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On separate chemical freeze-outs of hadrons and light (anti)nuclei in high energy nuclear collisions

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The multiplicities of light (anti)nuclei were measured recently by the ALICE collaboration in Pb+Pb collisions at the center-of-mass collision energy $\sqrt{s} = 2.76$ TeV [1]. Surprisingly, the hadron resonance gas model (HRGM) is able to perfectly describe the their multiplicities [2] under various assumptions. For instance, one can consider the (anti)nuclei with a vanishing hard-core radius (as the point-like particles) or with the hard-core radius of proton, but the fit quality is the same for these assumptions. However, it is clear that the hard-core radius of a nuclei consisting of A baryons or antibaryons must be give by the expression $R(A) = R(1)A^{\frac{1}{3}}$. To implement such a relation into the HRMG we employ the induced surface tension concept [3] and perform a thorough analysis of hadronic and (anti)nuclei multiplicities measured by the ALICE collaboration. The HRGM with the induced surface tension allows us to verify different assumptions on the values of hard-core radii and different scenarios of chemical freeze-out of (anti)nuclei. It is shown that the most successful description of hadrons can be achieved at the chemical freeze-out temperature $T_h = 150$ MeV, while the one for all (anti)nuclei is $T_A = 168$ MeV. Possible explanations of this very high temperature of (anti)nuclei chemical freeze-out are discussed.

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