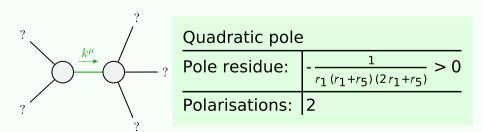
## Particle spectrograph

## Wave operator and propagator

Source constraints	const	train	ţ2									
SO(3) irreps	reps	Fun	dam	enta	Fundamental fields	S					Multi	Multiplicities
$\sigma_{0}^{\#1} == 0$		$\epsilon \eta_{\alpha_{\prime}}$	$\theta_{\chi\delta}$	$\epsilon \eta_{\alpha\beta\chi\delta}  \partial^{\delta} \sigma^{\alpha\beta\chi}$	0 == ,						1	
$\sigma_{0}^{\#1} == 0$		$\partial_{eta}\sigma^{lphaeta}$	$\alpha_{\alpha} = 0$	0 ::							1	
$\sigma_{1}^{\#2\alpha} == 0$	0	$\partial_{\chi}\partial_{\beta}$	$\partial_{\chi}\partial_{\beta}\sigma^{\alpha\beta\chi} == 0$	0 ==							m	
$\sigma_1^{\#2}\alpha\beta=$	0 ==	$\partial_{\delta}\partial_{\chi}$	$\partial^{\alpha}\sigma^{eta}$	$+_{\varphi\chi_i}$	$\partial_{\delta}\partial^{\delta}\partial_{\lambda}$	$\langle \sigma^{\alpha \beta \chi}$	$\partial_{\delta}\partial_{\chi}\partial^{\alpha}\sigma^{\beta\chi\delta} + \partial_{\delta}\partial^{\delta}\partial_{\chi}\sigma^{\alpha\beta\chi} == \partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\alpha\chi\delta}$	$\rho_{\chi} \partial^{\beta} \sigma'$	χχ		m	
$\sigma_{2}^{\#1}\alpha\beta$ =	0 ==	3 06	$\partial_{\chi}\partial^{\alpha}c$	- ρχδ_	+ 3 0 <sub>6'</sub>	$\partial_{\chi}\partial^{\beta}G$	rαχδ +	2 n <sup>af</sup>	$3\partial_{\delta}\partial_{\chi}\partial^{\alpha}\sigma^{\beta\chi\delta} + 3\partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\alpha\chi\delta} + 2\eta^{\alpha\beta}\partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}\sigma^{\chi\delta}$	$\frac{\partial^{\chi\delta}}{\partial x^{\xi}} ==$	2	
		2	$\partial_\delta\partial^eta \dot{\epsilon}$	$\beta^{\alpha} \mathcal{O}^{\chi c}$	+ + 3	(0 <sub>0</sub> 0	$\partial_{\chi}\sigma^{\alpha\chi_{l}}$	$^{\beta}+\partial_{\delta}$	$2 \partial_{\delta} \partial^{\beta} \partial^{\alpha} \sigma^{\chi \delta}_{\chi} + 3 (\partial_{\delta} \partial^{\delta} \partial_{\chi} \sigma^{\alpha \chi \beta} + \partial_{\delta} \partial^{\delta} \partial_{\chi} \sigma^{\beta \chi \alpha})$			
Total constraints/gauge generators:	nstra	aints	/gan	ge g	enera	tors:					13	
Ouadratic (free) action	ic (fr	ee)	actio	ڃ								
$S == \iiint (\omega^{\alpha\beta\chi} \ \sigma_{\alpha\beta\chi} - \frac{2}{2} \ r_1 \ (2 \ \partial_\beta \omega_{\alpha\beta} - \partial_\beta \omega_{\alpha\beta}) +$	$(\omega^{\alpha t})$	3χ σ	, , , ,	2 1 (2	$\frac{1}{2} \partial_{\beta} \omega_{\beta}$	6-A1	$\omega_{\alpha B_{I}}$	+				
			\ \ \ \	ک 4	$\partial_{\mathcal{B}}\omega_{,\mathcal{B}}$	( + °)	$\omega_{\alpha\beta\beta}$	$-\partial_{\theta}\omega_{\rho}$	$\omega_{\theta} e^{-i \theta}$	$4\partial_{eta}\omega_{,lpha_{,}}+\partial_{eta}\omega_{,lpha_{eta_{eta_{,}}}}-\partial_{eta}\omega_{,lpha_{,}}-\partial_{eta}\omega_{,lpha_{,}})\partial^{eta}\omega^{lphaeta_{'}}+$	+ <sub>ιβκ</sub>	
			r <sub>5</sub> (	$\partial_{i}\omega_{\theta}^{}$	$\omega^{\theta} \omega^{\lambda}$	α α - 6	$\omega_{\theta}^{\kappa}$	$\partial^{ heta}\omega^{lpha}$	$\alpha^{-}(\partial_{\alpha}\omega)$	$r_5 \left( \partial_i \omega_{\theta}^{\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	$\omega^{\alpha'}_{\alpha}$	
					$(\partial_{\kappa}\omega)$	, κ – θ	$\langle \omega_{\theta}^{K} \rangle$	))[t, x	í, y, z]c	$(\partial_{\kappa}\omega_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{$	x dlt	
$\omega_1^{\!\scriptscriptstyle f}$		$\omega_{\scriptscriptstyle 1}^{\scriptscriptstyle \#1}$		$\sigma_1^{\!\#}$	$\sigma_1^{\!\#}$	$\sigma_{1}^{\#2}$	$\sigma_{1}^{\#1}$			$\omega_2^{\#1}_{+}{}_{\alpha\beta}$	$\omega_{2}^{\#1}$	
<sup>‡1</sup> † <sup>α</sup> <sup>‡2</sup> † <sup>α</sup>	$\frac{2}{3}$ † $\alpha\beta$	ι † <sup>αβ</sup>		$\frac{1}{2}$ † $^{\alpha}$	$\pm^1 \dagger^{\alpha}$	$\dagger^{\alpha\beta}$	$\dagger^{lphaeta}$		$\omega_2^{\#1} + ^{lphaeta}$	0	0	
			ω	C	C	C	$\frac{1}{k^2 (2r)}$	$\sigma_{1}^{\#1}$	$\omega_{2}^{\#1} +^{\alpha \beta \chi}$	0 ×	$k^2 r_1$	
0	0	$r_1 + r$	#1 1 <sup>+</sup> αβ	)	)	)	1+r <sub>5</sub> )	_ αβ		$\sigma_{2}^{\#1}{}_{\alpha\beta}$	$\sigma_{2^{-}}^{\#1}{}_{lphaeta\chi}$	
			ω	0	0	0	0	$\sigma_{1}^{\#2}$	$\sigma_2^{\#1} +^{\alpha\beta}$	0	0	
0	0	0	#2 1 <sup>+</sup> αβ		$\frac{1}{k^2}$				$\sigma_{2}^{\#1} +^{\alpha \beta \chi}$	0	$\frac{1}{k^2 r_1}$	
k <sup>2</sup> (r <sub>1</sub>	C	C	$\omega_1^{\#}$	0	$\frac{1}{(r_1+r_5)}$	0	0	$\sigma_{1-lpha}^{\#1}$	$\omega_0^{\sharp 1} \ \omega_0^{\sharp 1}$	$\sigma_0^{\#1}$	$\sigma_{0}^{\#1}$	
	)		$\frac{1}{\alpha}$	0	0	0	0	$\sigma_{1 \alpha}^{\#2}$	† 0 † 0	$0$ $\omega_0^{\#_2}$	t 0	$\sigma_{0^+}^{\sharp 1}$
0	0	0	$\omega_{1-\alpha}^{\#2}$						0	$0$ $\omega_0^{\sharp 1}$	0	$\sigma_0^{\sharp 1}$

## Massive and massless spectra



(No massive particles)

## **Unitarity conditions**

$$r_1 < 0 \&\& (r_5 < -r_1 || r_5 > -2 r_1) || r_1 > 0 \&\& -2 r_1 < r_5 < -r_1$$