

Water is a (half) Empty Liquid

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It is becoming increasingly clear that water's structure has enough empty space to accommodate a second liquid at high pressure.

Exploiting this analogy, we classify water together with a larger group of liquids, aptly named Empty Liquids, whose constituents arrange in a random network through reversible bonds [1]. These bonds can be physically realized with a variety of interactions, such as hydrogen bonding, lock-and-key interactions, DNA base pairing, hydrophobic, dipolar, and even entropic interactions. Materials that fall in the category of empty liquids go from patterned colloidal particles, clays, DNA wireframe origamis, all the way down to atoms, like silicon.

In this seminar we make the case that water is a Half-Empty liquid, which, on top of the typical empty liquid's behaviour, can display complex properties such as thermodynamic and dynamic anomalies, the possibility of liquid–liquid phase transitions, and the crystallization of open crystalline structures. Finally, we will try to answer the age-old question whether amorphous glasses are half-empty too [2].

[1] J. Russo, F. Leoni, F. Martelli, F. Sciortino, *Rep. Prog. Phys.* **85**, 016601 (2022)

[2] F. Martelli, F. Leoni, F. Sciortino, J. Russo, *J. Chem. Phys.* **153**, 104503 (2020)

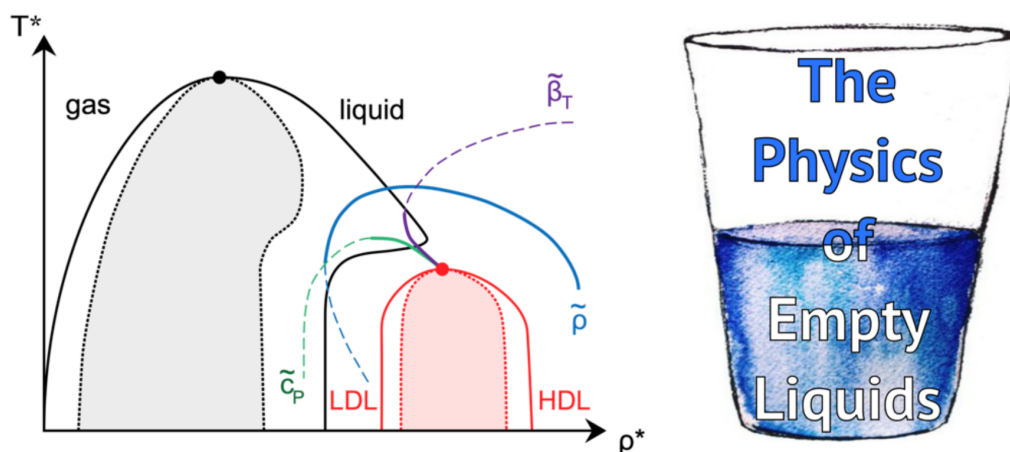


Figure 1 Typical half-empty liquid's behaviour