Note on the glue content in the η' meson

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The investigations of the η' meson aim in a better understanding of its structure and its interaction with nucleons. The η' meson being predominantly an flavour singlet state may be built out not only of the quarkonium but also out of the gluonium state, making it an very interesting object. The possible gluonium contents implies that the creation of this meson in the proton-proton collisions may proceed via a fusion of gluons emitted from the colliding protons [1].
Similarly, the creation of the η' in the fusion of gluons is considered when trying to explain the large branching ratios of B and D mesons decay into the η' meson observed by the CLEO Collaboration [2, 3]. Without assuming the significant gluonium [4] or charmonium content in the η' meson it is also not possible to explain its large mass in comparison to the masses of its counterpart mesons from the pseudoscalar flavour octet.

Recently it is discussed whether the "gluon rich" states are more copiously produced for small transverse momentum transfer in the reaction $pp \to ppX$ where the conventional quarkonium states are supposed to be suppressed [5, 6, 7]. The central particle production in the $pp \to ppX$ reaction has been studied by the CERN WA102 Collaboration [8] for the high incident beam momenta ranging between 85 and 450 GeV/c. There are examples shown in reference [9], that considering only a large transverse momentum transfer $\Delta P_T > 500$ MeV/c, the usual $q\bar{q}$ states like ρ are clearly seen in the $\pi\pi$ invariant mass spectrum, whereas they disappear at a small ΔP_T ($\Delta P_T < 200$ MeV/c). In contrary, the Θ/f_J state which is supposed to be dominantly a glueball appears at a small ΔP_T.

The performed and planned COSY - 11 experiments on η and η' production in the $pp \to ppX$ reaction close to the kinematical threshold may also be analysed in view of the cross section distribution as a function of the transverse momentum transfer. For example at an excess energy Q = 10 MeV the transverse momentum transfer range from zero to about 100 MeV/c, which is of the same order as a small momenta studied at high incident beam energies at CERN.
The η is predominantly a flavour octet state and hence its coupling to gluonium is expected to be much weaker than in the case of the η' meson. Therefore if the gluon-gluon fusion mechanism is to be taken seriously it is expected to observe the enhancement at a small ΔP_T value for the η' meson production relative to the η.
The study of the transverse momentum transfer distributions may be performed with a very good momentum accuarcy of 1 MeV/c achieved at the COSY - 11 experiments.

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