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Towards a p-adic theory of q-difference equations

ABSTRACT: Let q be a nonzero complex number. One usually calls q-difference operator the operator $\varphi_q(f)(x) = f(qx)$ or the associated q-derivation $d_q(f)(x) = \frac{f(qx)-f(x)}{(q-1)x}$, both acting on a convenient ring of functions. The relation $d_q x^n = (1 + q + \ldots + q^{n-1})x^{n-1}$ shows intuitively that $d_q \to \frac{d}{dx}$ when $q \to 1$: this phenomenon is known as confluence. In a recent paper J. Sauloy proves the confluence of the so-called *Birkhoff matrix* to the complex monodromy.

We will introduce p-adic q-difference equations and their first properties: namely their weak Frobenius structure and transfert theorems. These results are motivated by the p-adic confluence to differential equations.