

## Basic ADM equations, see PhysRevD.62.044034

```
1  from shared import *
2  import cdblib
3
4  jsonfile = 'adm.json'
5  cdblib.create (jsonfile)
6
7  # -----
8  # prd62 eqn 01
9  lhs := \partial_{t}{g_{i j}}. # cdb(adm.DgijDt.lhs,lhs)
10 rhs := -2 N K_{i j}. # cdb(adm.DgijDt.rhs,rhs)
11 DgijDt := @(lhs) -> @(rhs). # cdb(adm.DgijDt,DgijDt)
12
13 cdblib.put ('adm.DgijDt.lhs',lhs,jsonfile)
14 cdblib.put ('adm.DgijDt.rhs',rhs,jsonfile)
15 cdblib.put ('adm.DgijDt',DgijDt,jsonfile)
16
17 # -----
18 # raised indices of prd62 eqn 01
19 lhs := \partial_{t}{g^{i j}}. # cdb(adm.DhijDt.lhs,lhs)
20 rhs := 2 N K^{i j}. # cdb(adm.DhijDt.rhs,rhs)
21 DhijDt := @(lhs) -> @(rhs). # cdb(adm.DhijDt,DhijDt)
22
23 cdblib.put ('adm.DhijDt.lhs',lhs,jsonfile)
24 cdblib.put ('adm.DhijDt.rhs',rhs,jsonfile)
25 cdblib.put ('adm.DhijDt',DhijDt,jsonfile)
26
27 # -----
28 # prd62 eqn 02
29 lhs := \partial_{t}{K_{i j}}. # cdb(adm.DKijDt.lhs,lhs)
30 rhs := - D_{i j}{N} + N (R_{i j}
31         + trK K_{i j} - 2 K_{i c} K_{j d} g^{c d}). # cdb(adm.DKijDt.rhs,rhs)
32 DKijDt := @(lhs) -> @(rhs). # cdb(adm.DKijDt,DKijDt)
33
34 cdblib.put ('adm.DKijDt.lhs',lhs,jsonfile)
35 cdblib.put ('adm.DKijDt.rhs',rhs,jsonfile)
36 cdblib.put ('adm.DKijDt',DKijDt,jsonfile)
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37
38 # -----
39 # miscellaneous
40
41 lhs := \partial_{t}{detg}.                                # cdb(adm.DdetgDt.lhs, lhs)
42 rhs := detg g^{i j} \partial_{t}{g_{i j}}.                # cdb(adm.DdetgDt.rhs, rhs)
43 DdetgDt := @(lhs) -> @(rhs).                             # cdb(adm.DdetgDt, DdetgDt)
44
45 cdblib.put ('adm.DdetgDt.lhs', lhs, jsonfile)
46 cdblib.put ('adm.DdetgDt.rhs', rhs, jsonfile)
47 cdblib.put ('adm.DdetgDt', DdetgDt, jsonfile)

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$$\partial_t g_{ij} \rightarrow -2N K_{ij} \quad (\text{adm.DgijDt})$$

$$\partial_t g^{ij} \rightarrow 2N K^{ij} \quad (\text{adm.Dhi jDt})$$

$$\partial_t K_{ij} \rightarrow -D_{ij}N + N \left( R_{ij} + \text{tr}K K_{ij} - 2K_{ic}K_{jd}g^{cd} \right) \quad (\text{adm.DKi jDt})$$

$$\partial_t g \rightarrow g g^{ij} \partial_t g_{ij} \quad (\text{adm.DdetgDt})$$