"Does spacetime have signature (3,1) or (1,3)?"

The question of whether spacetime has signature (3,1) or (1,3) is an old one, originating in the Dirac theory of the electron, and the fact that the Clifford algebras Cl(3,1) and Cl(1,3) are not isomorphic, even as algebras. Neither of these Clifford algebras supports the Dirac equation for the electron mass, which suggests this is the wrong question to ask. As Lie algebras, Cl(3,1) reduces to gl(4,R) = so(3,3)+so(1,1) and Cl(1,3) to gl(2,H)=so(5,1)+so(1,1), but the Dirac gamma matrices together with the imaginary scalars (needed for the mass term) generate u(2,2)=so(4,2)+so(2), which leads to the Penrose theory of twistors. Adding the twistors in to the Lie algebra gives su(3,2), which supports the Dirac equation plus all the machinery of electro-weak unification, for three generations of electrons, but has lost the Clifford algebra, and therefore has lost the definition of spacetime.

But there is another definition of spacetime available using so(3,1) inside u(3,1), extended by a pair of Lorentz 4-vectors to su(3,2). The 10 dimensions of u(3,1) outside so(3,1) transform like the symmetric rank 2 tensors used in general relativity. This suggests a way to re-interpret the Dirac formalism to be compatible with general relativity, while also requiring a re-interpretation of general relativity to be compatible with quantum mechanics. This leads to a host of predictions and experimental tests that distinguish this model both from GR and from standard QM, in both the IR and UV limits. I will discuss some of these predictions, as time permits.