-called dualities.

Scientists at the ANU, in close collaboration with both physics and mathematics colleagues at other Australian Universities as well as overseas, predominantly work on the foundational aspects of String Theory/M-theory. This involves understanding and developing the mathematics behind these dualities (and leads to modern fields such as noncommutative geometry) with the ultimate aim of unraveling the physical principles behind M-theory.