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Undecidability Theorem and Quantum Randomness ALEXANDER A. BEREZIN, McMaster University — As scientific folklore has it, Kurt Godel was once annoyed by question whether he sees any link between his Undecidability Theorem (UT) and Uncertainty Relationship. His reaction, however, may indicate that he probably felt that such a hidden link could indeed exist but he was unable clearly formulate it. Informational version of UT (G.J.Chaitin) states impossibility to rule out algorithmic compressibility of arbitrary digital string. Thus, (mathematical) randomness can only be disproven, not proven. Going from mathematical to physical (mainly quantum) randomness, we encounter seemingly random acts of radioactive decays of isotopes (such as C14), emission of excited atoms, tunneling effects, etc. However, our notion of quantum randomness (QR) may likely hit similarly formidable wall of physical version of UT leading to seemingly bizarre ideas such as Everett many world model (D.Deutsch) or backward causation (J.A.Wheeler). Resolution may potentially lie in admitting some form of Aristotelean final causation (AFC) as an ultimate foundational principle (G.W.Leibniz) connecting purely mathematical (Platonic) grounding aspects with it physically observable consequences, such as plethora of QR effects. Thus, what we interpret as QR may eventually be manifestation of AFC in which UT serves as delivery vehicle. Another example of UT/QR/AFC connection is question of identity (indistinguishability) of elementary particles (are all electrons exactly the same or just approximately so to a very high degree?).

Alexander A. Berezin
McMaster University

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