Demonstration 2 (rnds1): Automatic generation of an NPtetrad and calculation of the Petrov type, and Ricci scalars.

> restart:
> grtw();

**GRTensorII Version 1.79 (R6)**

2 February 2001

*Developed by Peter Musgrave, Denis Pollney and Kayll Lake*

*Copyright 1994-2001 by the authors.*

*Latest version available from: http://grtensor.phy.queensu.ca/

*e:/Grtii(6)/Metrics*

> qload(rnds);

```
====
Default spacetime = rnds
For the rnds spacetime:
Coordinates
 x(up)
 x^d = [r, θ, φ, t]
Line element
 ds^2 = \frac{dr^2}{1 - \frac{2m}{r} - \frac{1}{3}Λ r^2 + \frac{e^2}{r^2}} + r^2 dθ^2 + r^2 \sin(θ)^2 dφ^2 + \left(-1 + \frac{2m}{r} + \frac{1}{3}Λ r^2 - \frac{e^2}{r^2}\right) dt^2
```

*The Reissner-Nordstrom-de Sitter metric*

> nptetrad([r,t]);

The metric signature of the rnds spacetime is +2.
In order to create an NP-tetrad, the signature of g(dn,dn) will be changed to -2.
Continue? (1=yes [default], other=no) :

```
nptetrad> 1;
```

1

> grcalc(Petrov);

```
'Basis/tetrad related object definitions'
'Last modified 23 January 2001'
Created a definition for e(bdn,dn,pdn)
```

CPU Time = .451

> grdisplay(_);

```
For the rnds spacetime:

Petrov Type
Petrov Type = D (or simpler)
```

> PetrovReport();

```
The conclusion 'Petrov type = D (or simpler)'
for the rnds metric
was based on the following results:
```
Weyl scalar $\Psi_0 = 0$
Weyl scalar $\Psi_1 = 0$
Weyl scalar $\Psi_2$ could not be evaluated to zero.
Weyl scalar $\Psi_3 = 0$
Weyl scalar $\Psi_4 = 0$

--- > Therefore the metric is Petrov D (or simpler).

The quantities that could not be evaluated to zero are:
\[
Weyl \text{ scalar } \Psi_2 = \frac{-m \, r + e^2}{r^4}
\]

\[
> \text{grcalc(RicciSc);}
\]

\[
CPU \text{ Time} = .020
\]

\[
> \text{grdisplay(_);}
\]

For the rnds spacetime:
\[
\text{Ricci Scalar, Phi00} \quad \Phi_{00} = 0
\]
\[
\text{Ricci Scalar, Phi01} \quad \Phi_{01} = 0
\]
\[
\text{Ricci Scalar, Phi02} \quad \Phi_{02} = 0
\]
\[
\text{Ricci Scalar, Phi11} \quad \Phi_{11} = \frac{1}{2} \frac{e^2}{r^4}
\]
\[
\text{Ricci Scalar, Phi12} \quad \Phi_{12} = 0
\]
\[
\text{Ricci Scalar, Phi22} \quad \Phi_{22} = 0
\]

\[
NPLambda := \text{Ricci Scalar/24}
\]

\[
NPLambda = \frac{1}{6} \Lambda
\]