

## PhysRevD.62.044034 equation (20)

```
1  from shared import *
2  import cdblib
3
4  jsonfile = 'eqtn20.json'
5  cdblib.create (jsonfile)
6
7  dotGiBar = cdblib.get ('dotGiBar','eqtn19.json')
8  defMomSub = cdblib.get ('defMomSub','momentum.json')
9
10 # -----
11 # DGiBarDt pt.2
12
13 substitute (dotGiBar, defMomSub)      # cdb(eq20.101,dotGiBar)
```

$$\partial_t \bar{\Gamma}^i = -2\bar{A}^{ia} \partial_a N - 2N \partial_a \bar{A}^{ia} \quad (\text{eq19.106})$$

$$= -2\bar{A}^{ia} \partial_a N - 2N \left( -6\bar{A}^{ia} \partial_a \phi - \bar{A}^{ab} \bar{\Gamma}^i_{ab} + \frac{2}{3} \bar{g}^{ia} \partial_a \text{tr} K \right) \quad (\text{eq20.101})$$

```

1  # -----
2  # Check against prd62.
3
4  foo := @(dotGiBar).                # cdb (eq20.lcb,foo)
5  bah  = cdblib.get('prd62.eq20.rhs','prd62.json')  # cdb (eq20.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 (eq20.chk,diff)

```

$$\text{eq20.lcb} := -2\bar{A}^{ia}\partial_a N - 2N \left( -6\bar{A}^{ia}\partial_a \phi - \bar{A}^{ab}\bar{\Gamma}^i_{ab} + \frac{2}{3}\bar{g}^{ia}\partial_a \text{tr} K \right)$$

$$\text{eq20.prd} := -2\bar{A}^{ij}\partial_j N + 2N \left( \bar{\Gamma}^i_{jk}\bar{A}^{kj} - \frac{2}{3}\bar{g}^{ij}\partial_j \text{tr} K + 6\bar{A}^{ij}\partial_j \phi \right)$$

$$\text{eq20.chk} := 0$$