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## A Chern-Simons approach to self-dual gravity in (2+1)-dimensions and quantisation of Poisson structure

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We present a Chern-Simons theory for the (2+1)-dimensional analog self-dual gravity theory that is based on the gauge group  $SL(2, \mathbb{C})_{\mathbb{R}} \bowtie \mathbb{R}^6$ . This is formulated by mapping the 3*d* complex self-dual dynamical variable and connection to 6*d* real variables which combines into a 12*d* Cartan connection.

Quantization is given by the application of the combinatorial quantisation program of Chern-Simons theory. The Poisson structure for the moduli space of flat connections on  $(SL(2, \mathbb{C})_{\mathbb{R}}) > \mathbb{R}^{6})^{n+2g}$  which emerges in the combinatorial description of the phase space on  $\mathbb{R} \times \Sigma_{g,n}$ , where  $\Sigma_{g,n}$  is a genus g surface with n punctures is given in terms of the classical r-matrix for the quantum double  $D(SL(2, \mathbb{C}))$ .

CC<sub>RR)</sub> viewed as the double of a double  $D(SU(2) \bowtie AN(2))$ . This quantum double provides a feature for quantum symmetries of the quantum theory for the model.

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