Gödel and the Theory of Everything *

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Among the hopes Gödel's famous *Incompleteness Theorem* is said to dash, one frequently encounters the Theory of Everything (T.O.E), an ideal quite popular among particle physicists. Indeed, Weinberg's *Dreams of a Final Theory* appear quite close to a complete formal system containing all physical laws: "the final theory [is] one that is so rigid that it cannot be warped into some slightly different theory without introducing logical absurdities like infinite energies."([17], p. 12) According to him, the fact to be *logically isolated* provides an internal check for a theory to be final. "In a logically isolated theory every constant of nature could be calculated from first principles; a small change in the value of any constant would destroy the consistency of the theory."([17], p. 189). Weinberg is convinced that "string theory has provided our first plausible candidate for a final theory."([17], p.169.) But his general claims are essentially cosmological ones that are embedded into a big bang type framework. Only one fundamental arbitrariness might remain unexplained by the T.O.E.: the actual value of the cosmological constant Λ. Its existence is consistent with the general symmetry principles of Einstein's equations:

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi T_{\mu\nu}. \tag{0.1}$$

Does this single undeterminable parameter already constitute a safe haven for Weinberg against Gödel's theorem? Λ appears to be the parameter distinguishing between several consistent T.O.E.'s. How is its measurement represented within the complete final theory? If it is not, there remains much more outside the system than just the numerical value of Λ.

At this point a mathematician or logician perhaps feels rather uneasy being faced with such a specific question without knowing whether the language Weinberg talks about can be gödelized at all. As Weinberg admits: "it is foolhardy to assume that one knows even the terms in which a future final theory will be formulated."([17], p.137) But then why should there be a T.O.E. at all? As a matter of fact, Weinberg's justification consists in his philosophical convictions of an *objective reductionism* that "is simply true"([17], p.42) because we can see by subdividing a piece of chalk (and have been taught by the history of physics) that the tinier parts contain the more fundamental physics. Moreover, Weinberg appears as a Platonist believing "in the reality of abstract ideas", in "the reality of the laws of nature."([17], p.35)

Opponents to the idea of a T.O.E. argue by means of Gödel's theorem also on this general level of beliefs:

* This paper is in its final form and no similar paper has been or is being submitted elsewhere.