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Formation and dynamics of an electromagnetic bubble during the NS binary inspiral: theory and observational signatures[1] MIKHAIL MEDVEDEV, U. Kansas, A. LOEB, Harvard U. — We consider a merging binary system of either two magnetized neutron stars or magnetars, or a neutron star – black hole binary during the last year days of its evolution. Both compact companions possess magnetic moments and hence are sources of low-frequency electromagnetic (EM) waves, whose frequency is the inverse orbital period and, hence, does not exceed a few kHz. Such EM waves are evanescent: they do not propagate in ambient ISM plasmas because the wave frequency is below the plasma frequency. As the EM energy is continuously pumped into the system by the binary, there forms a cavity (or a bubble) filled with EM radiation. The bubble pushes on the surrounding plasma and can drive a shock wave through the ISM. The shock dynamics is different from the Sedov blast wave solution describing a freely expanding shock from a point-like explosion. Instead, the shock in the system at hand is continuously driven by the ever-increasing pressure inside the bubble. Here we explain the dynamics and evolution of the bubble and the driven shock. We predict that such shocks can be observed just before the merger. These sources become brighter and spectrally harder as the binary evolves toward the final merger. After the merger, the shock should ultimately settle onto the Sedov solution.

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