$$x^0 \underbrace{dx^1}_{} \wedge \cdot\cdot \wedge \underbrace{dx^a}_{} + \sum_{j}^{1|a} \overset{j}{(-1)} \underbrace{dx^0}_{} \wedge \underbrace{dx^1}_{} \wedge \cdot\cdot\, x^j \cdot\cdot \wedge \underbrace{dx^a}_{} = \det \frac{x^0 \mid dx^0 \mid \cdot\cdot \mid dx^0}{x^j \mid dx^j \mid \cdot\cdot \mid dx^j}$$

$$\underbrace{\alpha|x}_{} \ast (\beta|y) = \underbrace{\alpha\beta + x\overset{*}{y}}_{} | \underbrace{\alpha x + \beta y}_{}$$

$$\Pi_1 \ni \frac{1}{2}\underbrace{1|x}_{} : \quad x\overset{*}{x} = 1$$

$$c = \frac{1}{2} \left[11 \quad 0\cdot\cdot 0\right] = \begin{array}{c|c} 1 & 0 \\ \hline 0 & 0 \end{array}$$

$$\bar{c} = \frac{1}{2} \left[1-1 \quad 0\cdot\cdot 0\right] = \begin{array}{c|c} 0 & 0 \\ \hline 0 & 1 \end{array}$$

$$X_c^{1/2} \ni \left[00 \quad v^1\cdot\cdot v^a\right] = \begin{array}{c|c} 0 & v \\ \hline \overset{*}{v} & 0 \end{array} : \quad v = v^1 \cdot\cdot v^a$$

$$s_v = 0 \left| \frac{1-v\overset{*}{v}}{1+v\overset{*}{v}} \right| \frac{2v}{1+v\overset{*}{v}} \in \mathbb{S}^a$$

$$\frac{\left(1-v\overset{*}{v}\right)^2}{\left(1+v\overset{*}{v}\right)^2} + \frac{4v\overset{*}{v}}{\left(1+v\overset{*}{v}\right)^2} = \frac{1-2v\overset{*}{v}+\left(v\overset{*}{v}\right)^2+4v\overset{*}{v}}{\left(1+v\overset{*}{v}\right)^2} = \frac{1+2v\overset{*}{v}+\left(v\overset{*}{v}\right)^2}{\left(1+v\overset{*}{v}\right)^2} = 1$$

$$d\frac{1}{1+v\overset{*}{v}} = \frac{-2vd\overset{*}{v}}{\overbrace{1+v\overset{*}{v}}^{}{}^2}$$

$$\text{LHS} = -2\frac{v^k dv^k}{\overbrace{1+v\overset{*}{v}}^{}{}^2} = \text{RHS}$$

$$\underbrace{dv^1 - v^1 f v d\overset{*}{v}}_{} \wedge\cdot\cdot\wedge \underbrace{dv^a - v^a f v d\overset{*}{v}}_{} = \underbrace{1 - f v\overset{*}{v}}_{}\underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{}$$

$$\underbrace{dv^1 - f v^1 v d\overset{*}{v}}_{} \wedge\cdot\cdot\wedge \underbrace{dv^a - f v^a v d\overset{*}{v}}_{} = \underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{} - f\sum_i \underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{v^i v d\overset{*}{v}}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{}$$

$$= \underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{} - f\sum_i \underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{v^i v^i dv^i}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{} = \underbrace{dv^1}_{}\wedge\cdot\cdot\wedge\underbrace{dv^a}_{}\overbrace{1 - f\sum_i v^i v^i}^{}$$

$$x^0\,\underbrace{dx^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dx^a}+\sum_{j}^{1|a}\overset{j}{(-1)}\,\underbrace{dx^0}\boxtimes\underbrace{dx^1}\boxtimes\cdot\cdot\,x^j\cdot\cdot\boxtimes\underbrace{dx^a}=\overbrace{1\underset{2}{+}v\overset{*}{v}}^{-a}\,\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}$$

$$x^0=\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}=\frac{2}{1+v\overset{*}{v}}-1\Longrightarrow d\,x^0=\frac{-4vd\overset{*}{v}}{\overbrace{1+v\overset{*}{v}}^{2}}$$

$$x^j=\frac{2v^j}{1+v\overset{*}{v}}:\quad 1\leqslant j\leqslant a\Longrightarrow\underbrace{dx^j}=\frac{2\,\underbrace{dv^j}}{1+v\overset{*}{v}}+2\,v^j\,d\frac{1}{1+v\overset{*}{v}}=\frac{2\,\underbrace{dv^j}}{1+v\overset{*}{v}}-\frac{4v^jvd\overset{*}{v}}{\overbrace{1+v\overset{*}{v}}^{2}}$$

$$\overbrace{1\underset{2}{+}v\overset{*}{v}}^{a}\;\underbrace{x^0\underbrace{dx^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dx^a}+\sum_{j}^{1|a}\overset{j}{(-1)}\underbrace{dx^0}\boxtimes\underbrace{dx^1}\boxtimes\cdot\cdot x^j\cdot\cdot\boxtimes\underbrace{dx^a}}=\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}\underbrace{dv^1-\frac{2v^1vd\overset{*}{v}}{1+v\overset{*}{v}}}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a-\frac{2v^avd\overset{*}{v}}{1+v\overset{*}{v}}}$$

$$-4\frac{vd\overset{*}{v}}{\overbrace{1+v\overset{*}{v}}^{2}}\boxtimes\sum_{j}^{1|a}\overset{j}{(-1)}\,\underbrace{dv^1-\frac{2v^1vd\overset{*}{v}}{1+v\overset{*}{v}}}\boxtimes\cdot\cdot\boxtimes\,v^j\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a-\frac{2v^avd\overset{*}{v}}{1+v\overset{*}{v}}}$$

$$=\left(\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}\right)^2\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}-4\frac{vd\overset{*}{v}}{\overbrace{1+v\overset{*}{v}}^{2}}\boxtimes\sum_{j}^{1|a}\overset{j}{(-1)}\,\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\,v^j\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}$$

$$=\left(\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}\right)^2\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}+\frac{4}{\overbrace{1+v\overset{*}{v}}^{2}}\sum_{j}^{1|a}\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{v^jvd\overset{*}{v}}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}$$

$$=\left(\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}\right)^2\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}+\frac{4}{\overbrace{1+v\overset{*}{v}}^{2}}\sum_{j}^{1|a}\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{v^jv^jdv^j}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}$$

$$=\underbrace{\left(\frac{1-v\overset{*}{v}}{1+v\overset{*}{v}}\right)^2+\frac{4}{\overbrace{1+v\overset{*}{v}}^{2}}\sum_{j}^{1|a}v^jv^j}_{=1}\underbrace{dv^1}\boxtimes\cdot\cdot\boxtimes\underbrace{dv^a}$$