Abstract Submitted
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Dynamics of the Direct Vortex Cascade in 2D Quantum Turbulence[1] GARY WILLIAMS, ANDREW FORRESTER, UCLA — The growth and decay of the direct vortex cascade in 2D quantum turbulence is studied for different rates of injection of vortex pairs of a given separation (the stirring scale), with the system in contact with a heat bath at low temperature. At low injection rates the vortices have no effect on the superfluidity, and the distribution of pair separations spreads out until reaching the steady-state distribution of the direct cascade, where pairs annihilate at the same rate they are injected. This cascade has a $k^{-}3$ energy spectrum, the same spectrum as the direct enstrophy cascade in 2D classical turbulence. On switching off the injection, the pair distribution first decays starting from the initial stirring scale, with the total vortex density decreasing linearly in time. As pairs at smaller scales decay, the vortex density then falls off as a power law, the same power law found in recent exact solutions of quenched 2D superfluids. At high injection rates the large density of vortices drives the superfluid density to zero at long length scales, and the growth and decay of the cascade is found to be much slower for this case.

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