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Might Dark Matter and Energy be Intrinsic Properties of Space?

RONALD BRUNER, Rowan University — It is shown that if a volume element, V, of space is assumed to have intrinsic energy E, then consistency of the work-energy theorem with special relativity leads to the equation of state (EOS): E=pV, where p is the pressure of space. When this EOS is incorporated in the Einstein equations it leads to the prediction that the orbital speed of matter circling a galaxy should be relativistic, in disagreement with observations. It is then argued that the mathematical structure of thermodynamics suggests pressure would more naturally be defined as the positive partial derivative of E with respect to V, in which case special relativity leads to the EOS: E=-pV. However, this EOS is also unable to account for observed rotational velocity curves of matter orbiting visible galaxies. Therefore, the possibility that that space has two distinct components of energy is investigated. This results in a plausible two-component EOS in which the former EOS is identified with the dark matter (DM) and the latter with the dark energy (DE). The effective EOS of space may then be written in the form: p=we, where e is the total energy density, p the total pressure, and w represents the fractional excess of DM over DE (and so may range from +1 to -1). This EOS is a viable candidate for explaining all observations attributed to both DM and DE. In particular, it predicts the constant rotational velocity curves observed for matter in circular orbits around visible galaxies.

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