

Geometrization(s) of Matter

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The basic categories postulated by physics are space and time (or rather spacetime) on the one hand, and matter on the other hand. However, the relationship between the two categories is still controversial. There are essentially three families of positions one can take towards this relationship:

- (i) substantivalism (roughly: both spacetime and matter are fundamental in their own right);
- (ii) relationalism (roughly: just matter is fundamental and spacetime is in some way reducible to matter);
- (iii) super-substantivalism (roughly: just spacetime is fundamental and matter is in some way reducible to spacetime).

The first two families of positions have been discussed in great detail in the modern philosophical literature, whereas the third has received almost no attention. However, there are research programmes in physics that directly correspond to this philosophical idea, and my aim is to (i) elaborate the *philosophical* idea of super-substantivalism; (ii) analyze and categorize various theories within *physics* that correspond to this idea; (iii) discuss possible advantages of such positions.

I will start out by investigating in how far super-substantial ideas are already compatible with standard general relativity theory (GR), i.e. in how far matter can be seen as an aspect of spacetime geometry even if no other fields than the gravitational one are associated with the geometry of spacetime.

I will then review John Wheeler's 'geometrodynamics' programme, which in its original version incorporates super-substantial ideas in a very direct manner. I will compare this to the original version of Kaluza-Klein theory, and to a very recent and promising modification of the latter.