P = NP:

Define the time required to calculate the NP problem as t_{NP}, in the reference frame of a travelling observer of the calculation, named "NP", who is at a velocity of $v_{NP.}$ The velocity of the computer performing the calculation is v_P . The computer is stationary relative to a second observer, named "P", who stays at the computer performing the calculation: $v_P = 0$.

Observer P, in the reference frame of the computer, sees a calculation time of t_P. Observer NP leaves Observer P at $t_0 = 0$.

Observer P and NP reunite at t_{NP} as the calculation finishes. Then, introducing the Lorentz Factor for Relativistic *time dilation*,

$t_{NP} = t_P (1 – (v_{NP}{}^2/ c^2))^{0.5}$. Eq. 1

Now, as v_{NP} approaches c,

$t_{NP} = t_P (1- 1)^{0.5}$

$t_{NP} = 0$,

such that Observer NP sees an instantaneous calculation time.

As an example, consider the Travelling Salesman Problem (TSP): We can calculate the velocity required for the NP Observer so as to reduce the computation time of an n-city problem compared to a trivial single operation by using Eq. 1.

At 0.9999999999 c,

$v_{NP}{}^2/ c^2 = 0.99999999995$;

$t_{NP} / t_P = (1 - 0.99999999995)^{0.5} = 0.707$ e-6

which is in the range of 9 about cities (1/9! =2.75 e-6).

While this problem has been cast in the rather unrealistic terms of the twins paradox, any calculation that could be achieved within an interacting and unconventional computation using a particle beam should enjoy the same advantage of time dilation.

One might consider an interference pattern to be a real-time NP calculation. Consider a third observer, you, watching two slits in an interference filter. Consider those slits to be the P and NP observers. Given the invariance of the speed of light, light emerging from one slit sees the velocity of light from the adjacent slight as travelling at an (increased) relative speed of c. In analogy with the twin paradox (above), and by stating Eq. 1 as its reciprocal, we find:

t_P / t_{NP} = infinity

which is consistent with the instantaneous and unconventional calculation of the Fourier transform that is formed in the interference pattern.