PhysRevD.62.044034

```
1    from shared import *
2    import cdblib
3
4    jsonfile = 'prd62.json'
5    cdblib.create (jsonfile)
6
7    # ------------------------------------------------------------------------------
8    # eqn 09
9    lhs := \partial_{t}{gBar_{i j}}.                              # cdb(prd62.eq09.lhs,lhs)
10   rhs := -2 N ABar_{i j}.                                      # cdb(prd62.eq09.rhs,rhs)
11
12   cdblib.put ('prd62.eq09.lhs',lhs,jsonfile)
13   cdblib.put ('prd62.eq09.rhs',rhs,jsonfile)
14
15   # ------------------------------------------------------------------------------
16   # eqn 10
17   lhs := \partial_{t}{\phi}.                                   # cdb(prd62.eq10.lhs,lhs)
18   rhs := -(1/6) N trK.                                         # cdb(prd62.eq10.rhs,rhs)
19
20   cdblib.put ('prd62.eq10.lhs',lhs,jsonfile)
21   cdblib.put ('prd62.eq10.rhs',rhs,jsonfile)
22
23   # ------------------------------------------------------------------------------
24   # eqn 11
25   lhs := \partial_{t}{K}.                                      # cdb(prd62.eq11.lhs,lhs)
26   rhs := - g^{i j} D_{i j}{N}
27         + N (ABar_{i j} ABar^{i j} + (1/3) trK**2).           # cdb(prd62.eq11.rhs,rhs)
28
29   cdblib.put ('prd62.eq11.lhs',lhs,jsonfile)
30   cdblib.put ('prd62.eq11.rhs',rhs,jsonfile)
31
32   # ------------------------------------------------------------------------------
33   # eqn 12
34   lhs := \partial_{t}{ABar_{i j}}.                             # cdb(prd62.eq12.lhs,lhs)
35   rhs := N (trK ABar_{i j} - 2 ABar_{i a} ABar^{a}_{j})
36         + \exp(-4\phi) (N R_{i j} - D_{i j}{N}
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            - (1/3) g_{i j} (N R_{a b} - D_{a b}{N}) g^{a b}).     # cdb(prd62.eq12.rhs,rhs)

    cdblib.put ('prd62.eq12.lhs',lhs,jsonfile)
    cdblib.put ('prd62.eq12.rhs',rhs,jsonfile)


    # ---------------------------------------------------------------------------------
    # eqn 15
    lhs := R^{\phi}_{i j}.                                           # cdb(prd62.eq15.lhs,lhs)
    rhs := - 2 DBar_{a b}{\phi}
           - 2 gBar_{a b} gBar^{c d} DBar_{c d}{\phi}
           + 4 DBar_{a}{\phi} DBar_{b}{\phi}
           - 4 gBar_{a b} gBar^{c d} DBar_{c}{\phi} DBar_{d}{\phi}.
                                                                     # cdb(prd62.eq15.rhs,rhs)

    cdblib.put ('prd62.eq15.lhs',lhs,jsonfile)
    cdblib.put ('prd62.eq15.rhs',rhs,jsonfile)


    # ---------------------------------------------------------------------------------
    # eqn 17
    lhs := GammaBar^{i}.                                             # cdb(prd62.eq17.lhs,lhs)
    rhs := - \partial_{j}{gBar^{i j}}.                              # cdb(prd62.eq17.rhs,rhs)

    cdblib.put ('prd62.eq17.lhs',lhs,jsonfile)
    cdblib.put ('prd62.eq17.rhs',rhs,jsonfile)


    # ---------------------------------------------------------------------------------
    # eqn 18
    lhs := RBar_{i j}.                                               # cdb(prd62.eq18.lhs,lhs)
    rhs := - (1/2) gBar^{l m} \partial_{l m}{gBar_{a b}}
           + (1/2) gBar_{k a} \partial_{b}{GammaBar^{k}}
           + (1/2) gBar_{k b} \partial_{a}{GammaBar^{k}}
           + (1/2) GammaBar^{k} GammaBar_{a b k}
           + (1/2) GammaBar^{k} GammaBar_{b a k}
           + gBar^{l m} gBar^{k e} (  GammaBar_{e l a} GammaBar_{b k m}
                                    + GammaBar_{e l b} GammaBar_{a k m}
                                    + GammaBar_{k a m} GammaBar_{e l b}).     # cdb(prd62.eq18.rhs,rhs)

    cdblib.put ('prd62.eq18.lhs',lhs,jsonfile)
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75    cdblib.put ('prd62.eq18.rhs',rhs,jsonfile)

76

77    # ---------------------------------------------------------------------------------
78    # eqn 19
79    lhs := \partial_{t}{GammaBar^{i}}.                                    # cdb(prd62.eq19.lhs,lhs)
80    rhs := - \partial_{j}{2 N ABar^{i j}}.                               # cdb(prd62.eq19.rhs,rhs)

81

82    cdblib.put ('prd62.eq19.lhs',lhs,jsonfile)
83    cdblib.put ('prd62.eq19.rhs',rhs,jsonfile)

84

85    # ---------------------------------------------------------------------------------
86    # eqn 20
87    lhs := \partial_{t}{GammaBar^{i}}.                                    # cdb(prd62.eq20.lhs,lhs)
88    rhs := - 2 ABar^{i j} \partial_{j}{N}
89          + 2 N (  GammaBar^{i}_{j k} ABar^{k j}
90                - (2/3) gBar^{i j} \partial_{j}{trK}
91                + 6 ABar^{i j} \partial_{j}{\phi}).                      # cdb(prd62.eq20.rhs,rhs)

92

93    cdblib.put ('prd62.eq20.lhs',lhs,jsonfile)
94    cdblib.put ('prd62.eq20.rhs',rhs,jsonfile)
```

$$\partial_t \bar{g}_{ij} = -2N\bar{A}_{ij} \tag{prd62.eq09.rhs}$$

$$\partial_t \phi = -\frac{1}{6}N\mathrm{tr}K \tag{prd62.eq10.rhs}$$

$$\partial_t K = -g^{ij}D_{ij}N + N\left(\bar{A}_{ij}\bar{A}^{ij} + \frac{1}{3}\mathrm{tr}K^2\right) \tag{prd62.eq11.rhs}$$

$$\partial_t \bar{A}_{ij} = N\left(\mathrm{tr}K\bar{A}_{ij} - 2\bar{A}_{ia}\bar{A}^a{}_j\right) + \exp(-4\phi)\left(NR_{ij} - D_{ij}N - \frac{1}{3}g_{ij}\left(NR_{ab} - D_{ab}N\right)g^{ab}\right) \tag{prd62.eq12.rhs}$$

$$\bar{\Gamma}^i = -\partial_j \bar{g}^{ij} \tag{prd62.eq17.rhs}$$

$$\partial_t \bar{\Gamma}^i = -2\partial_j\left(N\bar{A}^{ij}\right) \tag{prd62.eq19.rhs}$$

$$= -2\bar{A}^{ij}\partial_j N + 2N\left(\bar{\Gamma}^i{}_{jk}\bar{A}^{kj} - \frac{2}{3}\bar{g}^{ij}\partial_j\mathrm{tr}K + 6\bar{A}^{ij}\partial_j\phi\right) \tag{prd62.eq20.rhs}$$

$$R^\phi{}_{ij} = -2\bar{D}_{ab}\phi - 2\bar{g}_{ab}\bar{g}^{cd}\bar{D}_{cd}\phi + 4\bar{D}_a\phi\bar{D}_b\phi - 4\bar{g}_{ab}\bar{g}^{cd}\bar{D}_c\phi\bar{D}_d\phi \tag{prd62.eq15.rhs}$$

$$\bar{R}_{ij} = -\frac{1}{2}\bar{g}^{lm}\partial_{lm}\bar{g}_{ab} + \frac{1}{2}\bar{g}_{ka}\partial_b\bar{\Gamma}^k + \frac{1}{2}\bar{g}_{kb}\partial_a\bar{\Gamma}^k + \frac{1}{2}\bar{\Gamma}^k\bar{\Gamma}_{abk} + \frac{1}{2}\bar{\Gamma}^k\bar{\Gamma}_{bak} + \bar{g}^{lm}\bar{g}^{ke}\left(\bar{\Gamma}_{ela}\bar{\Gamma}_{bkm} + \bar{\Gamma}_{elb}\bar{\Gamma}_{akm} + \bar{\Gamma}_{kam}\bar{\Gamma}_{elb}\right) \tag{prd62.eq18.rhs}$$