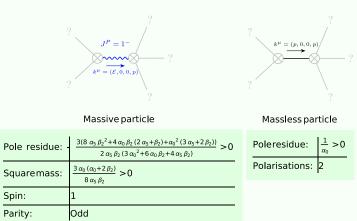
Particle spectrograph

Wave operator and propagator

| $^{\#2}_{1^{\bullet}}$ | 0 | 0 | 0 | $\frac{4i(3\alpha_0+4\beta_2)k}{(1+2k^2)(-3\alpha_0(\alpha_0+2\beta_2)+8\alpha_5\beta_2k^2)}$ | $\frac{2 i \sqrt{2} k (3 \alpha_0 + 8 \beta_2 + 12 \alpha_5 k^2)}{(1 + 2 k^2)^2 (+3 \alpha_0 (\alpha_0 + 2 \beta_2) + 8 \alpha_5 \beta_2 k^2)}$ | 0 | $\frac{4 k^2 (3 \alpha_0 + 8 \beta_2 + 12 \alpha_5 k^2)}{(1 + 2 k^2)^2 (-3 \alpha_0 (\alpha_0 + 2 \beta_2) + 8 \alpha_5 \beta_2 k^2)}$ | ies | | | I | I | 1 | #2 #1 r 0+ r 0- o | 2 0 0 0 | 0 0 | 0 0 | 0 $\frac{2}{\alpha_0}$ | | | | | | | |
|------------------------------------|---|--|--|---|---|--|--|----------------|--|--|--|--|----------------------------------|------------------------|--|--|---------------------|--------------------------------------|---|--|--|--|---|--|--|
| $^{*1}_{1}$ | | | | 0 | 0 | | 0 | Multiplicities | | | | $\partial_{\chi}\partial^{\alpha}t^{\beta\chi} + \partial_{\chi}\partial^{\beta}t^{\chi\alpha} + \partial_{\chi}\partial^{\chi}t^{\alpha\beta} + 2 \ \partial_{\sigma}\partial_{\chi}\partial^{\alpha}\sigma^{\beta\chi\delta} + 2 \ \partial_{\sigma}\partial^{\beta}\sigma^{\alpha}\nabla^{\beta} = = 3$ $\partial_{\chi}\partial^{\alpha}t^{\chi\beta} + \partial_{\chi}\partial^{\beta}t^{\alpha\chi} + \partial_{\chi}\partial^{\chi}t^{\beta\alpha} + 2 \ \partial_{\sigma}\partial_{\chi}\partial^{\beta}\sigma^{\alpha\chi\delta}$ | 10 | #1 0 ⁺ r | 1 1/2 B | | 0 | 0 | | | | | | | a - Opfab a - Opfab OpA x - a z d y d |
| $^{\#2}_{1^{-}}\sigma_{\alpha}$ | 0 0 | 0 0 | 0 0 | $\frac{2\sqrt{2}(3\alpha_0+4\beta_2)}{(1+2k^2)(-3\alpha_0(\alpha_0+2\beta_2)+8\alpha_5\beta_2k^2)}$ | $\frac{6\alpha_0 + 16\beta_2 + 24\alpha_5k^2}{(1 + 2k^2)^2(-3\alpha_0(\alpha_0 + 2\beta_2) + 8\alpha_5\beta_2k^2)}$ | 0 0 | $-\frac{2i\sqrt{2}k(3\alpha_0+8\beta_2+12\alpha_5k^2)}{(1+2k^2)^2(-3\alpha_0(\alpha_0+2\beta_2)+8\alpha_5\beta_2k^2)}$ | | 1 | $\hat{q}_{\partial^X}\partial_{\beta}\tau^{\alpha\beta} + 2 \ \partial_{\delta}\partial^{\delta}\partial_{\chi}\partial_{\beta}\sigma^{\alpha\beta\chi}$ 3 | 8 180 | | | | $\frac{1}{100}$ 0 0 $\frac{1}{0}$ 0 0 0 $\frac{4}{0}$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 1 1 1 | | $0 \frac{\alpha_0}{2} 0^{\#1} 0^+ 0$ | | | | ; | #1 2 σαβχ | 0 0 4 9 | $\mathcal{A}_{\beta,\chi}^{\chi} \partial^{\beta} f_{\alpha}^{\alpha} - \partial_{\beta} f_{\chi}^{\chi} \partial^{\beta} f_{\alpha}^{\alpha} - \beta_{\beta} f_{\chi}^{\chi} \partial^{\beta} f_{\alpha}^{\alpha} - \beta_{\beta} \partial_{\beta} \partial_{\beta}$ |
| $_{1}^{\#1}$ | 0 | 0 | 0 | $\frac{8\beta_2}{-3\alpha_0(\alpha_0+2\beta_2)+8\alpha_5\beta_2k^2}$ | $\frac{2 \sqrt{2} (3 \alpha_0 + 4 \beta_2)}{(1 + 2 \lambda^2) (-3 \alpha_0 (\alpha_0 + 2 \beta_2) + 8 \alpha_5 \beta_2 k^2)}$ | 0 | $-\frac{4i(3\alpha_0+4\beta_2)k}{(1+2k^2)(-3\alpha_0(\alpha_0+2\beta_2)+8\alpha_5\beta_2k^2)}$ | | | | | | | | $0^{+}\mathcal{A}$ $0^{+}\mathcal{A}$ $0^{+}\mathcal{A}$ $0^{+}\mathcal{A}$ $0^{+}\mathcal{A}$ | $\frac{i(\alpha_0+2\beta_2)k}{\sqrt{2}}$ | #2 + 0 + + 0 0 0 | | 2^{+1} 2^{+} \mathcal{A}^{-1} 2^{+} f^{-1} 2^{+} f^{-1} 2^{+} f^{-1} 2^{+} f^{-1} 1^{+} f^{-1} f^{-1} | | $\frac{f^{2}}{2} + f \alpha \beta$ $\frac{i \alpha_{0} k}{2 \sqrt{2}}$ 0 | $ \begin{array}{c c} & & & & & \\ & & & & & \\ & & & & & \\ & & & &$ | $2^{+}\sigma_{\alpha\beta}$ $2^{+}\tau_{\alpha\beta}$ | $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | $\sigma_{\alpha\beta\chi} - \frac{2}{3} \beta_2 (\mathcal{A}^{\alpha\beta}{}^{\alpha} \mathcal{A}_{\beta\chi}^{X} - 2 \mathcal{A}_{\alpha\chi}^{X} \partial_{\beta}f^{\alpha\beta} + 2 \mathcal{A}_{\beta\chi}^{X} \partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{X} \partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{X} \partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{X} \partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{X} \partial^{\beta}f^{X} \partial^{\beta}f^{$ |
| $_{1}^{\#1}_{+}\tau_{\alpha\beta}$ | $\frac{2i\sqrt{2}k}{\alpha_0 + \alpha_0 k^2}$ | $\frac{2i \ k(\alpha_0 + 4 \ \alpha_5 \ k^2)}{\alpha_0^2 \ (1 + k^2)^2}$ | $\frac{2k^2(\alpha_0\!+\!4\alpha_5k^2)}{\alpha_0^2(1\!+\!k^2)^2}$ | 0 | 0 | 0 | 0 | t form | <i>αβ</i> == 0 | 9 | $\alpha_{\mathbf{t}^{\beta X}} == \hat{q} \partial^X \partial_{\beta} \mathbf{t}^{\beta \alpha}$ | $\partial^{\alpha} t^{\beta \chi} + \partial_{\chi} \partial^{\beta} t^{\chi \alpha} + \partial_{\chi} \partial^{\alpha} t^{\chi \beta} + \partial_{\chi} \partial^{\beta} t^{\alpha \chi}$ | tors: | #1 1+ 9 | († αβ | $\frac{\alpha_0}{4} + \alpha_5 k$ $\frac{\alpha_0}{2\sqrt{2}}$ | ,2 _0 | | $\frac{i \ a_0 k}{2 \sqrt{2}}$ | 0 0 | 0 | 0 | 0 0 | 0 0 | $a_{\alpha\beta\chi} - \frac{2}{3}\beta_2 (\mathcal{A}^{\alpha\beta})$ $a_{\lambda}f_{\alpha}^{\chi} + 2\beta^{\beta}f_{\alpha}$ $2\partial_{\beta}\mathcal{A}^{\alpha\beta} - 2f^{\alpha\beta}$ $\partial_{\gamma}\mathcal{A}_{\alpha} \stackrel{?}{\circ} \partial_{\gamma}\mathcal{A}^{\alpha\beta} = .$ |
| $_{1}^{\#2}^{\#2}$ | $\frac{2\sqrt{2}}{\alpha_0 + \alpha_0 k^2}$ | $\frac{2(\alpha_0 + 4\alpha_5k^2)}{\alpha_0^2(1 + k^2)^2}$ | $\frac{2i \ K(\alpha_0 + 4 \ \alpha_5 \ k^2)}{\alpha_0^2 \ (1 + k^2)^2}$ | 0 | 0 | 0 | 0 | n Covariant | $\partial_{\beta}\partial_{\alpha} \tau^{\alpha\beta}$ | $\begin{array}{c} \alpha \\ \sigma \end{array} == 0 \partial_{\chi} \partial_{\beta} \partial^{\alpha} \tau^{\beta \chi} :$ | $\partial_{\chi}\partial_{\beta}\partial^{\alpha}\tau^{\beta\chi}$: | $\frac{a\beta}{\sigma} == 0 \frac{\partial_x \partial^\alpha t}{\partial x^{\alpha}}$ | Total expected gauge generators: | #1 1 ⁺) | $\alpha \beta$ $\alpha \beta$ $\alpha \beta$ $\alpha \beta$ | $-\frac{i \ q_0 k}{2 \sqrt{2}}$ | 0 | 0 | 0 | 0 $\frac{\alpha_0}{4} + \frac{2\beta_2}{3} + \alpha_9$ | 5 k ² | 0 $-\frac{3\alpha_0+4\beta_2}{6\sqrt{2}}$ | 0 | $0 \\ -\frac{1}{6} i (3 \alpha_0 + 4 \beta_2) k$ | $== \iiint (f^{\alpha\beta} \ t_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi} \ \sigma_{\alpha}$ $== 0$ $\geq 2 \partial_{\alpha\beta}$ |
| $1^+ \sigma_{lphaeta}$ | 0 | $\frac{2\sqrt{2}}{\alpha_0 + \alpha_0 k^2}$ | $\frac{2i\sqrt{2}k}{\alpha_0 + \alpha_0 k^2}$ | 0 | 0 | 0 | 0 | ity form | | i k1 | 0 | + i k 1 + 0 | ected g | | A † | 0 | 0 | 0 | | $-\frac{3 \alpha_0 + 4 \beta_2}{6 \sqrt{2}}$ | | <u>β2</u> 3 | 0 | $\frac{1}{3}i\sqrt{2}\beta_2k$ | f^{aeta} $t_{a\mu}$ |
| . [| $1^+\sigma^+$ | $1^+ \sigma^+$ | $\frac{#1}{1}\tau + \alpha \beta$ | $\frac{*1}{1}\sigma^{+}$ | $\frac{#2}{1^{-}}\sigma^{+}$ | $\frac{#1}{1}\tau + \frac{\alpha}{\alpha}$ | $\frac{#2}{1^-}$ $t + \frac{\alpha}{1}$ | Spin-parity | $0^{+} \tau == 0$ | $\frac{\#2}{1^- t} + 2$ | $\frac{\#1}{1^- t} \alpha == 0$ | $\frac{#1}{1^+ t} \alpha \beta +$ | Total exp | | $f \uparrow^{\alpha}$ $f \uparrow^{\alpha}$ | 0 | 0 | 0 | | $\frac{1}{6} i \left(3 \alpha_0 + 4 \beta_1 \right)$ | 0 3 ₂) k - | $\frac{1}{3}i\sqrt{2}\beta_2k$ | 0 | $\frac{2\beta_2 k^2}{3}$ | S == S |

Massive and massless spectra



Unitarity conditions