Strangeness at extremes

Laura Tolos[1], Daniel Cabrera[2], K.P. Khemchandani [1,3], A. Martinez Torres [1,3]

[1] Instituto de Ciencias del Espacio (IEEC/CSIC), Campus Universitat Autònoma de Barcelona, Carrer de Can Magrans, s/n, 08193 Cerdanyola del Valls, Spain

[2]Frankfurt Institute for Advanced Studies (FIAS), 60438 Frankfurt am Main, Germany

[3] Instituto de Fisica, Universidade de São Paulo, C.P 66318, 05314-970 São Paulo, SP, Brazil

We present a study of strange -1 and $+1$ meson-baryon sectors under extreme conditions. First, we present the in-medium cross sections and (off-shell) transition rates for the most relevant binary reactions for strange -1 pseudoscalar meson production [1]. Our results rely on a chiral unitary approach in coupled channels which incorporates the s- and p-waves of the kaon-nucleon interaction. The obtained total cross sections mostly reflect the fate of the $\Lambda(1405)$ resonance, which melts in the nuclear environment, whereas the off-shell transition probabilities are also sensitive to the in-medium properties of the hyperons excited in the p-wave amplitudes. The single-particle potentials of these hyperons at finite momentum, density and temperature are also discussed in connection with the pertinent scattering amplitudes. Second, we show the revised KN and K^*N amplitudes in the strange $+1$ sector [2]. We obtain the amplitudes for light vector meson-baryon systems by implementing the $s-$, $t-$, $u-$ channel diagrams and a contact interaction. The pseudoscalar meson-baryon interactions are obtained by relying on the Weinberg-Tomozawa theorem. The transition amplitudes between the systems consisting of pseudoscalars and vector mesons are calculated by extending the Kroll-Ruderman term for pion photoproduction replacing the photon by a vector meson. We fix the subtraction constants required to calculate the loops by fitting our KN amplitudes to the data available for the isospin 0 and 1 s-wave phase shifts. We provide the scattering lengths and the total cross sections for the KN and K^*N systems. Altogether our results for strangeness are the basis for future implementations in microscopic transport approaches accounting for strangeness production in nucleus-nucleus collisions.

[1] D. Cabrera, L. Tolos, J. Aichelin and E. Bratkovskaya, Phys. Rev. C 90, 055207 (2014)

[2] K. P. Khemchandani, A. Martinez Torres, F. S. Navarra, M. Nielsen, and L. Tolos, arXiv:1406.7203 [nucl-th], to be published in Phys. Rev. D 91 (2015)