Energy decay rates for the damped wave equation on the torus via non-polynomial derivative bound conditions

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For the damped wave equation on the torus, the energy decay rate is known to depend on the geometry of the support of the damping, and growth properties of the damping near where it is zero. In prior work, these growth properties are polynomial bounds on the damping, or derivative bound conditions, which control the gradient of the damping by a power of the damping. In this talk, we will show how these rates can be improved, and generalized to exponentially, or poly-logarithmically, growing damping, as well as more general non-polynomial derivative bound conditions. The proof of these results relies on resolvent estimates on very fine semiclassical scales. Time permitting, we will discuss how these new decay rates change when the geometry of the support of the damping changes.