# 1. Introduction, Notation

We consider fluid systems dominated by the influence of interfacial tension. The roles of curvature pressure and Marangoni stress are elucidated in a variety of situtations. Particular attention will be given to the dynamics of drops and bubbles, soap films and minimal surfaces, wetting phenomena, water-repellency, surfactants, Marangoni flows, capillary origami and contact line dynamics. Theoretical developments will be accompanied by classroom demonstrations. The role of surface tension in biology will be highlighted.

**Notation**

`Nomenclature`: $\sigma$ denotes surface tension (at fluid-gas interface)
$\gamma$ denotes interfacial tension (at fluid-fluid or fluid-solid interface).

`Note on units`: we will use predominantly ***cgs*** system.
Unit of force: 1 dyne = 1 g cm $s^{-2}$ = $10^{-5}$N as the *cgs* unit of force, roughly the weight of 1 mosquito.
Pressure: 1 atm $\approx$ 100kPa = $10^5$N/$m^2$=$10^6$ dynes/$cm^2$.
Units: $[\sigma]$=dynes/cm=mN/m.

`What is an interface?`: roughness scale $\delta$, from equality of surface and thermal energy get $\sigma\delta^2 \sim$kT$\Rightarrow$ $\delta \sim (\mathrm{kT}/\sigma)^{1/2}$. If $\delta \ll$ scales of experiment, can speak of a smooth interface.

## 1.1 Suggested References

While this list of relevant textbooks is far from complete, we include it as a source of additional reading for the interested student.

- **Capillarity and Wetting Phenomena: Drops, Bubbles, Pearls, Waves**
  by P.G. de Gennes, F. Brochard-Wyart and D. Quéré. Springer Publishing.
  *A readable and accessible treatment of a wide range of capillary phenomena.*
- **Molecular theory of capillarity**
  by J.S. Rowlinson and B. Widom. Dover 1982.
- **Intermolecular and surface forces**
  by J. Israelachvili. Academic Press, 2nd edition 1995.
- **Multimedia Fluid Mechanics**
  Cambridge University Press, Ed. Bud Homsy.
  *A DVD with an extensive section devoted to capillary effects. Relevant videos will be used throughout the course.*

# 357 Interfacial Phenomena

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