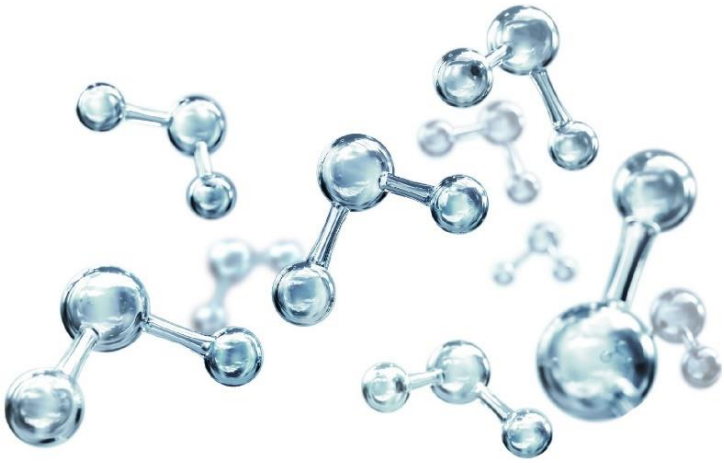
Seminar

CMWS Centre for Molecular Water Science

30th October 2025
12:00 h (CET)

Zoom Virtual Meeting:

https://tuhh.zoom.us/j/82631283465
Meeting-ID: 826 3128 3465
Password: 978444



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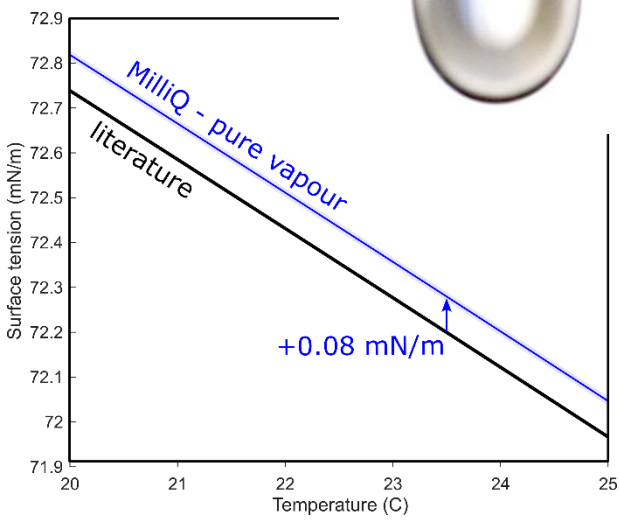
The Surface Tension of Ultra-Pure Water: in Its Pure Vapour

Water is the most studied liquid and many of its various thermodynamic properties, e.g. surface tension, have been measured a large number of times[1]. However, no surface tension measurements have been undertaken of water in its pure vapour, with the complete absence of contaminants or other gas phase species. This is surprising given that the presence of other species or contaminants, even in tiny quantities, are known to greatly affect interfacial phenomena. See for example the Jones-Ray effect with respect to dilute salt solutions[2] or the historic disagreements over the interfacial charge of the water-air interface[3,4]. In general, arguments have even been made that standard, ultra-pure lab water sources, e.g. the Milli-Q water system, are still too dirty for water interfacial experiments[5].

We have built an instrument to produce a pendant drop of ultra-pure water in its pure vapour and measure its surface tension aiming to completely remove contaminants. The drop is created by condensing water from a pure vapour phase onto a cooled “cold finger” inside a vacuum chamber. The chamber is previously pumped to ultra-high vacuum conditions, and the water is cleaned *in-situ* via UV light illumination to achieve ultimate cleanliness. The surface tension is measured by pendant drop tensiometry where the drop is imaged and the drop profile provides a direct measure of its surface tension.

Initial results show that the surface tension of Milli-Q lab water in our instrument has a higher value (+0.08 mN/m) than the literature. We attribute this to the removal of gases from our experiment, showing that the ambient conditions do affect interfacial phenomena. The next steps will be *in-situ* cleaning of the Milli-Q water via UV light illumination and measurements of how this cleaning further affects the water surface tension. We hope that the data from this instrument can provide a standard for use in fields such as meteorology or the soft-matter sciences.



[1] Pátek, J., et. al. J Chem Eng Data (2016)
[2] Uematsu, et. al. Journal of Physical Chemistry Letters (2017)
[3] V. Buch,et. al. Water surface is acidic, Proc. Natl. Acad. Sci. U.S.A. (2007)
[4] J. Beattie et. al., Water surface is basic, Faraday Discuss., (2009)
[5] Uematsu, Y., et. Al. Curr Opin Electrochem (2019)