Demonstration 1 (bondi): The Bondi metric.

```
> restart;
```

```
> grtw();
```

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

e:/Grtii(6)/Metrics

```
> grOptionDisplayLimit:=9000;
```

grOptionDisplayLimit := 9000

```
> qload(bondig1);
```

Default spacetime = bondig1

For the bondig1 spacetime:

Coordinates

x(*up*)

$$x^{a} = [u, r, \theta, \phi]$$

Line element

$$ds^2 = \left(-\frac{v(u,r,\theta)\, e^{(2\,b(u,r,\theta))}}{r} + w(u,r,\theta)^2 r^2 e^{(2\,y(u,r,\theta))} \right) du^2 - 2\, e^{(2\,b(u,r,\theta))}\, du\, dr$$
$$- 2\, w(u,r,\theta)\, r^2 e^{(2\,y(u,r,\theta))}\, du\, d\theta + r^2 e^{(2\,y(u,r,\theta))}\, d\theta^2 + r^2 \sin(\theta)^2 e^{(-2\,y(u,r,\theta))}\, d\phi^2$$

The Bondi Metric

```
> grcalcalter(detg,g(up,up),R(dn,dn,dn,dn),R(dn,dn),Ricciscalar,G(dn
  ,dn),expand);
Simplification will be applied during calculation.

Applying routine expand to object detg
Applying routine expand to object g(up,up)
Applying routine expand to object g(dn,dn,pdn)
Applying routine expand to object Chr(dn,dn,dn)
Applying routine expand to object R(dn,dn,dn,dn)
Applying routine expand to object Chr(dn,dn,up)
Applying routine expand to object R(dn,dn)
Applying routine expand to object tRicciscalar
Applying routine expand to object G(dn,dn)
```

CPU Time = .141

```
> grmap(_,autoAlias,`x`);
Applying routine autoAlias to detg
Applying routine autoAlias to g(up,up)
Applying routine autoAlias to R(dn,dn,dn,dn)
Warning, alias or macro v[r] defined in terms of v

Warning, alias or macro b[r] defined in terms of b
```

```
Warning, alias or macro w[r] defined in terms of w

Warning, alias or macro y[r] defined in terms of y

Applying routine autoAlias to R(dn,dn)
Applying routine autoAlias to Ricciscalar
Applying routine autoAlias to G(dn,dn)
```

To display the rather long output do grdisplay(_);

```
grdisplay(_);
```