













12



20







$R_{nl}(\tau)$

τ









$$\frac{d^2 R_{nl}(r)}{dr^2}$$





1

sinθ

5

59



$$\partial Y_m(\hat{\mathbf{r}})$$

$$\partial \theta$$



1



$\sin^2 \theta$

$$\frac{\partial^2 Y_{lm}(\hat{\mathbf{r}})}{\partial \phi^2}$$



1

2





$$\frac{l(l+1)}{r^2}$$













$$\frac{R_{nl}^2(r)}{4\pi r^2}$$





20



20

1



$r \sin \theta$





22



22

1



$r^2 \sin \theta$





1



$r^2 \sin^2 \theta$

$$\partial^2 \psi$$



$$\partial \phi^2$$























2021

$$R_{nlj}^2(r) + S_{nlj}^2(r)$$

$$4\pi r^2$$











$$a^2$$



$$4M(r)$$

$$dV(r)$$

$$dr$$



$$dP_{nl}(r)$$

$$dr$$



02



4



$df(r)$  dr

$$df(x)$$



$$dx$$

$$d^2 f(r)$$

$$dr^2$$



$$d^2 f(x)$$

$$dx^2$$





$$\frac{d^2 R_{nl}(x)}{dx^2}$$

$$dR_{nl}(x)$$

$$dx$$







$$\ell \sqrt{\ell^2 - a^2 z^2} + (\ell + 1) \sqrt{(\ell + 1)^2 - a^2 z^2}$$

$$2\ell + 1$$

$$\sqrt{\frac{l(l+1)}{r^2} + (V(r) - \epsilon)}$$

$$dR_{nl}(r_t^+)$$

$$dr$$

$$dR_{nl}(r_t^-)$$

$$dr$$

$$d^2 \tilde{R}_{nl}(r)$$

$$dr^2$$

A



$R_n(r_t)$



$$d^n R_{\text{PDS}}(r_c)$$

$$d^n r$$

$$d^n R(r_c)$$

$$dr^n$$

$$R(r_c)$$

$$r_c^{\ell+1}$$

$$dR_{ps}(r)$$

$$dr$$



$$dR(r_c)$$

$$dr$$

1



$R_{ps}(r_c)$

1

+

1

τ_c

$$d^2 R_{ps}(r)$$

$$d^2 r$$











$$2(l+1)$$

$$r$$



$$d^2 R_{ps}(r)$$

$$dr^2$$



2m



12







1

+

1

r_c^2

1

+

1

r_3
c







1



$R_{ps}(r)$





















