

## Viscous and Acoustic Damping on Tuning Forks Oscillating in Liquid Helium-4

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We present measurements of the dissipative forces on tuning forks, oscillating in both normal fluid and in superfluid <sup>4</sup>He, due to viscous drag and acoustic emission. The measurements were made over a temperature range from 1.5 K to 4.2 K. Arrays of several tuning forks were investigated. Each fork has prongs of width 75  $\mu\text{m}$  and thickness 90  $\mu\text{m}$ , but the prong length varies from 0.7 mm to 3.5 mm so that their fundamental mode of vibration covers a wide frequency range (6-200 kHz). The forks were also driven in their first harmonic mode to extend the frequency range up to 600 kHz. We observe a clear crossover in the behavior: viscous drag dominates at low frequencies whilst acoustic emission dominates at higher frequencies. The dissipative forces are compared quantitatively with available theoretical models.<sup>1,2</sup> Acoustic emission provides a limiting factor on the practical use of tuning forks for studying fluid properties.

<sup>1</sup>M. Blažková, D. Schmoranzer, L. Skrbek, and W. F. Vinen, Phys. Rev. B **79**, Issue 5, 054522 (2009)

<sup>2</sup>D. Schmoranzer, M. La Mantia, G. Sheshin, *et al.*, J. Low Temp. Phys. **163**, Issue 5-6, in print (2011).