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New synergies between traditional PN methods and EFT: contributions of the logarithmic tails in the energy.

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Combining different techniques, we derive the logarithmic contributions to the two-body conservative dynamics. Those logarithms come from the conservative part of non linear gravitational-wave tails and their iterations. Explicit, original expressions are found for conservative dynamics logarithmic tail terms up to 6PN order by adopting both traditional PN calculations and effective field theory (EFT) methods. We also determine all logarithmic terms at 7PN order, fixing a sub-leading logarithm from a tail-of-tail-of-tail process by comparison with self-force (SF) results. Moreover, we use renormalization group techniques to obtain the leading logarithmic terms to generic power n, appearing at (3n+1)PN order, and we resum the infinite series in a closed form.

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