Contribution ID: **99** Type: **not specified**

Phi mesons in cold nuclear matter with chirally-based resonant phi-N interactions

Tuesday, 26 July 2016 15:20 (30 minutes)

The phi-meson properties in cold nuclear matter are revisited by implementing resonant phi-N interactions as described in chirally-based approaches including the unitarization of scattering amplitudes. Several N*-like states are dynamically generated in these models around 2 GeV, immediately above the phi N threshold. We find that these states give a sizable contribution to the phi collisional self-energy at finite nuclear density, on top of (and with similar strength as) the widely studied medium effects from the K Kbar cloud. Depending on model details of the phi N dynamics (position of the resonances and strength of the coupling) we report a phi broadening up to about 40-50 MeV – again, to be added to the K Kbar in-medium decay width – and an attractive optical potential at threshold of about 30 MeV at normal matter density. The phi spectral function develops a double peak structure as a consequence of the mixing of resonance-hole modes with the phi quasi-particle peak. The former points in the direction of making up for missing absorption as usually reported in phi nuclear production experiments. The relevance of these novel aspects of the phi dynamics in a baryonic medium is also discussed in connection with recent HADES observations of deep sub-threshold phi (and cascade, Ξ) production.

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Session Classification: Meson-Nucleon Interactions