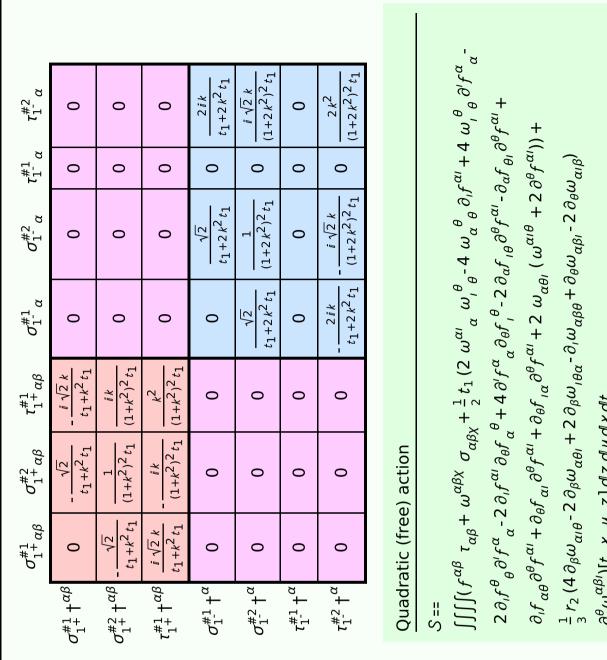
Particle spectrograph

Wave operator and propagator



			$\sigma_{0}^{\#1}$		$\tau_{0}^{\#1}$		$\tau_0^{\#}$	2 + <i>c</i>	$\sigma_{0}^{\#1}$					
	$\sigma_{0}^{#1} \dagger -{(1-}$		$\frac{1}{(1-2k^2)^2t_1}$		$\frac{i\sqrt{2}k}{+2k^2)^2t_1}$		0		0				$\sigma_{2}^{\#1}\alpha_{1}$	
$ au_{0}^{\#1}$ †		+ (1-	$-\frac{i\sqrt{2} k}{(1+2k^2)^2 t_1}$		$-\frac{2k^2}{(1+2k^2)^2t}$		0		0	$\sigma_2^{\#}$	¹ † ^{αβ}		$\frac{2}{(1+2k^2)^2t_1}$	
	$\tau_{0}^{\#2} + 0$			0				0	$ au_2^{\#1}\dagger^{lphaeta}$		$\frac{2}{(1+}$	$\frac{2 i \sqrt{2} k}{(1+2 k^2)^2 t_1}$		
	$\sigma_0^{\#1}$	+	0		0		0	$\frac{1}{k^2}$	$\frac{1}{r_2-t_1}$	$\sigma_2^{\#1}$	$\dagger^{\alpha\beta\lambda}$	(0	
				•			•	•	•					
	$f_{1^{ ext{-}}\alpha}^{\#2}$	0	0	0	ikt_1	C	>	0	0					
	$f_{1^-}^{\#1} \alpha$	0	0	0	0	c	>	0	0					
	$\omega_{1^{-}}^{\#2}{}_{\alpha}$	0	0	0	$\frac{t_1}{\sqrt{2}}$	c	>	0	0					4
alt	$\omega_{1^{ ext{-}}\alpha}^{\#1}$ (0	0	0	- [1]	<i>t</i> ₁	√2	0	$-ikt_1$	$\omega_{0}^{\#1}$	0	0	0	1,2 ,
メログ	$_{l}^{*1}$	$\frac{i k t_1}{\sqrt{2}}$	0	0	0	-)	0	0	$f_{0}^{#2}$	0 1	0	0	C
0 Z 0	lphaeta	- 1								$f_{0}^{\#1}$	$\sqrt{2} kt_1$	$-2 k^2 t_1$	0	
y, z]	$\omega_1^{\#_2}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0			0	0	f	Ĩ √.			
ס"ט"ר)[t, x, y, z]מצמעמאמד מיירין איירין איירין איירין איירין	$\omega_{1}^{\#1}_{+} \alpha_{\beta} \ \omega_{1}^{\#2}_{+} \alpha_{\beta} \ f_{1}^{\#1}_{+} \alpha_{\beta}$	$-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$\frac{ikt_1}{\sqrt{2}}$	0	C		0	0	$\omega_{0}^{\#1}$	$-t_1$	$-i\sqrt{2} kt_1$	0	c
3	!	$\alpha\beta$	$\alpha\beta$	$\alpha\beta$	$+^{\alpha}$	+α		†	†					
0,0		$\omega_1^{\#1} + ^{lphaeta}$	$\omega_1^{#2} + \alpha^{\beta}$	$f_1^{#1} + \alpha \beta$	$\omega_{1^{-}}^{\#1} +^{\alpha}$	",#2 + α	51,	$f_{1}^{\#1} +^{\alpha}$	$f_1^{\#2} +^{\alpha}$		$\omega_{0}^{\#1}$ †	$f_{0}^{\#1}$ †	$f_0^{\#2} \uparrow$,,#1+
											_			

$f_{2}^{\#1}$	$-\frac{ikt}{\sqrt{2}}$	k ² t	0						
$\omega_{2}^{\#1}{}_{\alpha\beta}$	<u>t1</u> 2	$\frac{i k t_1}{\sqrt{2}}$	0						
	$\omega_2^{\#1} + \alpha^{eta}$	$f_{2}^{#1} \dagger^{\alpha\beta}$	$\omega_{2}^{#1} +^{lphaeta\chi}$	•					
Source constraints/gauge generators									
	O(3) ir	reps			Multiplicities				
$ au_{\mathrm{C}}^{\#}$	^{‡2} == 0				1				
$\tau_{c}^{\#}$	‡1 - 2 <i>i l</i>	$k \overline{\sigma_{0}^{\#1}} =$	== 0		1				

<u>t</u>1

0

 $\tau_{2}^{\#1}_{\alpha\beta}$

 $2i\sqrt{2}k$

 $(1+2k^2)^2t_1$

 $(1+2k^2)^2t_1$

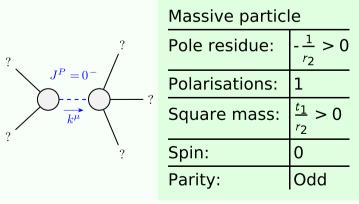
0

 $\sigma_{2}^{\#1}{}_{\alpha\beta\chi}$

 $\omega_{2}^{*1}{}_{lphaeta\chi}$

SO(3) irreps | Multiplicities $\tau_{0+}^{\#2} == 0 \qquad 1$ $\tau_{0+}^{\#1} - 2 i k \sigma_{0+}^{\#1} == 0 \qquad 1$ $\tau_{1-}^{\#2\alpha} + 2 i k \sigma_{1-}^{\#2\alpha} == 0 \qquad 3$ $\tau_{1+}^{\#1\alpha\beta} == 0 \qquad 3$ $\tau_{1+}^{\#1\alpha\beta} + i k \sigma_{1+}^{\#2\alpha\beta} == 0 \qquad 3$ $\tau_{2+}^{\#1\alpha\beta} - 2 i k \sigma_{2+}^{\#1\alpha\beta} == 0 \qquad 5$ Total constraints: 16

Massive and massless spectra



(No massless particles)

Unitarity conditions

 $r_2 < 0 \&\& t_1 < 0$