

PhysRevD.62.044034 equation (19)

```
1  from shared import *
2  import cdblib
3
4  jsonfile = 'eqtn19.json'
5  cdblib.create (jsonfile)
6
7  defGiBar = cdblib.get ('defGiBar','eqtn17.json')
8
9  # -----
10 # DGiBarDt pt.1
11
12 dotgBar_{a b}::Symmetric.
13 dotgBar^{a b}::Symmetric.
14 dotgBar{#}::LaTeXForm("{\bar{dg}}").
15
16 dotGiBar := \partial_{t}{GammaBar^{i}}.          # cdb (eq19.101,dotGiBar)
17
18 substitute (dotGiBar, defGiBar)                # cdb (eq19.102,dotGiBar)
19 substitute (dotGiBar, $\partial_{t a}{gBar^{i a}} \rightarrow \partial_{a}{dotgBar^{i a}}$)
20                                                    # cdb (eq19.103,dotGiBar)
21
22 defdotgBarD := dotgBar_{i j} -> -2 N ABar_{i j}.
23 defdotgBarU := dotgBar^{i j} -> 2 N ABar^{i j}.
24 # defABarD2ABarU := ABar_{i j} -> ABar^{a b} gBar_{a i} gBar_{b j}.
25
26 substitute (dotGiBar, defdotgBarU )             # cdb (eq19.104,dotGiBar)
27 product_rule (dotGiBar)                        # cdb (eq19.105,dotGiBar)
28
29 dotGiBar = product_sort (dotGiBar)              # cdb (eq19.106,dotGiBar)
30
31 cdblib.put ('dotGiBar',dotGiBar,jsonfile)
```

$$\partial_t \bar{\Gamma}^i = -\partial_{tb} \bar{g}^{ib} \tag{eq19.102}$$

$$= -\partial_b \bar{d} g^{ib} \tag{eq19.103}$$

$$= -2\partial_b (N \bar{A}^{ib}) \tag{eq19.104}$$

$$= -2\partial_b N \bar{A}^{ib} - 2N \partial_b \bar{A}^{ib} \tag{eq19.105}$$

$$= -2\bar{A}^{ia} \partial_a N - 2N \partial_a \bar{A}^{ia} \tag{eq19.106}$$

```

1  # -----
2  # Check against prd62.
3
4  foo := @(dotGiBar).                # cdb (eq19.lcb,foo)
5  bah  = cdblib.get('prd62.eq19.rhs','prd62.json')  # cdb (eq19.prd,bah)
6
7  diff := @(foo) - @(bah).
8
9  distribute      (diff)
10 product_rule    (diff)
11 diff = product_sort (diff)
12 rename_dummies (diff)
13 map_sympy       (diff, "simplify")
14 canonicalise    (diff)              # cdb (eq19.chk,diff)

```

$$\text{eq19.lcb} := -2\bar{A}^{ia}\partial_a N - 2N\partial_a \bar{A}^{ia}$$

$$\text{eq19.prd} := -2\partial_j (N\bar{A}^{ij})$$

$$\text{eq19.chk} := 0$$