

## PhysRevD.62.044034 equation (10)

```
1  from shared import *
2  import cdblib
3
4  jsonfile = 'eqtn10.json'
5  cdblib.create (jsonfile)
6
7  DgijDt = cdblib.get ('adm.DgijDt','adm.json')
8  DdetgDt = cdblib.get ('adm.DdetgDt','adm.json')
9
10 # -----
11
12 phi := \phi -> (1/12) \log(detg).
13 gdotK := g^{i j} K_{i j} -> trK.
14
15 # -----
16 # d\phi/dt
17
18 dotphi := \partial_{t}\{\phi\}.      # cdb (eq10.101,dotphi)
19
20 substitute (dotphi, phi)          # cdb (eq10.102,dotphi)
21 substitute (dotphi, dlog)         # cdb (eq10.103,dotphi)
22 substitute (dotphi, DdetgDt)      # cdb (eq10.104,dotphi)
23 substitute (dotphi, DgijDt)       # cdb (eq10.105,dotphi)
24 substitute (dotphi, gdotK)        # cdb (eq10.106,dotphi)
25 map_sympy (dotphi, "simplify")    # cdb (eq10.107,dotphi)
26
27 DphiDt := \partial_{t}\{\phi\} -> @(dotphi).
28
29 cdblib.put ('DphiDt',DphiDt,jsonfile)
```

$$\partial_t \phi = \frac{1}{12} \partial_t (\log (g)) \tag{eq10.102}$$

$$= \frac{1}{12} g^{-1} \partial_t g \tag{eq10.103}$$

$$= \frac{1}{12} g^{-1} g g^{ij} \partial_t g_{ij} \tag{eq10.104}$$

$$= -\frac{1}{6} g^{-1} g g^{ij} N K_{ij} \tag{eq10.105}$$

$$= -\frac{1}{6} g^{-1} g \text{tr} K N \tag{eq10.106}$$

$$= -\frac{1}{6} \text{tr} K N \tag{eq10.107}$$

```

1  # -----
2  # Check against prd62.
3
4  foo := @(dotphi).          # cdb(eq10.lcb,foo)
5  bah  = cdblib.get('prd62.eq10.rhs','prd62.json') # cdb(eq10.prd,bah)
6
7  diff := @(foo) - @(bah).
8
9  diff = product_sort (diff)
10 rename_dummies (diff)
11 canonicalise   (diff)      # cdb(eq10.chk,diff)

```

$$\text{eq10.lcb} := -\frac{1}{6}\text{tr}KN$$

$$\text{eq10.prd} := -\frac{1}{6}N\text{tr}K$$

$$\text{eq10.chk} := 0$$