

Title: Spin and Long-Range Forces: The Unfinished Tale of the Last Massless Particle

Abstract: The success of gauge theory descriptions of Nature follows simply, in hindsight, from Lorentz symmetry, quantum mechanics, and the existence of interacting massless particles with spin. Yet, remarkably, the most generic type of massless particle spin has never been seriously examined: Wigner's so-called "continuous spin" particles (CSPs), which have a tower of polarization states carrying all integer or half-integer helicities that mix under boosts. I will introduce the basic physics of this type of particle, present recent progress in understanding them using both S-matrix arguments and field theory, and explain how they might be relevant to Nature.