Particle spectrograph

Wave operator and propagator

\$\frac{1}{17} \text{ form } \text{Coherent form}\$ \$\text{Opt-party form } \text{Coherent form}\$ \$\text{Opt-party form } \text{Opt-party form}\$ \$\text{Opt-party form}\$ \$	es	1	1 _	1	1	1		1							1								#	1	#1 0 ⁺ 1	#2	#1			#1		#1	#2						
17 Form Cooperate from 2 p_0 x^2 v_0 = 0 p_0 x^2 v_0 =	iplicitie															t, 0, f 0	fα' -	- βfai	+ +	$\alpha^{(l)}$)+		#1 0+ σ+		1	i √2 /	k .			. [#1 0 ⁺ f	_						
ity form Covariant form $ \frac{*1}{b} \int_{0}^{*1} \sigma = 0 $ $ \frac{\partial_{1} \partial_{1} r \partial_{2} = 0}{\partial_{2} \partial_{1} r \partial_{2} = 0} \int_{0}^{*1} \sigma^{2} \sigma^{2} = 0$ $ \frac{\partial_{1} \partial_{2} r \partial_{2} = 0}{\partial_{2} \partial_{2} \sigma^{2} r \partial_{2} = 0} \int_{0}^{*1} \sigma^{2} \sigma$	Mult	н	н	m	е	м		2							16	رم -9	q, 99,	οf _{αθ} δ	est ia 0°f	t_2) $\partial^{\theta} f$ $ag_{\theta} \partial^{\theta} g$			_ i ·	√2 k	2 k ²	11			_								#1 2 ⁺ σαβ	#1 2 ⁺	. τα
ity form Covariant form $\frac{*1}{b} \int_{0}^{*1} \sigma = 0$ $\frac{\partial_{1} a_{1} c_{1}}{\partial a_{1}} = \frac{\partial_{1} a_{1} c_{2}}{\partial a_{2}} = \frac{\partial_{2} b_{1} c_{2}}{\partial a_{2}} + 2 \partial_{2} \partial_{$								- θ)		βδε						щ в д'у	+4 t ₂ 9	' +2 t ₁	$u - t_2 \partial_t$	$r_2 \partial_r \mathcal{A}$	x of t					0	0								#1 2 ⁺ c	η †		_ 2 i	i√
ity form Covariant form $ \frac{*1}{\delta \partial^{\alpha} a^{\alpha} \partial a^{-1}} = \frac{1}{\delta \partial^{\beta} a^{\alpha} a^{-1}} = \frac{1}{\delta \partial^{\beta} a^{-1}} + $						σαβχ ==		$^{6}\partial_{\chi}\partial^{\alpha}t^{\gamma}$	+	9 9	$o^{2}o^{\chi}o^{-1}$			0 ==		$12 t_1 S$	$\partial^{\theta} f^{\alpha \prime} +$. θ, θ ⁶ ξ ^α	ς ια ∂θf ^c	q ^{αιθ} +2 Я ^{αβι} -2	dy d			0	0	0			-	0	0	0		$k^2 r_2 + t$	#1 2 2 ⁺ 1				4 k ²
ity form Covariant form $\frac{*!}{b^{2}a^{1}}\sigma = 0$ $\frac{a_{0}a_{1}a^{2}a^{2}}{a^{2}a^{2}a^{2}a^{2}} = \frac{a_{0}a^{2}a^{2}a^{2}}{a^{2}a^{2}a^{2}a^{2}}$ $\frac{*!}{b^{2}a^{2}a^{2}a^{2}} = \frac{a_{0}a^{2}a^{2}a^{2}a^{2}a^{2}a^{2}a^{2}a^{2$						$\partial_{\delta}\partial_{\delta}\partial_{\chi}$		-3 00	$g_{\alpha}^{1}\chi e^{\lambda}$, ×	א פֿ	+ ;	30a -	$\chi \sigma^{\delta \epsilon}{}_{\delta}$		θ,f ^{α,} +	$\mathcal{R}_{\tilde{\theta}_{\alpha}}$	$-t_2\partial_{\alpha}f$	$2 t_1 \partial_{\theta}$	$(2 t_2) S$	N	$\frac{2}{\tau_{\alpha}}$	0	0	0	21 k	$\frac{\sqrt{2} k}{2k^2)^2 t_1}$	0	$\frac{2k^2}{2k^2)^2t_1}$							αβχ	0	0	
ity form Covariant form $\frac{*!}{b^{2}a_{1}c^{2}} = 0$ $\frac{\partial_{0}a_{1}c^{2}}{\partial_{0}a_{2}} = \frac{\partial_{0}^{2}a_{2}}{\partial_{0}a_{2}^{2}} = \frac{\partial_{0}^{2}a_{2}^{2}}{\partial_{0}a_{2}^{2}} = \frac$						βχδ +2		$^{\chi_{\theta^{1}}}\rho^{\alpha}$	0000	, 5e	0-0-	$\sigma_{\delta}\sigma_{\chi}\Gamma$	$\theta_{\delta}\theta_{\chi}\sigma'$	030000		B .	$\theta + 4t$	$^{1}\partial^{\theta}f^{\alpha}$, β ^θ ξ ^{αι} +	θ_{l} ((t_1)	, x, y,														$^{#2}_{i}$	0	0	0	Ĺ
ity form Covariant form $\frac{*!}{b^{2}a^{1}}\sigma = 0$ $\frac{a_{0}a_{1}a^{2}a^{2}}{a^{2}a^{2}a^{2}a^{2}} = \frac{a_{0}a^{2}a^{2}a^{2}}{a^{2}a^{2}a^{2}a^{2}} = \frac{a_{0}a^{2}a^{2}a^{2}a^{2}}{a^{2}a^{2}a^{2}a^$				$^{3}Q^{\alphaeta\chi}$		$\partial_{\chi}\partial^{\alpha}\sigma$	$\partial_{\delta}\partial_{\chi}\partial^{\beta}$	3 000	-χα +3	ag ag	0 0	$o_{\epsilon o}$,X 0E0!	~~		12 t ₁	, 0 ₀ f	$t_1 \partial_{\alpha} f_{\epsilon}$	$\partial_{ heta} f_{lpha_{l}}$	2 Aα [αβ] +1	l _{αβ'}))[t		0	0	0										$_{r}^{*1}$ $_{fa}$	0	0	0	Ĺ
ity form Covariant form $\frac{s_1}{b^2 a_1 c^2} = 0$ $\frac{s_2 a_1 c^2}{b^2 a_1 c^2} = \frac{s_2 s^2 a_1 c^2}{a_2 a_2 b_2 c^2} + 2 \frac{s_2 s^2}{a_2 a_2 b_2 c^2} + 2 \frac{s_2 s^2}{a_2 a_2 a_2 b_2 c^2} + 2 \frac{s_2 s^2}{a_2 a_2 a_2 a_2 b_2 c^2} + 2 \frac{s_2 s^2}{a_2 a_2 a_2 a_2 a_2 b_2 c^2} + 2 \frac{s_2 s^2}{a_2 a_2 a_2 a_2 a_2 a_2 a_2 a_2 a_2 a_2 $			$\beta \sigma^{\alpha \beta}$	$_{5}\partial ^{\delta }\partial _{\chi }\partial _{\mu }$		+2 06	βα +2	α _τ χ, -3	$^{\wedge}_{1}^{}^{}_{\Theta_{\chi}\Theta^{\delta}}$, « , «	K OEO,	11 7+	+6 i k	4 i n ^{at}		ρ -	$t_1 \partial' f^0$	f ^{a,} -4	$x' + t_2$	$f^{\alpha\prime}$)+ $f^{\alpha\prime}$)+	$\mathcal{R}^{ heta}$	$^{#2}_{1}\sigma_{lpha}$				$\frac{\sqrt{2}}{t_1 + 2k^2t}$	$\frac{1}{(1+2k^2)^2}$		$i\sqrt{2}k$						#2 1 %		0	0	Ĺ
ity form Cov $ \frac{\pi^{1}}{k^{1}\sigma^{2}} = 0 $ $ \frac{\pi^{1}}{k^{2}} = 0 $ $ \frac$			$\theta_x \theta_x \theta_y$	3 +2 0 _c	,	$^{\chi}\partial^{\chi}\iota^{\alpha\beta}$	$-\partial_{\chi}\partial^{\chi}\tau$	0,0000	′ -3 ∂ _ó ί	, ,	++ 4	ρ. Φ.	$\partial_{\chi}\sigma^{\alpha\delta\beta}$	$\partial^{\delta} \tau^{\chi}_{\chi}$ -	:		, +12	af 10 0°	$\alpha' \partial^{\theta} f'$	+2 0 ⁶	72 00 A	σ_{α}	0	0	0			0							1^*	0			
ity form Cov $ \begin{cases} $			~	$\partial^{\chi}\partial_{\beta} \tau^{\alpha l}$	$\partial^{\chi}\partial_{\beta} \tau^{\beta c}$		+ χ _α 1 ₉ (δ +2 ô	$\partial_{\chi}\partial^{\beta}\Gamma^{\alpha}$	ς 2x - βc	$x^{\alpha_{\lambda}}$	$Q \in Q \otimes Q_X^{-1}$	$\partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}i$	$\partial_{\epsilon}\partial^{\epsilon}\partial_{\delta^{i}}$		+6	$\alpha'' \partial_{\theta} f$, +2 <i>t</i> 2 ∂	t $t_1 \partial_{\theta} t$	(Α ^{αιθ} αβι -4 ,	αβι -4 ,		$\frac{t_2)}{t_2}$	(s) (t)	(2)	-	t ₁ +	0	-t ₁ -						fαβ	$\frac{1-2t_2}{\sqrt{2}}$	$_{1}+t_{2})$	$_1 + t_2)$	١
ity form Cov $ \begin{cases} $	orm	0 ==	:= 90 ⁸ :	x == 46	x == 46	$+ \partial_{\chi} \partial^{\beta} 1$	$^{\beta} + \partial_{\chi} \dot{c}$	$\partial^{\beta}\partial^{\alpha}\tau^{\chi}$	3 0 ₆ 0 ⁶	, , ,	50000		6 i k	$2 \eta^{\alpha\beta}$,,	$\partial^{\theta} f^{\alpha i}$	θf ^{αι} +1	Saub Beban	B, 39 €	1^{*1} $\tau_{\alpha\beta}$	$\sqrt{2} k(t_1-2)$	$(1+k^2)^2 t_1$	$(t_1 + 4t_2)^2 t_1$	0	0	0	0						1+1	i K(t.	$\frac{1}{3}$ i $k(t)$		
ity form Cov		βź	$\partial_{\alpha} \tau^{\alpha \beta}$:	$\partial_{\beta}\partial^{\alpha}\tau^{\beta}$	$\partial_{\beta}\partial^{\alpha}\tau^{\beta}$	$\partial^{\alpha} \iota^{\beta \chi}$	$\partial_{\chi}\partial^{\alpha} \tau^{\chi}$	(4 $\partial_{\delta}\partial_{\chi}$							rators	+6	ر ع/ <i>و</i> م -ا	$a_{1} \partial_{\alpha} f_{\beta}$	η β	$t_1 + t_2$ $2 \partial_{\beta} \mathcal{A}_{\alpha}$	2 00 A									$\mathcal{A}_{\alpha \beta \chi}$	0	0	<u>t1</u>	1	α αβ	2t ₂ \[\frac{2}{\frac{1}{2}}\]	12	$_1 + t_2)$	ĺ
in-parity form $ \begin{array}{c} $	Covari	Θβ	∂_{eta}		o _x	0		== 0 -i							e gene		٠,	4 t	t2 (2()	21	$1^+ \sigma_c$	$\sqrt{2(t_1-2)}$ 3(1+ k^2)	t_1+4t $3(1+k^2)^2$	$i \ k(t_1 + t_2)^2$					2#1		t_1			1+3	3,3	1 1 1	$-\frac{1}{3}i$ K(t	ĺ
in-parity find in-pa				α α == σ ==		$\alpha\beta$		α^{11}_{+})						gang	t, 20									$\frac{1-2t_2)}{ t_1t_2 }$		0	0	0		6. S	κ ₂	-		ταβ	.4 t ₂)	2 2		Ī
$\begin{array}{c} \begin{array}{c} \begin{array}{c} 1 \\ 1 \\ 1 \end{array} \end{array} \begin{array}{c} \begin{array}{c} 1 \\ 1 \\ 2 \end{array} \end{array} \begin{array}{c} \begin{array}{c} 1 \\ 2 \\ 3 \end{array} \end{array} \begin{array}{c} \begin{array}{c} 1 \\ 2 \\ 3 \end{array} \begin{array}{c} 1 \\$			#1 λ0 ⁺ σ	2 i k1	0	×		.2 i k2							pectec	را (<u>1</u> (6	•					1^+	$\frac{2(t_1+}{3t_1t}$	$\frac{\sqrt{2}(t_1-t_2)}{3(1+k^2)}$	$\frac{i\sqrt{2}k(t)}{3(1+k^2)}$	0	0	0	0	#1 2+36					1 + 1	$\frac{1}{6}(t_1 +$	3 1	i K(t₁ 3 √	
	in-par	υ ==0	τ-2 į	τ + 2	== μ			$\frac{1}{\tau}$ $\alpha\beta$							talex							I	αβ 7 †	αβ 7 +	αβ τ + α	σ^{\dagger}	σ †	ι τ†	: r+a		\mathcal{A}^{+}	. f +	$\alpha + \alpha \beta \chi$			74 + ^{ab}	αβ # †	$f + \alpha \beta$	-

Massive and massless spectra

Parity:	Spin:	Square mass:	Pole residue: -	Massive particle	$J^{P} = 0^{-}$ $\downarrow \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad $	(No particles)
Odd	0	$\frac{t_2}{r_2} > 0$	$\frac{1}{r_2} > 0$	ticle		

Unitarity conditions