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# A numerical-relativity gravitational-wave catalogue of spinning Proca-star collisions

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I will present a systematic study of the dynamics and gravitational-wave emission of head-on collisions of spinning vector boson stars, known as Proca stars. To this aim we build a catalogue of about 800 numerical-relativity simulations of such systems. We have found that the wave-like nature of bosonic stars has a large impact on the gravitational-wave emission. In particular, we show that the initial relative phase  $\Delta\epsilon = \epsilon_1 - \epsilon_2$  of the two complex fields forming the stars (or equivalently, the relative phase at merger) strongly impacts both the emitted gravitational-wave energy and the corresponding mode structure. This leads to a non-monotonic dependence of the emission on the frequency of the secondary star  $\omega_2$ , for fixed frequency  $\omega_1$  of the primary. This phenomenology, which has not been found for the case of black-hole mergers, reflects the distinct ability of the Proca field to interact with itself in both constructive and destructive manners. We postulate this may serve as a smoking gun to shed light on the possible existence of these objects.

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