

Phase operator on $L^2(\mathbb{Q}_p)$ and the zeroes of its resolvent

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Abstract

The generalised Vladimirov derivative acting on the space $L^2(\mathbb{Q}_p)$ of complex valued locally constant functions on the p -adic field \mathbb{Q}_p is like the number operator in quantum mechanics. We construct a ‘phase operator’ conjugate to it on a subspace $L^2(p^{-1}\mathbb{Z}_p)$ of $L^2(\mathbb{Q}_p)$. We discuss how to combine these for all primes (at physicists’ level of rigour). We comment on the connection between the distribution of the zeroes of the resolvent function of this operator and the non-trivial zeroes of the Riemann zeta function. We also extend these results to the Dirichlet L -functions.

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