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ABOUT THE SUBSTANTIVE NATURE OF SPACE-TIME
(ABSTRACT)

Since the Newton-Leibniz debate about the substantive or relational nature of space the problem is still going to be a bone of contention among philosophers. My present report will neither be based on historical facts about the debate, nor will it develop traditional theses and anti-theses. Its aim is the explication and the analysis of three relatively independent arguments in favour of the substantive nature of space-time. I say that these arguments are relatively independent not because they share some common theoretical parts, but because the third argument might be considered to provide a general "ideological" base for the first two.

Parity violation

Parity violation is a pretty well known fact in the realm of the week interactions in quantum physics. It is worth noticing that for the first time the possibility for the existence of incongruent counterparts in space (i.e. of mirror objects, which, though being quite similar like the left and the right human hands, still cannot be superimposed on each other) was connected with the existence of an absolute and substantive space, as was shown in the interesting argument of Kant from 1768. If only one human hand existed in the world, Kant contended, it would be either a left, or a right hand. And this is so, because the absolute space has something to do with the compositeness of matter. Having in mind the parity violation in the micro-world, I can go further on by saying that if there were only one weak interaction in the world, it would break the mirror symmetry. A physical system is invariant only with respect to the triple CPT transformation. If space-time had a relational nature, the first of the last two statements would not be true, and the second would have no reasonable explanation. If space-time had a purely relational nature, it would have no

impact on the symmetry of physical interactions, but vice versa, it would emerge out of the relations within, and among material structures.

The Cosmological Constant

A. Einstein introduced an additional term in the equation of the general theory of relativity, known as the cosmological constant, so that the equation could describe a static Universe. When astronomic observations showed that this was not the case, Einstein removed this term. However, 43 years after he was gone, observations showed not only that the Universe is expanding, but that its expansion is accelerating. Contemporary cosmologists re-introduced Einstein's cosmological constant taking it to refer to what is known now as dark energy. The latter is a fundamental quality of space-time itself. But if its nature is relational, space-time could hardly possess such a quality. So, we must conclude that it is substantive.

A Consistent Interpretation of Einstein's Equation in General Relativity

Einstein's equation can be consistently interpreted to express identity, and not mere correlation of equality between its left and right sides. Thus both these sides – the mathematical tensor – are theoretical constructs that refer to one and the same absolute entity – the space-time. Tis interpretation certainly excludes the possibility for its relational nature. At that the interpretation affords space-time to display physical features characteristic for the previous two arguments.