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Determination of the Turbulent Decay Exponent J. BLAIR PEROT, CHRIS ZUSI, University of Massachusetts, Amherst — All theories concerning the decay of isotropic turbulence agree that the turbulent kinetic energy has a power law dependence on time. However, there is significant disagreement about what the value of the exponent should be for this power law. The primary theories, proposed by researchers such as Batchelor, Townsend, and Kolmogorov, have the decay exponent at values of 1, 6/5, 10/7, 3/2, 2, and 5/2. The debate over the decay exponent has remained unresolved for many decades because the decay exponent is an extremely sensitive quantity. Experiments have decay times which are too short to be able to accurately differentiate between the various theoretical possibilities, and all prior numerical simulations of decaying turbulence impose the decay rate *a priori* via the choice of initial conditions. In this work, direct numerical simulation is used to achieve very long decay times, and the initial turbulence is generated by the Navier-Stokes equations and is not imposed. The initial turbulence is created by the stirring action of the flow past 768 small randomly placed cubes. Stirring occurs at $1/30^{th}$ of the simulation domain size so that the low wavenumber and large scale behavior of the turbulent spectrum which dictates the decay rate is generated by the fluid and is not imposed. It is shown that in all 16 simulations the decay exponent closely matches the theoretical predictions of Saffman at both high and low Reynolds numbers. Perot, AIP Advances **1**, 022104 (2011).

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