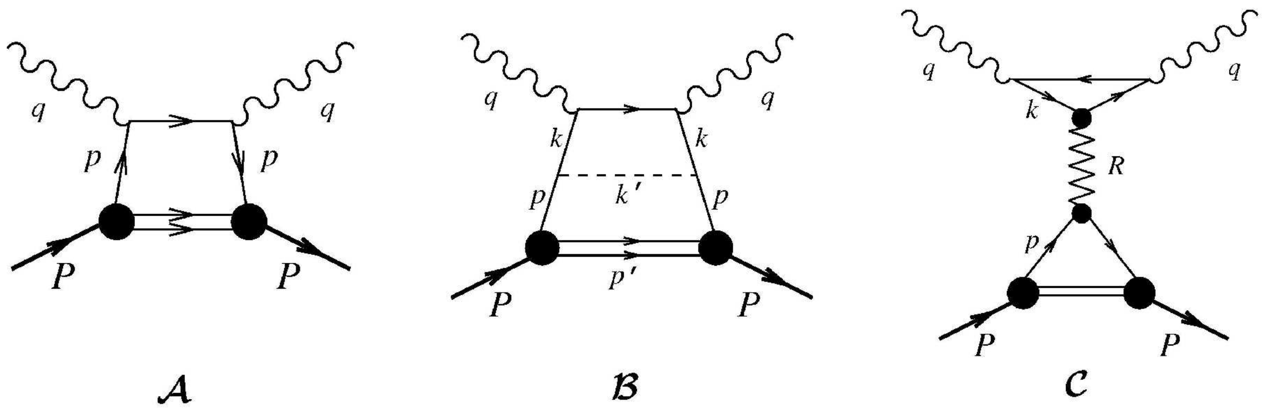

FIG. VI.29 Depiction of three invariant-mass sectors conjectured in (Kulagin *et al.*, 1996) to contribute to deep inelastic scattering. *Left image* – $\mathcal{A}$: low-w – diquark spectators. *Central image* – $\mathcal{B}$: intermediate-w – compound spectator system involving a pion (dashed line), constituent-quarks and diquarks. *Right image* – $\mathcal{C}$: large-w – Regge trajectory model for $q\bar{q}$ scattering from a constituent-quark. [Figure adapted from (Kulagin *et al.*, 1996).]

mass $w = (P-k)^2$ and

$$k^2_{\rm max}(w,x) = x\left(M^2 - \frac{w}{1-x}\right), \tag{VI.14}$$

where M is the nucleon mass, is the maximum kinematically-allowed value of the struck-quark's squared-four-momentum, which is equivalent to its virtuality if the quark is massless. In connection with Eq. (VI.13), convergence and internal consistency suggest that the probability density can only have material support for $k^2 \lesssim -M^2$. The condition

$$k^2_{\rm max}(w,x) = -M^2 \;\Rightarrow\; w^2 = M^2(1-x^2)/x\,. \tag{VI.15}$$

Hence, in this case it follows that only intermediate states with $w \lesssim M^2$ are important for $x \gtrsim 0.6$. This explains the spectator diquark assumption of Fig. VI.26. However, as x decreases below $x = 0.6$, intermediate states with $s > M^2$ will play an increasingly important role and must be included in order to obtain a pointwise-accurate result for $q_v(x;Q_0)$.

A concrete model is used in (Kulagin *et al.*, 1996) to illustrate these points. It is notable that, by combining the components indicated below, this study aims to produce a valence-quark distribution function that is valid at a resolving scale $Q_0 = 1\,$GeV; i.e., at a scale which may lie within the perturbative domain. We judge that perturbative QCD evolution from such a scale is sounder than from the manifestly infrared scales employed in Secs. VI.A.1 and VI.A.2.