Why Do We Need Spacetime?
Space, Time, and Individuation from Leucippus to Einstein

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As we pursue new programs in fundamental physics that would treat space or spacetime as derived, not fundamental structure, or even as something epiphenomenal, as will-o'-the-wisp residua of the classical within a basically quantum mechanical world, we would do well to remind ourselves of the physical and metaphysical work that space and time have done in the physics and natural philosophy of previous centuries.

This talk surveys the history of the concepts of space, time, and spacetime primarily from the point of view of such structures serving as grounds of individuation for physical systems and states of physical systems. Such a way of regarding the essential work of space, time, and spacetime is best known, of course, from the work of Albert Einstein, who, in the context of his evolving skeptical doubts about quantum mechanics, elevated the idea of spacetime as the basis of what he termed the "separation principle" nearly to the status of a necessary, a priori requirement on the very possibility of an objective physical theory. But in thinking about space, time, and spacetime in this manner, Einstein was drawing upon a much longer history that goes back through such thinkers as Schopenhauer, Kant, Locke, and Newton to Medieval thinkers, like Suarez and Aquinas, indeed, all the way back to the ancient atomists, such as Leucippus, for whom the "void" or the "empty" (κενόν) is, precisely, the interstitial or, as Epicurus and Lucretius later termed it, the "intervals" (διαστήματα) between the atoms. The talk will focus mainly, however, on the early modern debate over space and individuation, involving Newton, Locke, and Leibniz, and upon Schopenhauer's explicit characterization of space and time as the "principium individuationis," Schopenhauer being, so it would appear, the immediate source from which Einstein drew.

If such is the most basic work that space, time, and spacetime were long thought to do in fundamental physics, then we face a dilemma in a contemporary era in which such structure is no longer deemed fundamental by many, widely-discussed programs. We must argue either that the individuation of systems and states in the manner afforded by space, time, or spacetime is not required in fundamental physics, which means rebutting Einstein's claim that such schemes of individuation are necessary, or that a functional equivalent of spatial, temporal, or spatiotemporal modes of individuation is available in the mentioned, alternative, fundamental programs.