The Standard Model of particle physics in other universes

McCabe, Gordon (2005) The Standard Model of particle physics in other universes.

Abstract

The purpose of this paper is to demonstrate how the mathematical objects and structures associated with the particle physics in other universes, can be inferred from the mathematical objects and structures associated with the particle physics in our own universe. As such, this paper is a continuation of the research programme announced in McCabe (2004), which implemented this idea in the case of cosmology.

The paper begins with an introduction that outlines the structuralist doctrine which this research programme depends upon. Section 2 explains how free elementary particles in our universe correspond to irreducible representations of the double cover of the local space-time symmetry group, and relates the configuration representation to the momentum representation. The difficulties of treating elementary particles in curved space-time, and the Fock space second-quantization are also explained. Section 2.1 explores the particle physics of universes in which the local symmetry group is the entire Poincare group or the isochronous Poincare group. Section 2.2 considers free particles in universes with a different dimension or geometrical signature to our own. Section 3 introduces gauge fields, and, via Derdzinski's interaction bundle approach, explains how connections satisfying the Yang-Mills equations correspond to the irreducible representations for `gauge bosons'. To explore the possible gauge fields, section 3.1 explains the classification of principal G-bundles over 4-manifolds, and section 3.2 expounds the structure theorem of compact Lie groups. Section 3.3 summarises the consequences for classifying gauge fields in other universes, and section 3.4 infers the structures used to represent interacting particles in other universes. The paper concludes in Section 3.5 by explaining the standard model gauge groups and irreducible representations which define interacting particle multiplets, and specifies the possibilities for such multiplets in other universes.

Keywords:	Particles, space-time, symmetry, structuralism, gauge fields, parity, differential equations
Subjects:	Specific Sciences: Physics: Classical Physics Specific Sciences: Physics: Cosmology Specific Sciences: Mathematics Specific Sciences: Physics: Relativity Theory Specific Sciences: Physics: Fields and Particles Specific Sciences: Physics: Quantum Mechanics Specific Sciences: Physics: Quantum Field Theory
ID Code:	2218
Deposited By:	McCabe, Gordon
Deposited On:	03 March 2005