Neglect of General Covariance

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Abstract

Tensor ranks are not relative. Each tensor type and symmetry denotes its own class of geometric objects, that are not really interpretable as members of another class. Coordinate-free geometry is the real theory, so tensor notation with coordinates can only be taken as a distant translation. But there is a perverse tradition in academia to the contrary. Vectors are used to portray physical objects that are plainly nothing of the sort. This only adds confusion to the study of mechanics and electromagnetism. Even in cosmology the wrong tensor ranks and operators are used, invoking a system of compensating errors that eventually go uncompensated on the edge. The two Bianchi identities, with the exterior derivative as the operator, are the correct foundation for the theory. These identities are geometric in their essence, not based in coordinate algebra. By contrast, the cosmological constant is simply a mathematical error. And there is an analytical blunder to deal with - the failure to include (into the cosmological equation) the fictitious potentials that derive from the noninertial Friedmann coordinates. The equivalence principle demands this inclusion. Integrating from geometric initial conditions on the two Bianchi identities is a method that bypasses these errors.

General Covariance

General covariance is nothing less than the assertion that coordinate free geometry is the real essence of (classical) things - Einstein-Davis theory that in turn derives from the work of Spinoza.

A lesser implication, that is great fun and important in understanding physics, is that (classical) physics can always be solved by referring to a diagram of the problem, which has the property of retaining its validity even when it is scaled and sparse.

But tensors can be drawn correctly on a scaled and sparse diagram only when they have their proper rank, the one that corresponds to their dimensionality in units of length. Potential momentum is a 1-form, for example, and the Faraday tensor is a 2-form with a dimensionality of L^{-2}. These are covariant tensors - and not contravariant - by reason of the negative power of L. Coordinates are naturally covariant 1-forms with a dimensionality of L^{-1}. Spacetime intervals are the only natural vectors, contravariant with a dimensionality of L^{1}.

Drawing with the wrong tensor rank leads to gross inconsistencies between diagrams of different scale and sparseness, so that observers no longer have freedom in their choice of units of measurement. Relative motion between observers sets off great paradox.

Cosmological Sanity

The Einstein equation, as well as the cosmological equation, should be thought of as a correspondence principle, an approximate translation between two mathematical systems, with pure geometry on the left and classical mechanics on the right. There is not an enmeshment when the equation is invoked, with one side then becoming incomplete and dependent on the other. Each side has its own independent foundation - mechanics in its laws of conservation, and the geometry of spacetime in the two Bianchi identities.

In the cosmological equation, the expression for mechanics on the right side naturally includes gravitational potential energy in its term for density. But the fictitious potential is not traditionally included because it does not fit naturally into the density term; instead the fictitious potential varies with location and time in the Friedmann coordinates. So the fictitious potential must be included. No sensible observer calculating with mechanics would fail to include fictitious potentials, and the cosmological equation is not different. The equivalence principle makes it impossible to discriminate between fictitious and nonfictitious anyway.

These equations are written by tradition in the wrong tensor rank. By considering geometric units, as well as by the use of exterior derivatives to treat the geometry, the fourth rank covariant is mandated.

In this proper fourth tensor rank the cosmological constant becomes a coordinate artifact at best; it breaks the Bianchi identity, and forces nonconservation on mechanics as well.

Conclusion

Many more examples could be worked or expanded on. But I will just leave this as a word to the wise.