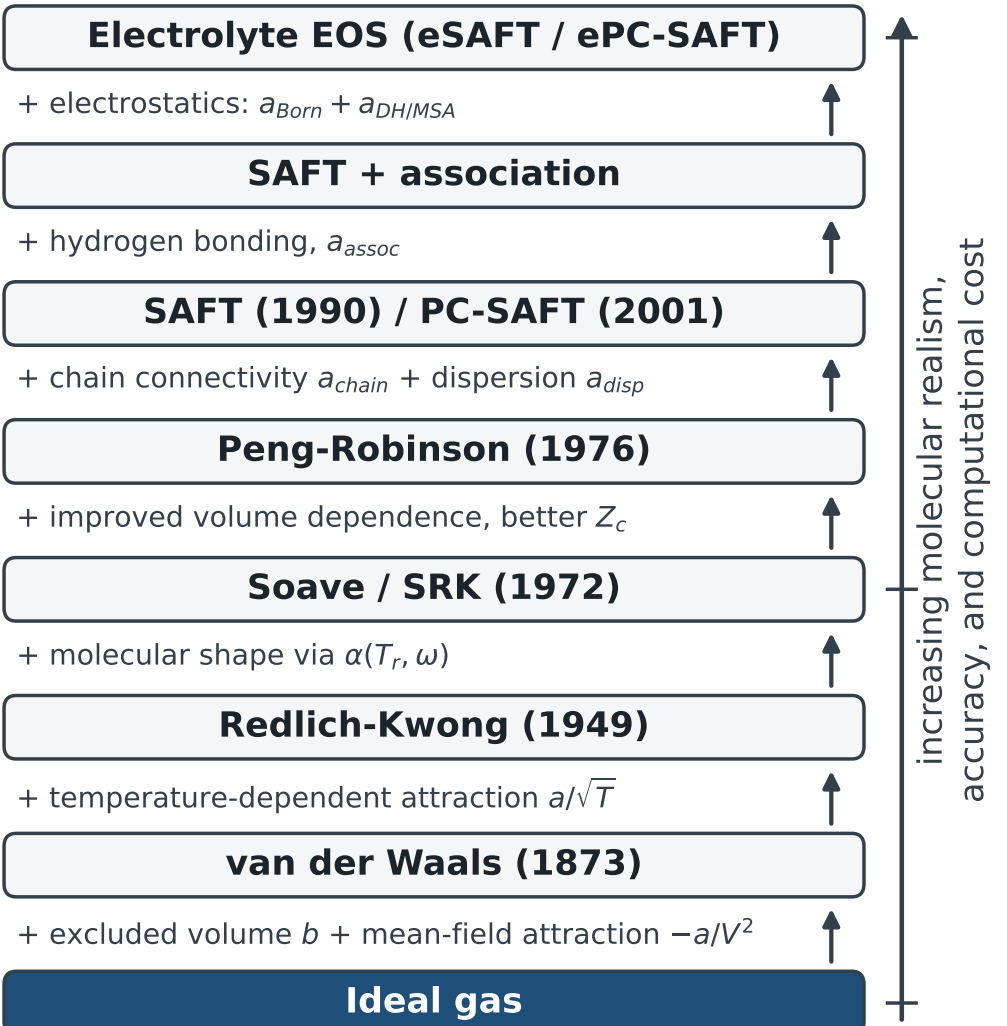The hierarchy of physics in the equation of state