On a large scale, inertial frames seem not to rotate relative to the average matter distribution in the universe. Without absolute space or finely tuned initial conditions, it is difficult to explain the lack of relative rotation. Although inflation and other classical mechanisms have been proposed as a possible explanation, a more likely explanation comes from considering reasonable forms of quantum gravity. A simple semi-classical approximation to quantum gravity (using a saddlepoint approximation to a path-integral calculation with a stationary-phase path) shows that phase interference would cancel out cosmologies with significant relative rotation. A generic general estimate for a perfect fluid cosmology with a realistic variation of average vorticity with cosmological scale factor (neglecting that with vorticity, flow lines are not normal to surfaces of constant global time) shows that only cosmologies with an average present relative rotation rate smaller than about $T^* H^2 \approx 10^{-71}$ radians per year could contribute significantly to a measurement of relative rotation rate in our universe, where $T^* \approx 10^{-51}$ years is the Planck time and $H \approx 10^{-10}$ yr^{-1} is the present value of the Hubble parameter. That the resulting maximum total rotation since the initial singularity would be less than about 10^{-58} radians suggests that neglecting that flow lines are not normal to surfaces of constant global time should be a good approximation. A more detailed calculation (approximating the action to second order in the square of average vorticity) shows that the saddlepoint at zero vorticity is isolated and that only cosmologies with an average present relative rotation rate smaller than about $T^* H^2 a_1^{1/2} \approx 10^{-73}$ radians per year could contribute significantly to a measurement of relative rotation rate in our universe, where $a_1 \approx 10^{-4}$ is the value of the cosmological scale factor at the time when matter became more significant than radiation in the cosmological expansion. This is consistent with measurements indicating a present relative rotation rate less than about 10^{-20} radians per year.