

PhysRevD.62.044034 equation (17)

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1  from shared import *
2  import cdblib
3
4  jsonfile = 'eqtn17.json'
5  cdblib.create (jsonfile)
6
7  # -----
8  defGammaBar := GammaBar^{a}_{b c} ->
9              (1/2) gBar^{a e} ( \partial_{b}{gBar_{e c}}
10                             + \partial_{c}{gBar_{b e}}
11                             - \partial_{e}{gBar_{b c}}).
12
13  foo := \partial_{a}{gBar_{b c}} gBar^{i b} gBar^{j c} -> - \partial_{a}{gBar^{i j}}.
14  bah := \partial_{a}{gBar_{b c}} gBar^{b c} -> 0.    # follows from det gBar = 1
15
16  # -----
17  # GiBar
18
19  GiBar := gBar^{j k} GammaBar^{i}_{j k}.          # cdb (eq17.101,GiBar)
20
21  substitute      (GiBar, defGammaBar)             # cdb (eq17.102,GiBar)
22  distribute      (GiBar)                          # cdb (eq17.103,GiBar)
23  GiBar = product_sort (GiBar)                     # cdb (eq17.104,GiBar)
24  rename_dummies  (GiBar)                          # cdb (eq17.105,GiBar)
25  canonicalise    (GiBar)                          # cdb (eq17.106,GiBar)
26  substitute      (GiBar, foo)                     # cdb (eq17.107,GiBar)
27  substitute      (GiBar, bah)                     # cdb (eq17.108,GiBar)
28
29  defGiBar := GammaBar^{i} -> @(GiBar).
30
31  cdblib.put ('defGiBar',defGiBar,jsonfile)

```

$$\bar{g}^{jk}\bar{\Gamma}^i_{jk} = \frac{1}{2}\bar{g}^{jk}\bar{g}^{ie}(\partial_j\bar{g}_{ek} + \partial_k\bar{g}_{je} - \partial_e\bar{g}_{jk}) \quad (\text{eq17.102})$$

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

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

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

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

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

$$= -\partial_b\bar{g}^{ib} \quad (\text{eq17.108})$$

```

1  # -----
2  # Check against prd62.
3
4  foo := @(GiBar).                # cdb(eq17.lcb,foo)
5  bah  = cdblib.get('prd62.eq17.rhs','prd62.json')  # cdb(eq17.prd,bah)
6
7  diff := @(foo) - @(bah).
8
9  distribute      (diff)
10 diff = product_sort (diff)
11 rename_dummies (diff)
12 map_sympy      (diff, "simplify")
13 canonicalise   (diff)          # cdb(eq17.chk,diff)

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

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

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