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We construct Mahler discrete residues for rational functions and show that they comprise a complete obstruction to the Mahler summability problem of deciding whether a given rational function $f(x)$ is of the form $g(x^p) - g(x)$ for some rational function $g(x)$ and an integer $p > 1$. This extends to the Mahler case the analogous notions, properties, and applications of discrete residues (in the shift case) and q -discrete residues (in the q -difference case) developed by Chen and Singer. Along the way we define several additional notions that promise to be useful for addressing related questions involving Mahler difference fields of rational functions, including in particular telescoping problems and problems in the (differential) Galois theory of Mahler difference equations.

Joint work with Carlos E. Arreche (The University of Texas at Dallas, USA).