

Too distant worlds. Spacetime Structural Realism and Physicality. [Extended abstract]

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The goal of my presentation is to evaluate spacetime structural realism (SSR) in the context of problems about classifying certain spacetime models as physical or unphysical. I claim that those problems lead to serious doubts about „realism” in spacetime structural realism.

SSR, if modelled after ontic structural realism (OSR) or moderate ontic structural realism (MOSR) should be considered, I think, as a strong realistic position towards spacetime. By „strong realistic position” I mean such a position in which one holds metaphysical, epistemological and semantic beliefs towards entities posited in the domain of discourse of a given scientific theory. Ontologically oriented structuralists seem to take the thesis of epistemological realism for granted; they sometimes try to ground their position in certain semantics (e.g. partial isomorphisms approach). The fuss is, of course, about the thesis of metaphysical realism - how to cash it out in structural terms, especially when one has in mind interpretative applications to certain theories, like general theory of relativity (GTR)? I claim that even if all three thesis are non-standard or somehow revisionistic, when all of them are hold jointly in one way or another, then we are dealing with strong realism. For some, surely, metaphysical realism alone is far too strong; but I bracket naive realism here.

What is the metaphysical thesis of SSR, what is the nature of spacetime according to SSR-ist? Surely, spacetime is treated here as a real existent. If SSR is modelled strictly after OSR then spacetime, metaphysically, has no parts, for only spacetime relations invariant under relevant transformations are considered ontologically real. Individuals – spacetime points – are banned from SSR-ists ontology. Structure is taken to be a set of relations. This version of SSR seems not to be promising.

SSR modelled after MOSR treats spacetime points and spacetime structure encoded in the metric tensor field as ontologically on a par, with the addition that spacetime points have no primitive individuality; they gain individuality via the metric tensor. However, this leads to the concept of discernibility only *via* spacetime relations. Admitting individuals in SSR while formulating criteria of identity in relational terms means that in case of spacetime in GTR the role of identification can only be played by spacetime curvature. This criterion is valid only in generally non-symmetric spacetimes. The argument called „the abysmal embarrassment for spacetime structuralism” points out that in highly symmetric, cosmic spacetimes (with Robertson-Walker metric) there is no way to discern spacetime points and SSR-ist is forced into accepting that there is only one point in the universe. This is a very

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uncomfortable result: to avoid this conclusion one must resort to arbitral admittment of numerical distinctivess or toy with the notion of discernibility.

Now, the usual response to problems generated by symmetries in spacetime is to discard such examples with highly symmetrical spacetimes, deeming them unphysical. But this price seems too high. Should we discard Minkowski spacetime or the Schwarzschild solution, and claim that those are unphysical? This would seem to be an instrumentalist ploy or a sort of selectivism. I think that this doesn't suit any realist well.

Given that in some forms of SSR one must reduce the number of physically sound spacetime models, it is reasonable to say that this lack of trust towards GTR makes SSR not that realistic at all. If we accept the strong realist reading of SSR, then in SSR there is an inconsistency regarding how to formulate (approximatly) true statements about physical facts dealt with in certain models generated from GTR. If we accept that SSR is only a metaphysical thesis then solutions to problems concerning symmetric spacetimes are poorly motivated.

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