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Using Clifford Algebra to Understand the Nature of Negative Pressure Waves GENE MCCLELLAN, Applied Research Associates, Inc. — The geometric algebra of 3-D Euclidean space, a sub-discipline of Clifford algebra, is a useful tool for analyzing wave propagation. We use geometric algebra to explore the concept of negative pressure. In free space a straightforward extension of Maxwell's equations using geometric algebra yields a theory in which classical electromagnetic waves coexist with nonelectromagnetic waves having retrograde momentum. By retrograde momentum we mean waves carrying momentum pointing in the opposite direction of energy flow. If such waves exist, they would have negative pressure. In rebounding from a wall, they would pull rather than push. In this presentation we use standard methods of analyzing energy and momentum conservation and their flow through the surface of an enclosed volume to illustrate the properties of both the electromagnetic and nonelectromagnetic solutions of the extended Maxwell equations. The nonelectromagnetic waves consist of coupled scalar and electric waves and coupled magnetic and pseudoscalar waves. They superimpose linearly with electromagnetic waves. We show that the nonelectromagnetic waves, besides having negative pressure, propagate with the speed of light and do not interact with conserved electric currents. Hence, they have three properties in common with dark energy.

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