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APPENDIX

APPENDIX

The evaluation of the kinematic functions $J(r,s)$ and $I(r,s)$ at $s \simeq 0$ is performed in this appendix explicitly. From

$$J(r,s) \;=\; \int_0^1 dx \frac{x^2}{1-x+rx-sx(1-x)}. \tag{A-1}$$

Putting $s=0$, the function becomes

$$\begin{aligned}
J(r,0) &= \int_0^1 dx \frac{x^2}{1-(1-r)x} \\
&= -\frac{1}{(1-r)^2}\int_0^1 dx \frac{(1-(1-r)^2x^2)-1}{1-(1-r)x} \\
&= -\frac{1}{(1-r)^2}\int_0^1 dx \left[(1+(1-r)x) - \frac{1}{1-(1-r)x}\right] \\
&= -\frac{1}{(1-r)^2}\left[1+\frac{1-r}{2}+\frac{1}{1-r}\ln(1-(1-r))\right] \\
&= -\frac{1}{2(1-r)^2}\left[3-r+\frac{2\ln r}{1-r}\right].
\end{aligned} \tag{A-2}$$

Similarly, from

$$I(r,s) \;=\; \int_0^1 dx \frac{x-x^2}{1-x+rx-sx(1-x)}. \tag{A-3}$$

When $s=0$,

$$\begin{aligned}
I(r,0) &= \int_0^1 dx \frac{x-x^2}{1-(1-r)x} = \int_0^1 dx \frac{x[1-(1-r)x]-rx^2}{1-(1-r)x} \\
&= \int_0^1 dx \left[x - \frac{rx^2}{1-(1-r)x}\right] = \frac{1}{2} - rJ(r,0) \\
&= \frac{1}{2(1-r)^2}\left[(1-r)^2+3r-r^2+\frac{2r\ln r}{1-r}\right] \\
&= \frac{1}{2(1-r)^2}\left[1+r+\frac{2r\ln r}{1-r}\right].
\end{aligned} \tag{A-4}$$

VITAE

Miss Warintorn Sreethawong received her Bachelor's degree (with *first class honour*) in physics from Chulalongkorn University in 2003. Her research interests are in theoretical elementary particle physics, especially in the area of supersymmetry phenomenology.