1 - 1 Progress of Theoretical Nuclear Research in 2017 at IMP

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In 2017, the researchers of Theoretical Physics Group at IMP have carried out their research work on in nuclear physics, heavy ion physics and hadron physics. Some important results have been obtained.

The effect of tensor correlations on the depletion of the nuclear Fermi sea in nuclear matter has been studied within the framework of the extended Brueckner-Hartree-Fock approach[1]. The depletion induced by the isospin $T=0$ interaction is shown to stem almost completely from the 3SD1 tensor channel which turns out to be responsible for most of the depletion, *i.e.*, more than 70 percent of the total depletion.

The inclusive spectra of preequilibrium nucleons produced in low-energy antiproton-nucleus collisions have been investigated within the framework of the Lanzhou quantum molecular dynamics model[2]. The unexpected neutron/proton ratio in comparison to the pion and proton induced reactions is shown to be caused by the isospin effects of pion-nucleon collisions and the density dependence of symmetry energy. Pion production in nucleus-nucleus collisions at intermediate energies has been modeled in the isospin-dependent Boltzmann-Uehling-Uhlenbeck transport model[3]. The obtained ratio and yields of π^- and π^+ in Au + Au reaction at 400 MeV/nucleon is shown to reproduce the FOPI data at GSI very well, especially with a soft symmetry energy in the present transport model[4]. The interplay of the nucleon-nucleon short-range correlations (SRCs) and nuclear symmetry energy on the hard-photon spectra in heavy ion collisions has been studied and it is found that over the whole spectra of hard photons, the effects of the SRCs overwhelm those owing to the symmetry energy. The multinucleon transfer reaction has been explored within the dinuclear system model[5], and it is found that the production of heavy neutron-rich nuclei weakly depends on the incident energy.

The neutrino emissivities in beta-stable neutron star matter from the direct Urca (DU) processes and the modified Urca (MU) processes have been calculated by adopting 26 Skyrme interactions[6]. The model-dependence of the neutrino emissivities from the DU processes is found to stem mainly from the model-dependence of the effective mass, while the neutrino emissivities from the MU processes are de-termined by the competition between the effects of the symmetry energy and the effective mass.

In hadron physics, the hidden bottom decays of Zb(10610) and Zb(10650) have been analyzed via final state interaction[7], and the results point out that the final-state interaction plays an important role in interpretation of the branching ratios of the hidden bottom decays of the Z(10650) states.

References

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1 - 2 Isospin Effect on the Fragmentation Reaction Induced by Low-energy Antiprotons*

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Since the first evidence of antiprotons was found in 1955 at Berkeley in collisions of protons on copper at the energy of 6.2 GeV, the secondary beams of antiprotons were produced at many laboratories, such as CERN, BNL, KEK, *etc.* A more localized energy is deposited in the nucleus with an excitation energy of several hundreds of MeV. The hot nucleus proceeds to the explosive decay via multifragmentation process or the sequential particle evaporation. On the other hand, the collisions of the antiproton and secondary particles with surrounding nucleons lead to the pre-equilibrium particle emissions, which are related to the scattering cross sections of each reaction channels, antiproton-nucleon interaction, particle-nucleon potentials, density profile of target nucleus. The unexpected large neutron yields produced by the stopped antiprotons in nuclei were reported in the low energy antiproton ring (LEAR)