## Particle spectrograph

Wave operator and propagator

SO(3) irreps Fundamental fields $ \frac{\sigma_{0}^{\#1} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{\sigma_{0}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{\sigma_{0}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{0}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{\alpha} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - 2 i k \sigma_{1}^{\#2} = 0}{\sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} r^{\beta}} = 0 $ $ \frac{r_{1}^{\#2} - r^{\beta}}{\sigma_{0} \sigma_{0} r^{$	Source constraints		
$ \begin{array}{cccc}  & & & & & & & & \\  & & & & & & \\  & & & &$	SO(3) irreps	Fundamental fields	Multiplicities
$ \begin{array}{ll} \partial_{\beta}\partial_{\alpha} t^{\alpha\beta} = \\ \partial_{\alpha}^{\#1} = 0 & \partial_{\beta}\partial_{\alpha} t^{\alpha\beta} = \\ i k \sigma_{1}^{\#2} = 0 & \partial_{\alpha}\partial_{\beta}\partial^{\alpha} t^{\beta} \\ 0 & \partial_{\alpha}\partial_{\beta}\partial^{\alpha} t^{\beta} \\ i k \sigma_{1}^{\#2} = 0 & \partial_{\alpha}\partial_{\alpha} t^{\beta} \\ \partial_{\alpha}\partial^{\alpha} t^{\lambda} \\ \partial$	$\sigma_{0}^{\#1} == 0$	$\epsilon \eta_{\alpha\beta\chi\delta}  \partial^{\delta} \sigma^{\alpha\beta\chi} == 0$	1
	$t_0^{\#2} == 0$	$\partial_{\beta}\partial_{\alpha}\tau^{\alpha\beta} == 0$	1
$ \frac{r_1^{\#2}\alpha}{r_1^{\#1}} + 2 i k o_1^{\#2}\alpha = 0  $ $ \frac{\partial_x \partial_\beta \partial^\alpha r^{\beta X}}{\partial_x \partial_\beta \partial_\alpha r^{\beta X}} = \frac{\partial_x \partial^\lambda \partial_\beta r^{\alpha \beta}}{\partial_x \partial_\beta r^{\beta \alpha}} $ $ \frac{r_1^{\#1}\alpha}{r_1^{\#1}} = 0  $ $ \frac{\partial_x \partial_\beta \partial^\alpha r^{\beta X}}{\partial_x \partial_\alpha r^{\beta X}} + \frac{\partial_x \partial^\beta r^{\alpha A}}{\partial_x \partial_\beta r^{\alpha B}} + \frac{\partial_x \partial^\beta r^{\alpha A}}{\partial_x \partial_\alpha r^{\lambda B}} + \frac{\partial_x \partial^\alpha r^{\lambda B}}{\partial_\alpha \partial_\alpha r^{\lambda B}} + \frac{\partial_x \partial^\beta r^{\alpha A}}{\partial_\alpha r^{\lambda B}} + \frac{\partial_x \partial^\beta r^{\alpha A}$	$\tau_0^{\#1} - 2  i  k  \sigma_0^{\#1} == 0$	$_{\alpha}$ + 2 $\partial_{\chi}\partial^{\chi}\partial_{\beta}\sigma^{\alpha\beta}$	1
$t_{1}^{\#,1}\alpha := 0$ $a_{\lambda}\partial_{k}\partial^{\alpha}\tau^{\beta}X = a_{\lambda}\partial^{\lambda}\partial_{\beta}\tau^{\beta}\alpha$ $t_{1}^{\#,1}\alpha\beta + ik \ \sigma_{1}^{\#,2}\alpha\beta := 0$ $a_{\lambda}\partial^{\alpha}\tau^{\beta}X + \partial_{\lambda}\partial^{\alpha}\tau^{\lambda}X + \partial_{\lambda}\partial^{\alpha}\tau^{\alpha}X + \partial_{\lambda}\partial^{\alpha}\sigma^{\alpha}X + \partial_{\lambda}\partial^{\alpha}\sigma^{\alpha}$	$\tau_{1}^{\#2}{}^{\alpha} + 2ik \ \sigma_{1}^{\#2}{}^{\alpha} = 0$	$\partial_{\chi}\partial_{\beta}\partial^{\alpha}\tau^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\tau^{\alpha\beta} + 2\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial_{\beta}\sigma^{\alpha\beta\chi}$	ĸ
$t_{1}^{\#1} \alpha \beta + i k \ o_{1}^{\#2} \alpha \beta = 0 $ $2 \ \partial_{\alpha} \partial^{\alpha} \tau^{\beta} X + \partial_{\chi} \partial^{\beta} \tau^{\chi} \alpha + \partial_{\chi} \partial^{\chi} \tau^{\alpha\beta} + $ $2 \ \partial_{\alpha} \partial_{\gamma} \partial^{\alpha} \sigma^{\beta} X^{\delta} + 2 \ \partial_{\delta} \partial^{\delta} \partial_{\alpha} \sigma^{\beta} X = $ $3 \ \partial_{\alpha} \partial^{\alpha} \tau^{\beta} X^{\delta} + 2 \ \partial_{\delta} \partial^{\beta} \partial^{\alpha} \tau^{\chi} X^{\delta} + $ $2 \ \partial_{\alpha} \partial^{\alpha} \tau^{\beta} X^{\delta} + 2 \ \partial_{\delta} \partial^{\beta} \partial^{\alpha} \chi^{\chi} + $ $3 \ \partial_{\alpha} \partial^{\beta} \partial^{\alpha} \tau^{\lambda} X^{\delta} + 2 \ \partial_{\delta} \partial^{\beta} \partial^{\alpha} \tau^{\chi} X^{\delta} + $ $3 \ \partial_{\delta} \partial^{\delta} \partial_{\alpha} \partial^{\beta} \nabla^{\alpha} \tau^{\lambda} X^{\delta} + 2 \ \partial_{\delta} \partial^{\delta} \partial^{\alpha} \partial^{\alpha} \tau^{\lambda} X^{\delta} + $ $3 \ \partial_{\delta} \partial^{\delta} \partial_{\alpha} \partial^{\beta} \nabla^{\alpha} \tau^{\lambda} X^{\delta} + 2 \ \partial_{\delta} \partial^{\delta} \partial^{\alpha} \partial^{\beta} \nabla^{\alpha} \tau^{\lambda} X^{\delta} + $ $4 \ i \ k^{\chi} \ \partial_{\epsilon} \partial^{\delta} \partial_{\alpha} \partial^{\beta} \nabla^{\alpha} \nabla^{\beta} \partial^{\alpha} \nabla^{\delta} \partial^{\beta} \nabla^{\alpha} \nabla^{\delta} \partial^{\beta} \partial^{\alpha} \nabla^{\delta} \partial^{\beta} \nabla^{\alpha} \partial^{\beta} \partial^{\beta} \nabla^{\alpha} \partial^{\beta} \partial^{\alpha} \nabla^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} \partial$	$\tau_{1}^{\#1}{}^{\alpha} == 0$	$\partial_{\chi}\partial_{\beta}\partial^{\alpha}\tau^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\tau^{\beta\alpha}$	Е
$ 2 \cos_{\alpha} x^{\alpha} + 2 \cos_{\alpha} x^{\alpha} + 2 \cos_{\alpha} x^{\alpha} - x =  $ $ a_{x} \partial^{\alpha} t^{x} + 3 + 2 \cos_{\alpha} x^{\beta} \partial^{\alpha} t^{x} +  $ $ a_{x} \partial^{\alpha} t^{x} + 2 \cos_{\alpha} x^{\beta} \partial^{\alpha} t^{x} -  $ $ a_{x} \partial^{\alpha} t^{x} + 2 \cos_{\alpha} x^{\beta} \partial^{\alpha} t^{x} -  $ $ 3 \cos_{\alpha} \partial^{\alpha} x^{x} + 3 \cos_{\alpha} \partial^{\alpha} t^{x} -  $ $ 3 \cos_{\alpha} \partial^{\alpha} x^{x} + 3 \cos_{\alpha} \partial^{\alpha} t^{x} -  $ $ 3 \cos_{\alpha} \partial^{\alpha} x^{x} + 3 \cos_{\alpha} \partial^{\alpha} t^{x} -  $ $ 3 \cos_{\alpha} \partial^{\alpha} x^{x} + 3 \cos_{\alpha} \partial^{\alpha} t^{x} -  $ $ 4 i k^{x} \partial_{\epsilon} \partial_{x} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} -  $ $ 6 i k^{x} \partial_{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial_{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} \partial^{\alpha} e^{\epsilon} +  $ $ 6 i k^{x} \partial_{\epsilon} \partial^{\alpha} \partial^$		$\partial_{\chi}\partial^{\alpha}\tau^{\beta\chi} + \partial_{\chi}\partial^{\beta}\tau^{\chi\alpha} + \partial_{\chi}\partial^{\chi}\tau^{\alpha\beta} + \partial_{\chi}\partial^{\chi}\tau$	м
$a_{x}\partial^{x}t^{\beta\alpha} + 2a_{5}\partial_{x}\partial^{\beta}\sigma^{\alpha x\delta}$ $t_{2}^{\#+}a^{\beta} - 2ik \sigma_{2}^{\#+}a^{\beta} = 0$ $a_{5}\partial^{\delta}\partial_{x}\partial^{\beta}\sigma^{x}t^{x\delta} + 2a_{5}\partial^{\delta}\partial^{\beta}\sigma^{x}t^{x} - 3a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}t^{x\delta} - 3a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}t^{x\delta} + 4ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}t^{x\delta} + 4ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $6ik^{x}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $2n^{\alpha\beta}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $2n^{\alpha\beta}a_{5}\partial^{\delta}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$ $4in^{\alpha\beta}k^{x}\partial_{\phi}\partial^{\phi}\partial_{x}\partial^{\alpha}d^{\delta}e^{-}$		$2  \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\gamma} x^{\alpha} + 2  \partial_{\delta} \partial^{\alpha} \partial_{\chi} \partial^{-\gamma} x = 0$ $\partial_{\chi} \partial^{\alpha} \tau^{\chi \beta} + \partial_{\chi} \partial^{\beta} \tau^{\alpha \chi} + 0$	
$t_{2}^{\#1}\alpha\beta - 2ik \ d_{2}^{\#1}\alpha\beta == 0  -i(4 \partial_{\delta} \lambda_{\lambda} \partial^{\beta} \partial^{\alpha} t^{X^{\delta}} + 2 \partial_{\delta} \partial^{\delta} \partial^{\beta} \partial^{\alpha} t^{X} - 3 \partial_{\delta} \partial^{\delta} \partial^{\alpha} t^{X^{\delta}} + 4 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\alpha} t^{X^{\delta}} + 4 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} \partial^{\delta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\delta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} e^{-} + 2 \partial_{\delta} \partial^{\delta} \partial^{\alpha} \partial^{\delta} e^{-} + 2 \partial_{\delta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} \partial^{\delta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} \partial^{\delta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\beta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial_{\epsilon} \partial^{\beta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} e^{-} - 6 i k^{X} \partial^{\beta} \partial^{\beta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} \partial^{\beta} \partial^{\beta} \partial^{\beta} \partial^{\alpha} \partial^{\beta} \partial^$		$\partial_{\chi}\partial^{\chi}\tau^{\beta\alpha} + 2 \partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\alpha\chi\delta}$	
$3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\beta \chi} - 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\chi \beta} - 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\chi \beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\chi \beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\chi \beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\alpha} t^{\beta \alpha} + 4 i k^{\chi} \partial_{\epsilon} \partial_{\lambda} \partial^{\alpha} t^{\alpha \beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\chi} t^{\beta \alpha} + 4 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\delta} \partial_{\epsilon} - 6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\delta} \partial_{\epsilon} - 6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\beta} \partial_{\epsilon} - 6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\beta} \partial_{\epsilon} + 2 \partial_{\delta} \partial_{\lambda} \partial^{\alpha} \partial^{\beta} \partial_{\lambda} \partial^{\beta} $	$\tau_2^{\#1}\alpha\beta - 2ik\sigma_2^{\#1}\alpha\beta == 0$	$-i \left(4 \partial_{\delta} \partial_{\chi} \partial^{\beta} \partial^{\alpha} \tau^{\chi \delta} + 2 \partial_{\delta} \partial^{\delta} \partial^{\beta} \partial^{\alpha} \tau^{\chi} \right)$	2
$3 \partial_{\sigma} \partial^{5} \partial_{\chi} \partial^{\beta} \tau^{\alpha \chi} - 3 \partial_{\sigma} \partial^{5} \partial_{\chi} \partial^{\beta} \tau^{\chi \alpha} +$ $3 \partial_{\sigma} \partial^{5} \partial_{\chi} \partial^{\chi} \tau^{\alpha \beta} + 3 \partial_{\sigma} \partial^{5} \partial_{\chi} \partial^{\chi} \tau^{\beta \alpha} +$ $4 i k^{\chi} \partial_{\varepsilon} \partial_{\chi} \partial^{\beta} \partial^{\alpha} \partial^{\delta \varepsilon} -$ $6 i k^{\chi} \partial_{\varepsilon} \partial_{\sigma} \partial_{\chi} \partial^{\beta} \partial^{\alpha} \partial^{\varepsilon} \varepsilon -$ $6 i k^{\chi} \partial_{\varepsilon} \partial_{\varepsilon} \partial_{\chi} \partial^{\chi} \partial^{\zeta} +$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \tau^{\chi \delta} +$ $6 i k^{\chi} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\sigma} \partial_{\chi} \partial^{\beta} \partial^{\alpha} -$ $6 i k^{\chi} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\sigma} \partial_{\chi} \partial^{\beta} \partial^{\alpha} -$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\sigma} \partial_{\chi} \partial^{\beta} \partial^{\alpha} -$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\sigma} \partial^{\gamma} \partial^{\chi} \partial^{\gamma} -$ $4 i \eta^{\alpha \beta} k^{\chi} \partial_{\sigma} \partial^{\sigma} \partial_{\sigma} \partial_{\chi} \partial^{\varepsilon} \partial_{\chi} \partial^{\varepsilon} \partial_{\sigma} -$		$3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\alpha}\tau^{\beta\chi}$ - $3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\alpha}\tau^{\chi\beta}$ -	
$3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\chi} t^{\alpha \beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\chi} t^{\beta \alpha} + 4 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\lambda} \partial^{\chi} t^{\beta \alpha} + 4 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\lambda} \partial^{\alpha} \partial^{\delta \epsilon} - 6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\delta \epsilon} - 6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \partial^{\delta \epsilon} + 2 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\lambda} \partial^{\alpha} \partial^{\delta} \partial^{\alpha} \partial^{\delta} \partial^{\epsilon} + 2 i k^{\chi} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\lambda} \partial^{\alpha} \partial^{\delta} \partial^{\alpha} \partial^{\delta} \partial^{\alpha} \partial^{\delta} \partial^{\alpha} \partial^{\alpha$		$3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\beta}\tau^{\alpha\chi}$ - $3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\beta}\tau^{\chi\alpha}$ +	
$4 i k^{X} \partial_{\epsilon} \partial_{\chi} \partial^{\beta} \partial^{\alpha} \sigma^{\delta \varepsilon} -$ $6 i k^{X} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \sigma^{\beta \delta \varepsilon} -$ $6 i k^{X} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \sigma^{\delta \varepsilon} +$ $2 \eta^{\alpha \beta} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} t^{X \delta} +$ $6 i k^{X} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\epsilon} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \tau^{X} -$ $4 i \eta^{\alpha \beta} k^{X} \partial_{\phi} \partial_{\phi} \partial_{\epsilon} \partial_{\chi} \sigma^{\delta \varepsilon} \partial_{\delta} = 0$		$3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\chi} \tau^{\alpha\beta} + 3 \partial_{\delta} \partial^{\delta} \partial_{\chi} \partial^{\chi} \tau^{\beta\alpha} +$	
$6 i k^{X} \partial_{\varepsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \sigma^{\beta \delta \varepsilon} -$ $6 i k^{X} \partial_{\varepsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \sigma^{\beta \delta \varepsilon} +$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} t^{X \delta} +$ $6 i k^{X} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \tau^{X} -$ $4 i \eta^{\alpha \beta} k^{X} \partial_{\phi} \partial^{\phi} \partial_{\varepsilon} \partial_{\chi} \sigma^{\delta \varepsilon} \partial_{\delta} -$		$4\ ^{ec{l}}\ k^{\chi}\ \partial_{\epsilon}\partial_{\chi}\partial^{eta}\partial^{lpha}\sigma^{\delta\epsilon}{}_{\delta}$ -	
$6 i k^{X} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\beta} \sigma^{\alpha \delta \epsilon} +$ $2 \eta^{\alpha \beta} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} t^{X \delta} +$ $6 i k^{X} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} t^{X} -$ $4 i \eta^{\alpha \beta} k^{X} \partial_{\phi} \partial^{\phi} \partial_{\epsilon} \partial_{\chi} \sigma^{\delta \epsilon} \partial_{\delta} = 0$		$6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\alpha} \sigma^{\beta \delta \epsilon}$ -	
$2 \eta^{\alpha\beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \chi^{\chi \delta} +$ $6 \tilde{I} k^{\chi} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 \tilde{I} k^{\chi} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha\beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial_{\chi} \chi^{\chi} -$ $4 \tilde{I} \eta^{\alpha\beta} k^{\chi} \partial_{\phi} \partial_{\phi} \partial_{\varepsilon} \partial_{\chi} \sigma^{\delta \varepsilon} \partial_{\delta} = 0$		$6 i k^{\chi} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \partial^{\beta} \sigma^{\alpha \delta \epsilon} +$	
$6 i k^{X} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$ $6 i k^{X} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial^{\zeta} \chi^{\chi} -$ $4 i \eta^{\alpha \beta} k^{X} \partial_{\phi} \partial^{\phi} \partial_{\epsilon} \partial_{\chi} \sigma^{\delta \epsilon}_{\delta}) = 0$		$2 \eta^{\alpha\beta} \partial_{\epsilon} \partial_{\delta} \partial_{\chi} \tau^{\chi\delta} +$	
$6 i k^{X} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\chi} \sigma^{\beta \delta \alpha} -$ $2 \eta^{\alpha \beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial^{\chi} \chi^{-}$ $4 i \eta^{\alpha \beta} k^{X} \partial_{\phi} \partial^{\phi} \partial_{\varepsilon} \partial_{\chi} \sigma^{\delta \varepsilon}_{\delta}) == 0$		$6 i k^{\chi} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial_{\chi} \sigma^{\alpha \delta \beta} +$	
$2 \eta^{\alpha\beta} \partial_{\varepsilon} \partial^{\varepsilon} \partial_{\delta} \partial^{\zeta} \chi^{\chi} - 4 \tilde{I} \eta^{\alpha\beta} \chi^{\chi} \partial_{\phi} \partial^{\phi} \partial_{\varepsilon} \partial_{\chi} \sigma^{\delta \varepsilon}) = 0$		$6$ i $k^{\chi}$ $\partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}\partial_{\chi}\sigma^{eta\deltalpha}$ -	
$4  \mathbb{I}  \eta^{\alpha \beta}  k^{X}  \partial_{\phi} \partial_{\phi} \partial_{\varepsilon} \partial_{\chi} \sigma^{\delta \varepsilon}_{\delta}) == 0$		$2 \eta^{\alpha\beta} \partial_{\epsilon} \partial^{\epsilon} \partial_{\delta} \partial^{\delta} \tau_{\chi}^{\chi}$	
		$4  \bar{l}  \eta^{\alpha\beta}  k^{\chi}  \partial_{\phi} \partial^{\phi} \partial_{\epsilon} \partial_{\chi} \sigma^{\delta \epsilon}_{\delta}) == 0$	
lotal constraints/gauge generators:	Total constraints/gaug	ge generators:	17

$\tau_{1^{-}\alpha}^{\#2}$	0	0	0	$\frac{2ik}{t_1 + 2k^2t_1}$	$-\frac{i\sqrt{2}k(2k^2r_5-t_1)}{(t_1+2k^2t_1)^2}$	0	$\frac{-4k^4r_5 + 2k^2t_1}{(t_1 + 2k^2t_1)^2}$	
$\tau_{1}^{\#1}{}_{\alpha}$	0	0	0	0	0	0	0	
$\sigma_{1^-}^{\#2}{}_{\alpha}$	0	0	0	$\frac{\sqrt{2}}{t_1 + 2 k^2 t_1}$	$\frac{-2 k^2 r_5 + t_1}{(t_1 + 2 k^2 t_1)^2}$	0	$\frac{i\sqrt{2} k(2k^2 r_5 - t_1)}{(t_1 + 2k^2 t_1)^2}$	
$\sigma_{1^{\bar{-}}\alpha}^{\#1}$	0	0	0	0	$\frac{\sqrt{2}}{t_1 + 2k^2t_1}$	0	$-\frac{2ik}{t_1+2k^2t_1}$	
$\tau_{1}^{\#1}_{\alpha\beta}$	$\frac{i}{\sqrt{2} (k r_5 + k^3 r_5)}$	$\frac{i(6k^2r_5+t_1)}{2k(1+k^2)^2r_5t_1}$	$\frac{6k^2r_5+t_1}{2(1+k^2)^2r_5t_1}$	0	0	0	0	
$\sigma_{1}^{\#2}{}_{\alpha\beta}$	$\frac{1}{\sqrt{2} \left( k^2  r_5 + k^4  r_5 \right)}$	$\frac{6k^2r_5+t_1}{2(k+k^3)^2r_5t_1}$	$-\frac{i(6k^2r_5+t_1)}{2k(1+k^2)^2r_5t_1}$	0	0	0	0	
$\sigma_{1}^{\#1}{}_{\alpha\beta}$	$\frac{1}{k^2 r_5}$	$\frac{1}{\sqrt{2} \left( k^2  r_5 + k^4  r_5 \right)}$	$\frac{i}{\sqrt{2} (k r_5 + k^3 r_5)}$	0	0	0	0	
	$\sigma_{1}^{\#1} + \alpha \beta$	$\sigma_{1}^{\#2} + \alpha^{\beta}$	$\tau_{1}^{\#1} + \alpha \beta$	$\sigma_{1}^{\#1} +^{\alpha}$	$\sigma_{1}^{\#2} +^{\alpha}$	$\tau_{1}^{\#1} +^{\alpha}$	$\tau_1^{\#2} + \alpha$	

7 ± L1)		0	(	$\frac{1}{2}$	<u>1</u> 2	
	+	$f_{0}^{\#2}$ $\omega_{0}^{\#1}$	0	0	0	0
(L)	+ + ('α)	$f_{0}^{\#2}$	0	0	0	0
11 + 2 × 1	$f^{\alpha}_{\alpha} \partial^{j} f^{\alpha}_{\alpha} - f^{\alpha}_{\alpha} \partial^{j} f^{\alpha} + f^{\alpha}_{\alpha} \partial^{j} f^{\alpha} \partial^$	$f_0^{\#1}$	$i \sqrt{2} k t_1$	$-2 k^2 t_1$	0	0
2 v z . T 2	$a'' + 6 \omega_{I}^{\theta}$ $f_{\alpha}^{\theta} + 6 \partial^{I}$ $f_{\alpha''} - 2 \partial_{\alpha} f_{IG}$ $f^{\alpha I} + \partial_{\theta} f_{IG}$ $+ \omega_{\alpha \theta_{I}} (\omega_{IG} + \omega_{IG})$ $x, y, z] dix$	$\omega_{0}^{\#1}$	-t <sub>1</sub>	$f_0^{#1} + -i \sqrt{2} kt_1$	0	0
	ction	•	$\omega_{0}^{\#1}\dagger$		# £#5 + 1.	$\omega_{0}^{\#1}$ $\dagger$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\omega_1^{\#}$	<sup>1</sup> † <sup>α</sup> /	$k^2$		$\frac{t_1}{6}$
	$\begin{array}{c} \chi \\ \alpha \\ \alpha \\ \beta \\ \alpha \\ \alpha \\ \alpha \\ \alpha \\ \alpha \\ \alpha \\ \alpha$	$\omega_1^{\#}$	<sup>2</sup> † <sup>α</sup> /	β <u>-</u>	$\frac{t_1}{3\sqrt{2}}$	
	Quadratic (free) action $S == \iiint (f^{\alpha\beta} \tau_{\alpha\beta} + \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} + \frac{1}{3} t_1 (3 \omega^{\alpha'} \omega_{\alpha})$ $3 \partial_i f^{\theta}_{\theta}$ $2 \omega_i \theta_{\alpha}$ $\partial_i f_{\alpha\theta} \partial^{\theta}$ $v_{\alpha'\theta} (v_{\theta})$ $v_{\beta} (v_{\theta})$ $(\partial_k \omega_i)$	$\omega_1^{\#}$ $f_1^{\#}$	‡†α/	β	$\frac{i k t_1}{3 \sqrt{2}}$	
	$rac{ce)}{r}$	ω	# <u>-</u> 1 †'	α	0	
	tic (final $\int_{\mathbb{R}} \int_{\mathbb{R}} (f^{\alpha} f) df$	ω	#1 † ' #2 † ' #1 † ' #1 † '	α	0	
	= ∭	f	# <u>1</u> †'	α	0	
	ال ال	f	#2 <b>†</b>	α	0	

$\omega_{0}^{\#1}$	-t <sub>1</sub>	$-i\sqrt{2}kt_1$	0	0							$\sigma_{2}^{\#1}$
	$\omega_{0}^{\#1}\dagger$	$f_{0}^{\#1}$ †	$f_{0}^{#2}$ †	$\omega_{\tilde{o}^{-1}}^{*1}$ +	- - !						
		L	$o_{1}^{\#1}$ $\alpha_{I}$	в	$\omega_{1}^{\#2}{}_{\alpha\beta}$	$f_{1^{+}\alpha\beta}^{\#1}$	$\omega_{1^{-}lpha}^{\sharp 1}$	$\omega_{1^-\alpha}^{\text{\#2}}$	$f_{1-\alpha}^{\#1}$	$f_{1-\alpha}^{\#2}$	
$\omega_1^{\!\scriptscriptstyle\#}$	†† † <sup>α</sup>	$k^2$	r <sub>5</sub> +	<u>t</u> 1 6	$-\frac{t_1}{3\sqrt{2}}$	$-\frac{ikt_1}{3\sqrt{2}}$	0	0	0	0	$_{+}^{2}$ $\sigma _{0}^{\#1}$
$\omega_1^{\scriptscriptstyle\#}$	÷2 † <sup>αμ</sup>	3 _	$\frac{t_1}{3\sqrt{2}}$		<u>t</u> 1 3	<u>i kt</u> 3	0	0	0	0	τ#2 τ <sub>0</sub> +
$f_1^{\#}$	‡1 † <sup>α</sup>	3	$\frac{i k t_1}{3 \sqrt{2}}$		$-\frac{1}{3}ikt_1$	$\frac{k^2t_1}{3}$	0	0	0	0	${t_0^{\#1}}$
ω	)#1 †°	χ	0		0	0	$k^2 r_5 - \frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	īkt <sub>1</sub>	
ω	)#2 †°	χ	0		0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0	$\sigma_{0}^{\#1}$
f	`#1 †°	χ	0		0	0	0	0	0	0	
f	<sup>#2</sup> †	χ	0		0	0	$-ikt_1$	0	0	0	

	[)	[]		
$\sigma_{2}^{\#1}{}_{lphaeta}$	$\frac{2}{(1+2k^2)^2t_1}$	$t_2^{\#1} + \alpha \beta \frac{2i\sqrt{2}k}{(1+2k^2)^2 t_1}$	0	
	$\sigma_2^{\#1} + \alpha \beta$	$\tau_2^{\#1} + \alpha^{\beta}$	$\sigma_{2}^{\#1} + \alpha \beta \chi$	
$ au_0^{\#2} \ \sigma_0^{\#1}$	0	0	0	0
$\tau_{0}^{\#2}$	0	0	0	0
$ au_0^{\#1}$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	$-\frac{2k^2}{(1+2k^2)^2t_1}$	0	0
$\sigma_{0}^{\#1}$	$\frac{1}{1+2k^2)^2t_1}$	$\frac{i\sqrt{2}k}{1+2k^2)^2t_1}$	0	0

 $\begin{array}{c}
\sigma_{0}^{\#1} + \\
\tau_{0}^{\#1} + \\
\tau_{0}^{\#2} + \\
\sigma_{0}^{\#1} + \\
\end{array}$ 

Massive and massless spectra

Unitarity conditions

 $r_5 > 0 \&\& t_1 < 0 || t_1 > 0$