Abstract Submitted for the MAR06 Meeting of The American Physical Society

Epistemic Excess Baggage of Hidden Variable Theories NICHOLAS HARRIGAN, TERRY RUDOLPH, Imperial College London — In Quantum Mechanics (QM) preparations of a system are represented by density operators acting on the associated Hilbert space. An ontological ('hidden' variable) model however, views preparations as being described by probability distributions (known as epistemic states) over a set of 'hidden' variables. We investigate restrictions on the efficiency of any such model of QM through studying its preparation contextuality, a property that one can prove to be possessed by ontological models. This property implies the existence of cases wherein more than one distinct epistemic state must be associated with a single density operator in order to correctly reproduce QM predictions. Traditional proofs of preparation contextuality have exhibited scenarios in which it can only be seen that an ontological model must associate more than one epistemic state with some density operator, the exact number being uncertain. We investigate the existence of upper or lower bounds on the number of distinct epistemic states that an ontological model must associate with density operators in order to reproduce QM statistics. The bounds obtained are yet another clue as to how one might quantify the non-classical nature of QM. We provide some speculation on how these results may shed light on the difficulty of simulating quantum mechanical systems on a classical computer.

> Nicholas Harrigan Imperial College London

Date submitted: 16 Jan 2006

Electronic form version 1.4