Chapter VIII
Absolute quantum space

8.1 Introduction.

8.2 The classical absolute space.

8.3 Potentials or the ether?

For two objects A and B, an operation $*$ is covariant if under composition AB

$$(A^*)(B^*) = (AB)^*.$$

An operation T is contravariant if

$$(A^T)(B^T) = (BA)^T.$$

Clearly if the composition AB is commutative, so AB = BA, then covariance is the same as contravariance.

The quantum phenomenons we have met in the Heisenberg model are noncommutative, so $AB \neq BA$. Further, the differential structures on spaces with a commutative distance between points can be noncommutative. This is explained in chapters XV and XVII. Then there is a difference between covariance and contravariance in these cases.

As described by Einstein, the commonly adopted equations of physics are covariant. These are equations for instance in general relativity concerning the energy or transformation of a system using potentials.

If the equations are contravariant, this is a hydrodynamic model of physics. Landau and Lifschitz [ref] have described equations for relativistic gravitation which are partly covariant and partly contravariant. We might say in this case that the model describes the ether.

8.4 Quantisation at t = 0.

8.5 The absolute energy.