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Type: 4th week (Nuclear matter under extreme conditions)

## The Effect of Isovector Scalar Meson on Neutron Star Matter Based on a Parity Doublet Model

Thursday, November 7, 2024 5:30 PM (30 minutes)

We study the effect of the isovector-scalar meson  $a_0(980)$  on the properties of nuclear matter and the neutron star (NS) matter by constructing a parity doublet model with including the  $a_0$  meson based on the chiral  $SU(2)_L \times SU(2)_R$  symmetry.

We also include the  $\omega$ - $\rho$  mixing contribution to adjust the slope parameter at the saturation.

We find that, when the chiral invariant mass of nucleon  $m_0$  is smaller than about 800 MeV, the existence of  $a_0(980)$  enlarges the symmetry energy by strengthening the repulsive  $\rho$  meson coupling. On the other hand, for large  $m_0$  where the Yukawa coupling of  $a_0(980)$  to nucleon is small, the symmetry energy is reduced by the effect of  $\omega$ - $\rho$  mixing.

We then construct the equation of state (EoS) of a neutron star matter to obtain the mass-radius relation of NS.

We find that, in most choices of  $m_0$ , the existence of  $a_0(980)$  stiffens the EoS and makes the radius of NS larger.

We then constrain the chiral invariant mass of nucleon from the observational data of NS, and find that 580 MeV

*lessim* $m_0$

*lessim*860 MeV for  $L_0 = 57.7$  MeV.

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