PhysRevD.62.044034 equation (17)

```
from shared import *
import cdblib

jsonfile = 'eqtn17.json'
cdblib.create (jsonfile)

# ----------------------------------------------------------------------
defGammaBar := GammaBar^{a}_{b c} ->
               (1/2) gBar^{a e} (   \partial_{b}{gBar_{e c}}
                                  + \partial_{c}{gBar_{b e}}
                                  - \partial_{e}{gBar_{b c}}).

foo := \partial_{a}{gBar_{b c}} gBar^{i b} gBar^{j c} -> - \partial_{a}{gBar^{i j}}.
bah := \partial_{a}{gBar_{b c}} gBar^{b c} -> 0.   # follows from det gBar = 1

# ----------------------------------------------------------------------
# GiBar

GiBar := gBar^{j k} GammaBar^{i}_{j k}.            # cdb (eq17.101,GiBar)

substitute     (GiBar, defGammaBar)               # cdb (eq17.102,GiBar)
distribute     (GiBar)                            # cdb (eq17.103,GiBar)
GiBar = product_sort (GiBar)                      # cdb (eq17.104,GiBar)
rename_dummies (GiBar)                            # cdb (eq17.105,GiBar)
canonicalise   (GiBar)                            # cdb (eq17.106,GiBar)
substitute     (GiBar, foo)                       # cdb (eq17.107,GiBar)
substitute     (GiBar, bah)                       # cdb (eq17.108,GiBar)

defGiBar := GammaBar^{i} -> @(GiBar).

cdblib.put ('defGiBar',defGiBar,jsonfile)
```

$$\bar{g}^{jk}\bar{\Gamma}^{i}{}_{jk} = \frac{1}{2}\bar{g}^{jk}\bar{g}^{ie}\left(\partial_j\bar{g}_{ek} + \partial_k\bar{g}_{je} - \partial_e\bar{g}_{jk}\right) \tag{eq17.102}$$

$$= \frac{1}{2}\bar{g}^{jk}\bar{g}^{ie}\partial_j\bar{g}_{ek} + \frac{1}{2}\bar{g}^{jk}\bar{g}^{ie}\partial_k\bar{g}_{je} - \frac{1}{2}\bar{g}^{jk}\bar{g}^{ie}\partial_e\bar{g}_{jk} \tag{eq17.103}$$

$$= \frac{1}{2}\bar{g}^{ia}\bar{g}^{cb}\partial_c\bar{g}_{ab} + \frac{1}{2}\bar{g}^{ib}\bar{g}^{ac}\partial_c\bar{g}_{ab} - \frac{1}{2}\bar{g}^{ic}\bar{g}^{ab}\partial_c\bar{g}_{ab} \tag{eq17.104}$$

$$= \frac{1}{2}\bar{g}^{ib}\bar{g}^{ac}\partial_a\bar{g}_{bc} + \frac{1}{2}\bar{g}^{ib}\bar{g}^{ca}\partial_a\bar{g}_{cb} - \frac{1}{2}\bar{g}^{ia}\bar{g}^{bc}\partial_a\bar{g}_{bc} \tag{eq17.105}$$

$$= \bar{g}^{ia}\bar{g}^{bc}\partial_b\bar{g}_{ac} - \frac{1}{2}\bar{g}^{ia}\bar{g}^{bc}\partial_a\bar{g}_{bc} \tag{eq17.106}$$

$$= -\partial_b\bar{g}^{ib} - \frac{1}{2}\bar{g}^{ia}\bar{g}^{bc}\partial_a\bar{g}_{bc} \tag{eq17.107}$$

$$= -\partial_b\bar{g}^{ib} \tag{eq17.108}$$

```
# ----------------------------------------------------------------------------
# Check against prd62.

foo := @(GiBar).                                        # cdb(eq17.lcb,foo)
bah  = cdblib.get('prd62.eq17.rhs','prd62.json')        # cdb(eq17.prd,bah)

diff := @(foo) - @(bah).

distribute     (diff)
diff = product_sort (diff)
rename_dummies (diff)
map_sympy      (diff, "simplify")
canonicalise   (diff)                                   # cdb(eq17.chk,diff)
```

$$\texttt{eq17.lcb} := -\partial_b \bar{g}^{ib}$$

$$\texttt{eq17.prd} := -\partial_j \bar{g}^{ij}$$

$$\texttt{eq17.chk} := 0$$