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*Vanishing of  $L$ -functions in families*

To many arithmetic objects  $M$  (e.g., Dirichlet and Hecke characters, elliptic curves, modular forms...), one can associate a complex-analytic function  $L(M, s)$  defined on some right half-plane  $\operatorname{Re} s \gg 0$  admitting meromorphic continuation to all of  $\mathbf{C}$  and satisfying a function equation relating the values at  $s$  and  $k - s$  for a positive integer  $k$ . The value of  $L(M, s)$  at its central point  $s = k/2$  conjecturally encodes arithmetic information about  $M$  (e.g., sizes of certain class groups, ranks of elliptic curves). After reviewing a few results on the vanishing of certain families of Dirichlet, Hecke, and modular  $L$ -functions at their central points, we discuss some  $p$ -adic analogues and their relationship to the classical cases.