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**Quark Coalescence with Quark Number Conservation and the Effect on Quark-Hadron Scaling** ZIWEI LIN, East Carolina University — We incorporate unitarity to quark coalescence by describing its time evolution (Z.W. Lin, arXiv:0901.3737). Our general results reproduce the previous quark coalescence model for hard quarks, which have small coalescence probabilities. However, the relations for soft partons (the bulk) are totally different. If we consider the formations of light meson $M$, charm meson $D$ and $J/\psi$, the general results give $f_M^{soft}(\vec{p}) \propto f_{q0}(\vec{p}/2)$ and $f_D^{soft}(\vec{p}_D) \propto f_{c0}(\vec{p}_c)$. These two linear relations are the result of quark number conservation for light quarks and charm quarks, respectively. They also lead to $v_{2,M}^{soft}(p_\perp) \approx v_{2,q}(p_\perp/2)$ and $v_{2,D}^{soft}(p_{\perp D}) \approx v_{2,c}(p_{\perp c})$ for elliptic flows. The weaker scaling comes from the fact that, as coalescence progresses in time, the remaining soft quarks have smaller and smaller $v_2$, leading to a smaller overall hadron $v_2$. We also obtain $v_{2,\psi}^{soft}(p_\perp) \approx v_{2,c}(p_\perp/2) - a v_{2,q}(p_{\perp q})$ with $a > 0$. An interesting scenario is that soft $J/\psi$ can have a negative $v_2$ even if charm quarks have no $v_2$. This can be understood in the following picture. As coalescence progresses in time, some charm quarks will coalesce with co-moving light quarks to form $D$ mesons. Because light quarks have a positive $v_2$, those charm quarks forming $D$ mesons also have a positive $v_2$. Given that charm quarks have zero $v_2$ overall, the charm quarks available for $J/\psi$ production will have a negative $v_2$, leading to a negative $J/\psi$ elliptic flow.

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