Electromagnetic Skyrmions of Free Space

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Abstract

The transverse electromagnetic waves generated by oscillating Hertzian dipole emitters are major information and energy carriers. In 1996, Hellwarth and Nouchi theoretically identified a radically new, non-transfer type of propagating electromagnetic pulses of toroidal topology that are propagating counterparts of the localized toroidal dipoles. In this talk we overview recent progress in toroidal electrodynamics including generation and detection of toroidal pulses, the study of their space-time "entanglement" and isodiffraction behaviour and light-matter interactions involving anapoles. We will report on the unique supertoroidal pulses, propagating skyrmionic formations of electromagnetic fields that can be non-diffracting and exhibit superoscillatory behavior.