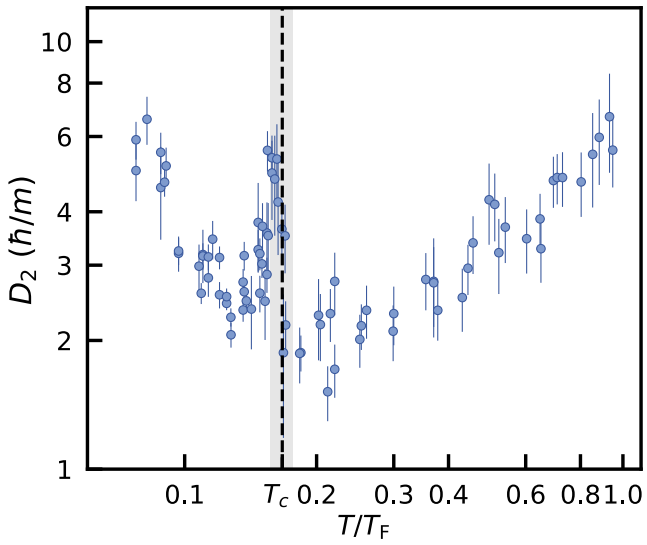

Figure 5-14: Second Sound and thermal diffusivity across the superfluid transition. The vertical dashed line and shaded area are the position and uncertainty of the superfluid transition temperature from Ref. [101].

5.4.2 Viscosity measured from thermal and sound diffusivity

In the normal phase of unitary Fermi gas, the damping of first sound comes from spatial gradients of both density and temperature, hence the diffusivity of first sound depends on both thermal conductivity κ and shear viscosity η:

$$D_1 = \frac{4\eta}{3\rho} + \frac{\kappa}{nc_V}. \tag{5.78}$$

Using the thermal conductivity measured from heat diffusion and the diffusivity of first sound (see Appendix. D), we can solve the shear viscosity in Eq. (5.78), as shown in Fig. 5-15B.