Experiment E325 at KEK 12-GeV PS

Study of Chiral Property of Dense Nuclear Matter through Measurements of Meson Mass Modification in Medium.

We know that 95% of hadron mass is originated from the spontaneous breaking of the chiral symmetry. Such effective mass of hadron is determined in vacuum, and it is quite natural to expect that *those masses will be modified when their circumstance is changed*. The major scientific interest of E325 is to investigate the property of hadron (and then of quark) in a dense matter, naturally existing as nucleus. The basic experimental concept is to measure vector mesons, which *are produced and decay in a nucleus*, through the invariant mass spectroscopy in the electron- positron pair channel. Experimental details can be find Ref.1 and 2, whereas Ref.2 has been completed this year.

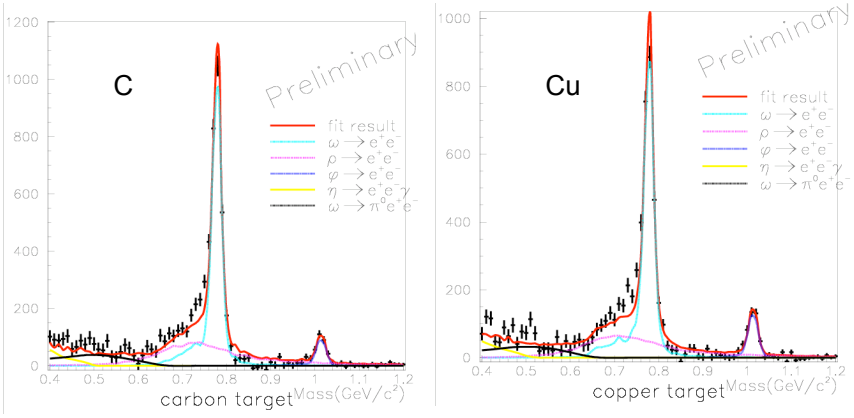

Fig.1: Observed invariant mass spectra of the e^+e^- data, after subtracting combinatorial back- ground. The left panel is for the carbon and the right panel for the copper target. Lines are the model calculation as described in the text.

The experiment has been running at EP1B from1996 to 2002, spending about 3200 hours of beam time. From the earlier data we have reported the signature of in-medium modification of ρ and ω mesons [3]. This was the first observation in the leptonic in-medium decay of vector meson at a normal nuclear matter density. Here, we describe our preliminary results from the data taken in 2002. Figure 1 shows the electron pair spectrum for carbon (left) and copper (right) targets, after subtracting the combinatorial background. Free decay peaks of ω and ϕ are clearly observed and significant excess can be seen on the low mass side of the ω peaks, as consistent to our previous publication [3].

To reproduce the excess, we have employed a toy model calculation based on the theoretical prediction by Hatsuda and Lee[4]. Here the ρ/ω mesons are supposed to be produced at the front surface of nuclei in 1:1 ratio as measured by the previous experiment, decay according to their natural life, and be modified as Hatsuda suggested. We found that the model reproduces the date fairly well. Due to the short lifetime of ρ meson, the shape of the excess does not change much from C to Cu targets. Analysis for the ϕ meson mass-shape is on going both in the electron-pair channel and the kaon- pair channel.

Reference:

[1] MASS PRODUCTION OF HYDROPHOBIC SILICA AEROGEL AND READOUT OPTICS OF CHERENKOV LIGHT. By M. Ishino *et al.* (E325 collaboration). Nucl.Instrum.Meth.A457:581-587,2001

[2] SPECTROMETER FOR MEASUREMENTS OF PHI MESONS IN NUCLEAR MATTER PRODUCED THROUGH 12-GEV P + A REACTIONS. By M. Sekimoto *et al.* (E325 collaboration), Nucl. Instrum. Meth. A516:390-405,2004

[3] K. Ozawa et al. Phys. Rev. Lett. Vol.86 (2001) p5019.

[4]T. Hatsuda and S. H. Lee, Phys. Rev. C46 (1992) R34.