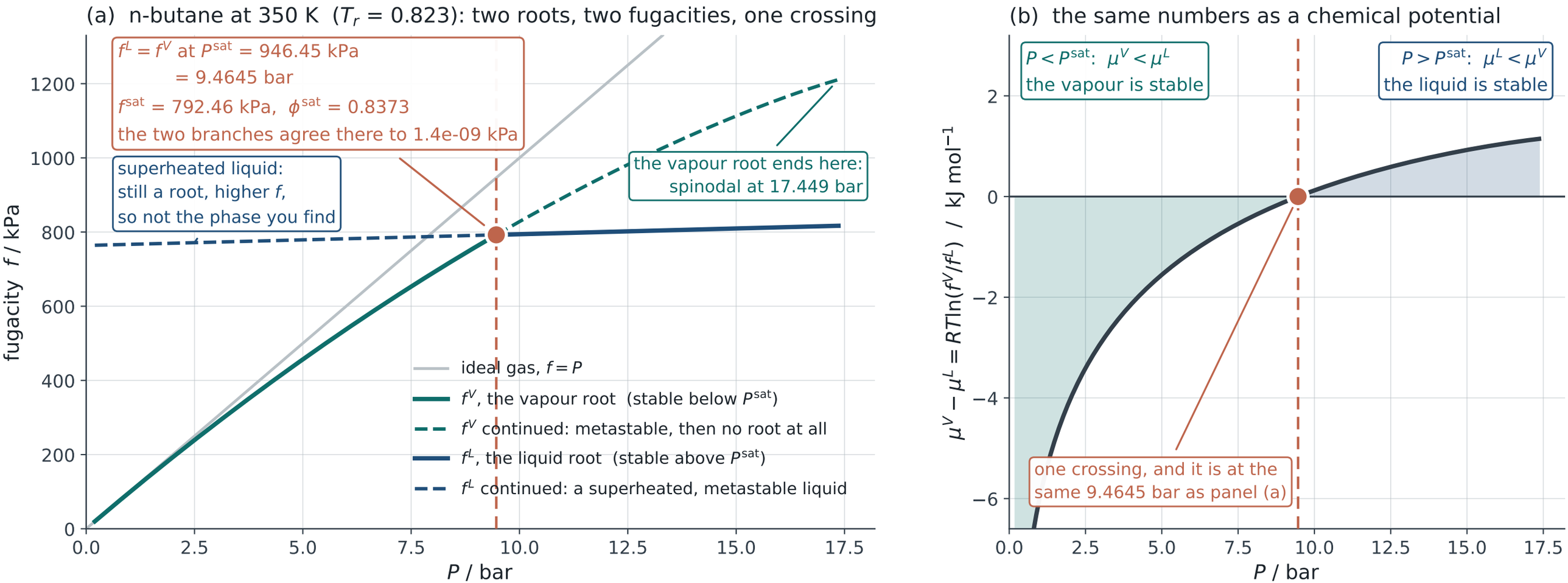
The equation of state offers two answers at every pressure; the equilibrium criterion picks one, and they are equal only at P^{sat}



n-butane: T_c = 425.12 K, P_c = 37.96 bar, ω = 0.2 [Yaws, log10(mmHg), T in C; Tc/Pc/omega Poling et al.].

Fugacities from `vlekit.cubic.PengRobinson.ln_phi` with the root forced to 'liquid' and to 'vapour'; P^{sat} from `vlekit.cubic.psat`;
the spinodals from $(\partial P/\partial v)_T = 0$ on the same isotherm. ASSUMED: nothing beyond the library constants above and the 1976 α function.

Peng-Robinson puts P^{sat} at 946.45 kPa; the library Antoine correlation puts it at 932.97 kPa, 1.4 % lower.

The figure uses the equation of state throughout so that both branches come from one model — the discrepancy is the cubic's, and it is stated rather than patched.

The liquid root survives down to the liquid spinodal at -60.65 bar, which is negative, so it exists everywhere on this axis; the vapour root dies at 17.449 bar.