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An unorthodox study of bidirectional light waves ANKIT PANDEY, BILL POIRIER, LUIS PERALTA, MUHAMMAD SIDDIQUE, YU-CHE HO, HIRA FAROOQ, Texas Tech University — We consider linear superpositions of electromagnetic waves of similar frequencies, moving in opposite directions. Surprisingly, these superpositions have a lot more complexity than what has been reported in the literature. On the one hand, it is fairly intuitive that one should expect to see slowly translating standing waves. This feature may have its own applications in precise control of nanoparticles. An experiment to observe these is underway. On the other hand, a hardly studied superluminal wave is observed, which has startling parallels with quantum mechanics. An effective "rest mass", which is relativistically invariant, can be assigned to these bidirectional waves. This in itself is surprising, because the unidirectional electromagnetic wave components are themselves massless. Further, the superluminal wavelength is found to be exactly the same as the relativistic de Broglie wavelength. The subluminal (standing) waves on the other hand, have exactly the same wavelength as the corresponding Compton wavelength, thus having parallels with the Zitterbewegung oscillations of the Dirac equation. Finally we show that, by considering small non-linear modifications of the electromagnetic wave equation, it is possible to end up with Schrodinger-like solutions.

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