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New Structures in Gravitational Radiation

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Gravitational waves transport information from faraway regions of the Universe. Most studies so far have been devoted to sources like binary black hole mergers or neutron star mergers, or generally to sources that are stationary outside of a compact set. We describe these systems by asymptotically-flat manifolds solving the Einstein equations. These sources have in common that far away their gravitational field decays fast enough towards Minkowski spacetime. In particular, far away from the source, the decay behavior can be described by a term that is homogeneous of degree (-1) and lower order terms. I will present new results on gravitational radiation for sources that are not stationary outside of a compact set, but whose gravitational fields decay more slowly towards infinity. A panorama of new gravitational effects opens up when delving deeper into these more general spacetimes. In particular, whereas the former sources produce memory effects that are of purely electric parity (permanent displacement only), the latter in addition generate memory of magnetic type, thus allowing for rotation in the system. These new effects emerge naturally from the Einstein equations.