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in the Model of the Stochastic Vacuum**

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Pre-resonant Charmonium - Nucleon Cross Section in the Model of the Stochastic Vacuum

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We calculate the nonperturbative charmonium - nucleon cross sections with the model of the stochastic vacuum which has been successfully applied in many high energy reactions. We also give a quantitative discussion of pre-resonance formation and medium effects.

1. Introduction

Charmonium nucleon cross sections are of crucial importance in the context of Quark Gluon Plasma (QGP) physics [1,2]. One needs to know the cross section $\sigma_{c\bar{c}N}$ in order to explain nuclear suppression of J/Ψ in terms of ordinary absorption by nucleons without assuming a so called "deconfining regime". Estimates using perturbative QCD give values which are too small to explain the observed absorption conventionally, but they are certainly not reliable for that genuine nonperturbative problem. A nonperturbative estimate may be tried by applying vector dominance to J/Ψ and Ψ' photoproduction. In this way a cross section of $\sigma_{J/\psi} \simeq 1.3$ mb for $\sqrt{s} \simeq 10$ GeV and $\sigma_{\psi'}/\sigma_{J/\psi} \simeq 0.8$ has been obtained [3,4]. A more refined multichannel analysis [3] leads to $\sigma_{J/\psi} \simeq 3 - 4$ mb.

The fact that the absorption cross section seems to be nearly the same both for J/ψ and ψ' has been interpreted as meaning that what is really absorbed is rather a pre-resonant $c - \bar{c}$ state and not the physical particles. The size of this state has been estimated to be [5]

$$r_8 = \frac{1}{\sqrt{2m_c\Lambda_{QCD}}} = 0.2 - 0.25\text{fm} \quad (1)$$

and its cross section was then calculated with short distance QCD. A value of $\sigma_8 \simeq 5.6 - 6.7$ mb was found.

In this note we calculate the pre-resonant $c - \bar{c}$ - nucleon cross sections in the model of the stochastic vacuum (MSV) [6-9]. It has been applied to a large number of hadronic and photoproduction processes with remarkably good success.

2. The Model of the Stochastic Vacuum

The basis of the MSV is the calculation of the scattering amplitude of two colourless dipoles [10,9] based on a semiclassical treatment developed by Nachtmann [11]. The dipole-dipole scattering amplitude is expressed as the expectation value of two Wegner-Wilson loops with lightlike sides and transversal extensions \vec{r}_{t1} and \vec{r}_{t2} respectively. This leads to a profile function $J(\vec{b}, \vec{r}_{t1}, \vec{r}_{t2})$ from which hadron-hadron scattering amplitudes are obtained by integrating over different dipole sizes with the transversal densities of the hadrons as weight functions according to

$$\sigma_{(c\bar{c})N}^{tot} = \int d^2b d^2r_{t1} d^2r_{t2} \times \rho_{(c\bar{c})N}(\vec{r}_{t1}) \rho_N(\vec{r}_{t2}) J(\vec{b}, \vec{r}_{t1}, \vec{r}_{t2}) \quad (2)$$

Here $\rho_{(c\bar{c})N}(\vec{r}_{t1})$ and $\rho_N(\vec{r}_{t2})$ are the transverse densities of the pre-resonant charmonium state and nucleon respectively.

The basic ingredient of the model is the gauge invariant correlator of two gluon field strength tensors. The latter is characterized by two con-