/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 1

```
!simdata ana : atentie, aici,
      !%%%%%%%%%%%%%%%%%%%%%%%%%
      ! The `halofit' code model
      ! cosmological power spect
      ! this is done are present
      !
      ! The code `halofit' was w
      ! See http://www.astro.upe
      !
      ! Subsequent updates as be
      ! Only tested for basic mo

      ! Adapted for F90 and CAMB
      !!BR09 Oct 09: generalized

      ! RT12 Oct: update some fi
      !            the power spec

      !!JD 08/13: generalized ex
      !            w_0 and w_a
      ! SPB14 Feb: update the fi
      !            modifications
      ! AL Sept 14: added halofi
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1

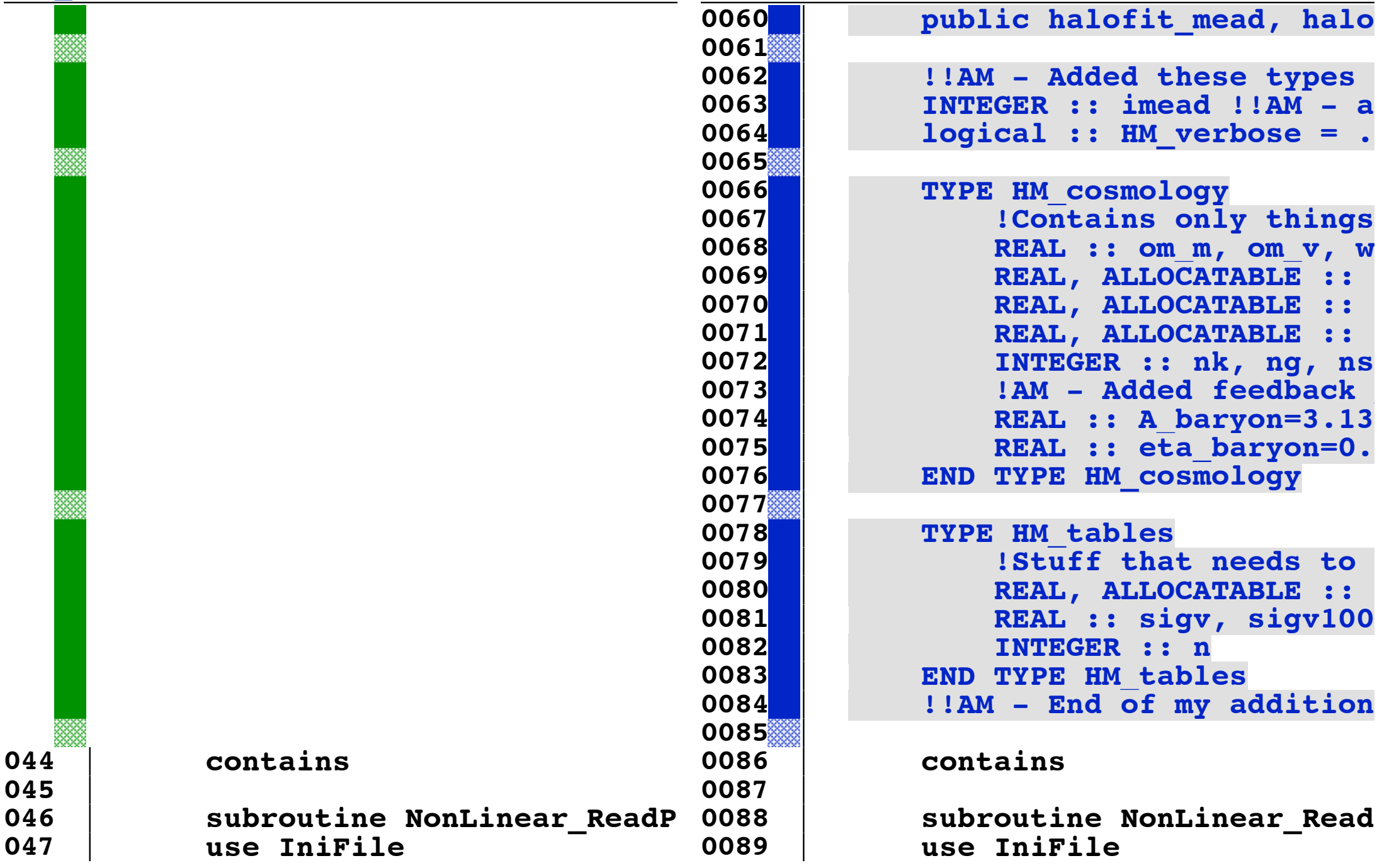
```
      !%%%%%%%%%%%%%%%%%%%%%%%%%
      ! The `halofit' code mode
      ! cosmological power spec
      ! this is done are presen
      !
      ! The code `halofit' was 
      ! See http://www.astro.up
      !
      ! Subsequent updates as b
      ! Only tested for basic m
      ! References for variant 
      !   halofit_original: ast
      !   halofit_peacock: http
      !   halofit_bird: arXiv: 
      !   halofit_takahashi: ar
      !   halofit_mead: arXiv:1
      !   halofit_casarini: arX

      ! Adapted for F90 and CAM
      !!BR09 Oct 09: generalize

      ! RT12 Oct: update some f
      !            the power spe

      !!JD 08/13: generalized e
      !            w_0 and w_a
      ! SPB14 Feb: update the f
      !            modifications
      ! AL Sept 14: added halof
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 24

```
024 |       !   separate halofit.f90 i
025 |       ! Jan 15: Suggested change
026 |
027 |       !%%%%%%%%%%%%%%%%%%%%%%%%%
028 |
029 |       module NonLinear
030 |       use ModelParams
031 |       use transfer
032 |       use LambdaGeneral
033 |       implicit none
034 |       private
035 |
036 |       real, parameter :: Min_kh_
037 |       real(dl):: om_m,om_v,fnu,o
038 |
039 |       integer, parameter :: halo
    |
040 |       integer, parameter :: halo
041 |       integer :: halofit_version
042 |       public Min_kh_nonlinear,No
043 |       public halofit_version,hal
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 30

```
0030 |       !   separate halofit.f90
0031 |       ! Jan 15: Suggested chang
0032 |       !AM Mar 16: Added in HMco
0033 |       !AM May 16: Fixed some sm
0034 |       !AL Jun16: put in partial
0035 |       !AM Sep 16: Attempted fix
0036 |       !LC Oct 16: extended Halo
0037 |       !AM May 17: Made the bary
0038 |       !AL Jul 17: fixed undefin
0039 |       !AM Jul 17: sped-up HMcod
0040 |
0041 |
0042 |       !%%%%%%%%%%%%%%%%%%%%%%%%%
0043 |
0044 |       module NonLinear
0045 |       use ModelParams
0046 |       use transfer
0047 |       use LambdaGeneral
0048 |       implicit none
0049 |       private
0050 |
0051 |       real, parameter :: Min_kh
0052 |       real(dl):: om_m,om_v,fnu,
0053 |
0054 |       integer, parameter :: hal
0055 |       integer, parameter :: hal
0056 |       integer, parameter :: hal
0057 |       integer :: halofit_versio
0058 |       public Min_kh_nonlinear,
0059 |       public halofit_version, h
```


/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 44
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 60
public halofit_mead, halo
!!AM - Added these types
INTEGER :: imead !!AM - a
logical :: HM_verbose = .
TYPE HM_cosmology
!Contains only things
REAL :: om_m, om_v, w
REAL, ALLOCATABLE ::
REAL, ALLOCATABLE ::
REAL, ALLOCATABLE ::
INTEGER :: nk, ng, ns
!AM - Added feedback
REAL :: A_baryon=3.13
REAL :: eta_baryon=0.
END TYPE HM_cosmology
TYPE HM_tables
!Stuff that needs to
REAL, ALLOCATABLE ::
REAL :: sigv, sigv100
INTEGER :: n
END TYPE HM_tables
!!AM - End of my addition
contains
subroutine NonLinear_ReadP
use IniFile
contains
subroutine NonLinear_Read
use IniFile

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 48

```
048         Type(TIniFile) :: Ini
049
050         halofit_version = Ini_Read
051
052         end subroutine NonLinear_R
053
054         subroutine NonLinear_GetNo
055         !Fill the CAMB_Pk%nonlin_s
056         !for each redshift and wav
057         !This implementation uses
058         type(MatterPowerData) :: C
059         integer itf
060         real(dl) a,plin,pq,ph,pnl,
061         real(dl) sig,rknl,rneff,rn
062         real(dl) diff,xlogr1,xlogr
063         integer i
064
065         !!BR09 putting neutrinos i
066         omm0 = CP%omegac+CP%omegab
067         fnu = CP%omegan/omm0
068
069         CAMB_Pk%nonlin_ratio = 1
070
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 90

```
0090         Type(TIniFile) :: Ini
0091
0092         halofit_version = Ini_Rea
0093
0094         end subroutine NonLinear_
0095
0096         subroutine NonLinear_GetN
0097         !Fill the CAMB_Pk%nonlin_
0098         !for each redshift and wa
0099         !This implementation uses
0100         type(MatterPowerData) ::
0101         integer itf
0102         real(dl) a,plin,pq,ph,pnl
0103         real(dl) sig,rknl,rneff,r
0104         real(dl) diff,xlogr1,xlog
0105         integer i
0106
0107         IF(halofit_version==halof
0108
0109             !AM - Call HMcode her
0110             CALL HMcode(CAMB_Pk)
0111
0112         ELSE
0113
0114             !!BR09 putting neutri
0115             omm0 = CP%omegac+CP%o
0116             fnu = CP%omegan/omm0
0117
0118             CAMB_Pk%nonlin_ratio
0119
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 71

```
071        do itf = 1, CAMB_Pk%num_z
072
073
074           ! calculate nonlinear
075           ! curvature (rncur) of
076           ! described in Smith e
077           a = 1/real(1+CAMB_Pk%R
078
079     !SimDataReplace
080     !          om_m = omega_m(a, omm
081     !          om_v = omega_v(a, omm
082
083           om_m = omega_m(a, omm0,
084           om_v = omega_v(a, omm0,
085     !#SimDataReplace
086
087           acur = a
088           xlogr1=-2.0
089           xlogr2=3.5
090           do
091               rmid=(xlogr2+xlogr
092               rmid=10**rmid
093               call wint(CAMB_Pk,
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 120

```
0120        do itf = 1, CAMB_Pk%n
0121
0122              w_hf=w_lam
0123              wa_hf=wa_ppf
0124              if (halofit_versi
0125                  ! calculate e
0126                  ! [Casarini+
0127                  call PKequal(
0128              endif
0129
0130              ! calculate nonli
0131              ! curvature (rncu
0132              ! described in Sm
0133              a = 1/real(1+CAMB
0134              om_m = omega_m(a,
0135              om_v = omega_v(a,
0136              acur = a
0137              xlogr1=-2.0
0138              xlogr2=3.5
0139              do
0140                  rmid=(xlogr2+
0141                  rmid=10**rmid
0142                  call wint(CAM
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 94

```
094            diff=sig-1.0
095            if (abs(diff).le.0
096                rknl=1./rmid
097                rneff=-3-d1
098                rncur=-d2
099                exit
100            elseif (diff.gt.0.
101                xlogr1=log10(r
102            elseif (diff.lt.-0
103                xlogr2=log10(r
104            endif
105            if (xlogr2 < -1.99
106                !is still line
107                goto 101
108            else if (xlogr2>3.
109                ! Totally craz
110                global_error_f
111                write(*,*) 'Er
112                goto 101
113            end if
114        end do
115
116        ! now calculate power
117
118        do i=1, CAMB_PK%num_k
119            rk = exp(CAMB_Pk%l
120
121            if (rk > Min_kh_no
122
123                ! linear power
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 143

```
0143            diff=sig-1.0
0144            if (abs(diff)
0145                rknl=1./r
0146                rneff=-3-
0147                rncur=-d2
0148                exit
0149            elseif (diff.
0150                xlogr1=lo
0151            elseif (diff.
0152                xlogr2=lo
0153            endif
0154            if (xlogr2 <
0155                !is still
0156                goto 101
0157            else if (xlog
0158                ! Totally
0159                global_er
0160                write(*,*
0161                goto 101
0162            end if
0163        end do
0164
0165        ! now calculate p
0166
0167        do i=1, CAMB_PK%n
0168            rk = exp(CAMB
0169
0170            if (rk > Min_
0171
0172                ! linear
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 124

```
124                     ! constant = 4
125
126                     plin= MatterPo
127
128                     ! calculate no
129                     ! where pq rep
130                     ! where ph is
131
132                     call halofit(r
133                     CAMB_Pk%nonlin
134
135                 end if
136
137             enddo
138
139     101     continue
140         end do
141
142         end subroutine NonLinear_G
143
144         !%%%%%%%%%%%%%%%%%%%%%%%%
145
146
147         subroutine halofit(rk,rn,r
148         implicit none
149
150         real(dl) gam,a,b,c,xmu,xnu
151         real(dl) rk,rn,plin,pnl,pq
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 173

```
0173                    ! constan
0174
0175                    plin= Mat
0176
0177                    ! calcula
0178                    ! where p
0179                    ! where p
0180
0181                    call halo
0182                    CAMB_Pk%n
0183
0184                end if
0185
0186            enddo
0187
0188    101     continue
0189        end do
0190
0191    END IF
0192
0193        end subroutine NonLinear_
0194
0195        !%%%%%%%%%%%%%%%%%%%%%%%%
0196
0197
0198        subroutine halofit(rk,rn,

0199
0200        real(dl) gam,a,b,c,xmu,xn
0201        real(dl) rk,rn,plin,pnl,p
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 152

```
152         real(dl) rknl,y,rncur
153         real(dl) f1a,f2a,f3a,f1b,f
154         real(dl) extragam, peacock
155
156         if (halofit_version ==halo
157             .or. halofit_version =
158         ! halo model nonlinear fit
159         ! Appendix C of Smith et a
160         !SPB11: Standard halofit u
161         !factor of two. Add an ext
162         !Haehnelt 2011 which parti
163         if (halofit_version ==halo
164             extragam = 0.3159 -0.0
165             gam=extragam+0.86485+0
166         else
167             gam=0.86485+0.2989*rn+
168         end if
169         a=1.4861+1.83693*rn+1.6761
170             0.1670756*rn*rn*rn*rn-
171         a=10**a
172         b=10**(0.9463+0.9466*rn+0.
173         c=10**(-0.2807+0.6669*rn+0
174         xmu=10**(-3.54419+0.19086*
175         xnu=10**(0.95897+1.2857*rn
176         alpha=1.38848+0.3701*rn-0.
177         beta=0.8291+0.9854*rn+0.34
178         elseif (halofit_version ==
179             !RT12 Oct: the halofit
180             !than latest N-body si
181             !Update the following
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 202

```
0202        real(dl) rknl,y,rncur
0203        real(dl) f1a,f2a,f3a,f1b,
0204        real(dl) extragam, peacoc
0205
0206        if (halofit_version ==hal
0207            .or. halofit_version
0208            ! halo model nonlinea
0209            ! Appendix C of Smith
0210            !SPB11: Standard halo
0211            !factor of two. Add a
0212            !Haehnelt 2011 which
0213            if (halofit_version =
0214                extragam = 0.3159
0215                gam=extragam+0.86
0216            else
0217                gam=0.86485+0.298
0218            end if
0219            a=1.4861+1.83693*rn+1
0220                0.1670756*rn*rn*r
0221            a=10**a
0222            b=10**(0.9463+0.9466*
0223            c=10**(-0.2807+0.6669
0224            xmu=10**(-3.54419+0.1
0225            xnu=10**(0.95897+1.28
0226            alpha=1.38848+0.3701*
0227            beta=0.8291+0.9854*rn
0228        elseif (halofit_version =
0229            !RT12 Oct: the halofi
0230            !than latest N-body s
0231            !Update the following
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 182

```
182             !alpha & beta from the
183             !The improved halofit
184             !cosmological models w
185             gam=0.1971-0.0843*rn+0
186
187     !#SimDataReplace
188
189     !        a=1.5222+2.8553*rn+2.
190     !            0.2250*rn*rn*rn*r
191
192
193             a=1.5222+2.8553*rn+2.3
194                 0.2250*rn*rn*rn*rn
195
196     !#SimDataReplace
197
198             a=10**a
199
200     !#SimDataReplace
201     !        b=10**(-0.5642+0.5864
202     !            0.2279*om_v*(1.+w
203
204             b=10**(-0.5642+0.5864*
205                 0.2279*om_v*(1.+CP
206     !!! atentie ca wa_ppf sa fie 0
207     !print*, 'In halofit_ppf wa_pp
208     !#SimDataReplace
209             c=10**(0.3698+2.0404*r
210             xmu=0.
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 232

```
0232            !alpha & beta from th
0233            !The improved halofit
0234            !cosmological models
0235            !LC16 Jun: Casarini+
0236            gam=0.1971-0.0843*rn+
0237            a=1.5222+2.8553*rn+2.
0238                0.2250*rn*rn*rn*r
0239            a=10**a
0240            b=10**(-0.5642+0.5864
0241                0.2279*om_v*(1.+w
0242            c=10**(0.3698+2.0404*
0243            xmu=0.
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 211

```
211           xnu=10**(5.2105+3.6902
212           alpha=abs(6.0835+1.337
213           beta=2.0379-0.7354*rn+
214               0.3980*rn**4-0.168
215       else
216           stop 'Unknown halofit_
217       end if
218
219       if(abs(1-om_m).gt.0.01) th
220           f1a=om_m**(-0.0732)
221           f2a=om_m**(-0.1423)
222           f3a=om_m**(0.0725)
223           f1b=om_m**(-0.0307)
224           f2b=om_m**(-0.0585)
225           f3b=om_m**(0.0743)
226           frac=om_v/(1.-om_m)
227           f1=frac*f1b + (1-frac)
228           f2=frac*f2b + (1-frac)
229           f3=frac*f3b + (1-frac)
230       else
231           f1=1.0
232           f2=1.
233           f3=1.
234       endif
235
236       y=(rk/rknl)
237
238
239       ph=a*y**(f1*3)/(1+b*y**(f2
240       ph=ph/(1+xmu*y**(-1)+xnu*y
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 244

```
0244          xnu=10**(5.2105+3.690
0245          alpha=abs(6.0835+1.33
0246          beta=2.0379-0.7354*rn
0247              0.3980*rn**4-0.16
0248      else
0249          call MpiStop('Unknown
0250      end if
0251
0252      if(abs(1-om_m).gt.0.01) t
0253          f1a=om_m**(-0.0732)
0254          f2a=om_m**(-0.1423)
0255          f3a=om_m**(0.0725)
0256          f1b=om_m**(-0.0307)
0257          f2b=om_m**(-0.0585)
0258          f3b=om_m**(0.0743)
0259          frac=om_v/(1.-om_m)
0260          f1=frac*f1b + (1-frac
0261          f2=frac*f2b + (1-frac
0262          f3=frac*f3b + (1-frac
0263      else
0264          f1=1.0
0265          f2=1.
0266          f3=1.
0267      endif
0268
0269      y=(rk/rknl)
0270
0271
0272      ph=a*y**(f1*3)/(1+b*y**(f
0273      ph=ph/(1+xmu*y**(-1)+xnu*
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 241

```
241         plinaa=plin*(1+fnu*47.48*r
242         pq=plin*(1+plinaa)**beta/(
243
244         pnl=pq+ph
245
246         if (halofit_version == hal
247             !From http://www.roe.a
248             !(P-P_linear) -> (P-P_
249             peacock_fudge = rk/10
250             pnl = plin + (pnl-plin
251         end if
252
253         end subroutine halofit
254
255
256         !%%%%%%%%%%%%%%%%%%%%%%%%
257
258         ! The subroutine wint, fin
259         ! rknl, rneff & rncur. Thi
260         ! the Gaussian filter at w
261         ! rneff is defined as the
262         ! at the nonlinear wavenum
263         ! derivative at the nonlin
264
265         subroutine wint(CAMB_Pk,it
266             implicit none
267         integer, intent(in) :: itf
268         type(MatterPowerData) :: C
269         real(dl) sum1,sum2,sum3,t,
270         real(dl) x2,rk, fac,r, sig
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 274

```
0274        plinaa=plin*(1+fnu*47.48*
0275        pq=plin*(1+plinaa)**beta/
0276
0277        pnl=pq+ph
0278
0279        if (halofit_version == ha
0280            !From http://www.roe.
0281            !(P-P_linear) -> (P-P
0282            peacock_fudge = rk/10
0283            pnl = plin + (pnl-pli
0284        end if
0285
0286        end subroutine halofit
0287
0288
0289        !%%%%%%%%%%%%%%%%%%%%%%%%
0290
0291        ! The subroutine wint, fi
0292        ! rknl, rneff & rncur. Th
0293        ! the Gaussian filter at
0294        ! rneff is defined as the
0295        ! at the nonlinear wavenu
0296        ! derivative at the nonli
0297
0298        subroutine wint(CAMB_Pk,i

0299        integer, intent(in) :: it
0300        type(MatterPowerData) ::
0301        real(dl) sum1,sum2,sum3,t
0302        real(dl) x2,rk, fac,r, si
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 271

```
271         integer i,nint
272
273         nint=3000
274         sum1=0.d0
275         sum2=0.d0
276         sum3=0.d0
277         anorm = 1/(2*pi**2)
278         do i=1,nint
279             t=(i-0.5_dl)/nint
280             y=-1.d0+1.d0/t
281             rk=y
282             d2=MatterPowerData_k(C
283             x=y*r
284             x2=x*x
285             w1=exp(-x2)
286             w2=2*x2*w1
287             w3=4*x2*(1-x2)*w1
288             fac=d2/y/t/t
289             sum1=sum1+w1*fac
290             sum2=sum2+w2*fac
291             sum3=sum3+w3*fac
292         enddo
293         sum1=sum1/nint
294         sum2=sum2/nint
295         sum3=sum3/nint
296         sig=sqrt(sum1)
297         d1=-sum2/sum1
298         d2=-sum2*sum2/sum1/sum1 -
299
300         end subroutine wint
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 303

```
0303        integer i,nint
0304
0305        nint=3000
0306        sum1=0.d0
0307        sum2=0.d0
0308        sum3=0.d0
0309        anorm = 1/(2*pi**2)
0310        do i=1,nint
0311            t=(i-0.5_dl)/nint
0312            y=-1.d0+1.d0/t
0313            rk=y
0314            d2=MatterPowerData_k(
0315            x=y*r
0316            x2=x*x
0317            w1=exp(-x2)
0318            w2=2*x2*w1
0319            w3=4*x2*(1-x2)*w1
0320            fac=d2/y/t/t
0321            sum1=sum1+w1*fac
0322            sum2=sum2+w2*fac
0323            sum3=sum3+w3*fac
0324        enddo
0325        sum1=sum1/nint
0326        sum2=sum2/nint
0327        sum3=sum3/nint
0328        sig=sqrt(sum1)
0329        d1=-sum2/sum1
0330        d2=-sum2*sum2/sum1/sum1 -
0331
0332        end subroutine wint
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 301

```
301
302         !!JD 08/13 generalize to v
303       !     #Simdata : aproximativ ac
304
305       !     function omega_m(aa,om_m0
306       !     implicit none
307       !     real(dl) omega_m,omega_t,
308       !     Qa2= aa**(-1.0-3.0*(wval+
309       !     omega_t=1.0+(om_m0+om_v0-
310       !     omega_m=omega_t*om_m0/(om
311       !     end function omega_m
312
313         !     function omega_m(aa,om_m0
314         !     implicit none
315         !     real(dl) omega_m,omega_t,
316         !     v_fac= aa**(-1.0-3.0*(w0v
317         !     omega_t=1.0+(om_m0+om_v0-
318         !     omega_m=omega_t*om_m0/(om
319         !     end function omega_m
320
321         !%%%%%%%%%%%%%%%%%%%%%%%%%%
322
323         ! evolution of omega lambd
324
325       !     function omega_v(aa,om_m0
326       !     implicit none
327       !     real(dl) aa,omega_v,om_m0
328       !     Qa2= aa**(-1.0-3.0*(wval+
329       !     omega_t=1.0+(om_m0+om_v0-
330       !     omega_v=omega_t*om_v0*Qa2
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 333

```
0333
0334          !!JD 08/13 generalize to
0335
0336          function omega_m(aa,om_m0
0337          real(dl) omega_m,omega_t,
0338          Qa2= aa**(-1.0-3.0*(wval+
0339          omega_t=1.0+(om_m0+om_v0-
0340          omega_m=omega_t*om_m0/(om
0341          end function omega_m
0342
0343          !%%%%%%%%%%%%%%%%%%%%%%%%%%
0344
0345          ! evolution of omega lamb
0346
0347          function omega_v(aa,om_m0
0348          real(dl) aa,omega_v,om_m0
0349          Qa2= aa**(-1.0-3.0*(wval+
0350          omega_t=1.0+(om_m0+om_v0-
0351          omega_v=omega_t*om_v0*Qa2
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 331

```
331     !    end function omega_v
332
333           function omega_v(aa,om_m
334           implicit none
335           real(dl) aa,omega_v,om_m
336           v_fac = aa**(-1.d0-3.d0*
337           omega_t=1.0+(om_m0+om_v0
338           omega_v=omega_t*om_v0*v_
339           end function omega_v
340     !#SimDataReplace
341         !!JD end generalize to var
342
```

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 352

```
0352          end function omega_v
0353
0354          !!JD end generalize to va
0355
0356          !!AM Below is for HMcode
0357          SUBROUTINE HMcode(CAMB_Pk
0358          !!AM - A CAMB derived typ
0359          TYPE(MatterPowerData) ::
0360          REAL :: z, k
0361          REAL :: p1h, p2h, pfull,
0362          INTEGER :: i, j, nk, nz
0363          TYPE(HM_cosmology) :: cos
0364          TYPE(HM_tables) :: lut
0365          REAL, PARAMETER :: pi=3.1
0366
0367          !HMcode developed by Alex
0368          !Please contact me if you
0369          !If you use this in your
0370          !If you use the extension
0371          !Also consider citing the
0372
0373          !Use imead to switch betw
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 374

```
0374        !0 - Standard (this is ju
0375        !1 - Accurate from Mead e
0376        !2 - Accurate from Mead e
0377        IF(halofit_version==halof
0378        IF(halofit_version==halof
0379        IF(halofit_version==halof
0380
0381        IF(FeedbackLevel>0) HM_ve
0382
0383        IF(HM_verbose) WRITE(*,*)
0384        IF(HM_verbose) WRITE(*,*)
0385        IF(HM_verbose) WRITE(*,*)
0386
0387        !!AM - Translate from CAM
0388        nz=CAMB_PK%num_z
0389        nk=CAMB_PK%num_k
0390
0391        !!AM - Assign cosmologica
0392        CALL assign_HM_cosmology(
0393
0394        !Fill growth function tab
0395        CALL fill_growtab(cosi)
0396
0397        !Loop over redshifts
0398        DO j=1,nz
0399
0400            !Initialise the speci
0401            !Currently this needs
0402            !For non-massive-neut
0403            CALL initialise_HM_co
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 404

```
0404
0405            !Sets the current red
0406            z=CAMB_Pk%Redshifts(j
0407
0408            !Initiliasation for t
0409            CALL halomod_init(z,l
0410
0411            !Loop over k values a
0412            !$OMP PARALLEL DO DEF
0413            DO i=1,nk
0414                k=exp(CAMB_Pk%log
0415                plin=p_lin(k,z,0,
0416                CALL halomod(k,z,
0417                CAMB_Pk%nonlin_ra
0418            END DO
0419            !$OMP END PARALLEL DO
0420
0421        END DO
0422
0423        END SUBROUTINE HMcode
0424
0425        FUNCTION Delta_v(z,lut,co
0426
0427        !Function for the viriali
0428        REAL :: Delta_v
0429        REAL, INTENT(IN) :: z
0430        TYPE(HM_cosmology), INTEN
0431        TYPE(HM_tables), INTENT(I
0432
0433        IF(imead==0) THEN
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 434

```
0434            !Value that is normal
0435            Delta_v=200.
0436        ELSE IF(imead==1 .OR. ime
0437            !Mead et al. (2015; a
0438            Delta_v=418.*(Omega_m
0439            !Mead et al. (2016; a
0440            IF(imead==1) Delta_v=
0441        END IF
0442
0443        END FUNCTION Delta_v
0444
0445        FUNCTION delta_c(z,lut,co
0446
0447        !Function for the linear
0448        REAL :: delta_c
0449        REAL, INTENT(IN) :: z
0450        TYPE(HM_cosmology), INTEN
0451        TYPE(HM_tables), INTENT(I
0452
0453        IF(imead==0) THEN
0454            delta_c=1.686
0455        ELSE IF(imead==1 .OR. ime
0456            !Mead et al. (2015; a
0457            delta_c=1.59+0.0314*l
0458            IF(imead==1) THEN
0459                delta_c=delta_c*(
0460                delta_c=delta_c*(
0461            END IF
0462        END IF
0463
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 464

```
0464     END FUNCTION delta_c
0465
0466     FUNCTION eta(z,lut,cosm)
0467
0468     !Function eta that puffs
0469     REAL :: eta
0470     REAL, INTENT(IN) :: z
0471     TYPE(HM_cosmology), INTEN
0472     TYPE(HM_tables), INTENT(I
0473     REAL :: eta0
0474
0475     IF(imead==0) THEN
0476         eta=0.
0477     ELSE IF(imead==1 .OR. ime
0478         !The first parameter
0479         !eta=0.603-0.3*lut%si
0480         !AM - made baryon fee
0481         eta0=cosm%eta_baryon
0482         !eta0=0.98-0.12*cosm%
0483         eta=eta0-0.3*lut%sig8
0484     END IF
0485
0486     END FUNCTION eta
0487
0488     FUNCTION kstar(z,lut,cosm
0489
0490     !Function k* that cuts of
0491     REAL :: kstar
0492     REAL, INTENT(IN) :: z
0493     TYPE(HM_cosmology), INTEN
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 494

```
0494        TYPE(HM_tables), INTENT(I
0495
0496        IF(imead==0) THEN
0497            !Set to zero for the
0498            kstar=0.
0499        ELSE IF(imead==1 .OR. ime
0500            !One-halo cut-off wav
0501            !Mead et al. (2015; a
0502            kstar=0.584*(lut%sigv
0503        END IF
0504
0505        END FUNCTION kstar
0506
0507        FUNCTION As(z,lut,cosm)
0508
0509        !Halo concentration pre-f
0510        REAL :: As
0511        REAL, INTENT(IN) :: z
0512        TYPE(HM_cosmology), INTEN
0513        TYPE(HM_tables), INTENT(I
0514
0515        IF(imead==0) THEN
0516            !Set to 4 for the sta
0517            As=4.
0518        ELSE IF(imead==1 .OR. ime
0519            !This is the 'A' halo
0520            !As=3.13
0521            !AM - added for easy
0522            As=cosm%A_baryon
0523        END IF
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 524

```
0524
0525        END FUNCTION As
0526
0527        FUNCTION fdamp(z,lut,cosm
0528
0529        !Linear power damping fun
0530        REAL ::fdamp
0531        REAL, INTENT(IN) :: z
0532        TYPE(HM_cosmology), INTEN
0533        TYPE(HM_tables), INTENT(I
0534
0535        !Linear theory damping fa
0536        IF(imead==0) THEN
0537            !Set to 0 for the sta
0538            fdamp=0.
0539        ELSE IF(imead==1) THEN
0540            !Mead et al. (2016; a
0541            fdamp=0.0095*lut%sigv
0542        ELSE IF(imead==2) THEN
0543            !Mead et al. (2015) v
0544            fdamp=0.188*lut%sig8z
0545        END IF
0546
0547        !Catches extreme values o
0548        IF(fdamp<1.e-3) fdamp=1.e
0549        IF(fdamp>0.99)  fdamp=0.9
0550
0551        END FUNCTION fdamp
0552
0553        FUNCTION alpha(z,lut,cosm
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 554

```
0554
0555        !Two- to one-halo transit
0556        REAL :: alpha
0557        REAL, INTENT(IN) :: z
0558        TYPE(HM_tables), INTENT(I
0559        TYPE(HM_cosmology), INTEN
0560
0561        IF(imead==0) THEN
0562            !Set to 1 for the sta
0563            alpha=1.
0564        ELSE IF(imead==1) THEN
0565            !This uses the top-ha
0566            !Mead et al. (2016; a
0567            alpha=3.24*1.85**lut%
0568        ELSE IF(imead==2) THEN
0569            !Mead et al. (2015) v
0570            alpha=2.93*1.77**lut%
0571        END IF
0572
0573        !Catches values of alpha
0574        IF(alpha>2.)  alpha=2.
0575        IF(alpha<0.5) alpha=0.5
0576
0577        END FUNCTION alpha
0578
0579        FUNCTION r_nl(lut)
0580
0581        !Calculates R_nl, defined
0582        TYPE(HM_tables), INTENT(I
0583        REAL :: r_nl
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 584

```
0584
0585        IF(lut%nu(1)>1.) THEN
0586            !This catches some ve
0587            r_nl=lut%rr(1)
0588        ELSE
0589            r_nl=exp(find(log(1.)
0590        END IF
0591
0592        END FUNCTION r_nl
0593
0594        SUBROUTINE halomod(k,z,p1
0595
0596        !Calcuates 1-halo and 2-h
0597        REAL, INTENT(OUT) :: p1h,
0598        REAL, INTENT(IN) :: plin,
0599        REAL :: a
0600        TYPE(HM_cosmology), INTEN
0601        TYPE(HM_tables), INTENT(I
0602
0603        !Calls expressions for on
0604        !to form the full power s
0605        IF(k==0.) THEN
0606            p1h=0.
0607            p2h=0.
0608        ELSE
0609            p1h=p_1h(k,z,lut,cosm
0610            p2h=p_2h(k,z,plin,lut
0611        END IF
0612
0613        a=alpha(z,lut,cosm)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 614

```
0614       pfull=(p2h**a+p1h**a)**(1
0615
0616       END SUBROUTINE halomod
0617
0618       SUBROUTINE fill_table(min
0619
0620       !Fills array 'arr' in equ
0621       IMPLICIT NONE
0622       INTEGER :: i
0623       REAL, INTENT(IN) :: min,
0624       REAL, ALLOCATABLE :: arr(
0625       INTEGER, INTENT(IN) :: n
0626
0627       !Allocate the array, and
0628       IF(ALLOCATED(arr)) DEALLO
0629       ALLOCATE(arr(n))
0630       arr=0.
0631
0632       IF(n==1) THEN
0633          arr(1)=min
0634       ELSE IF(n>1) THEN
0635          DO i=1,n
0636             arr(i)=min+(max-m
0637          END DO
0638       END IF
0639
0640       END SUBROUTINE fill_table
0641
0642       SUBROUTINE fill_table8(mi
0643
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 644

```
0644        !Fills array 'arr' in equ
0645        IMPLICIT NONE
0646        INTEGER :: i
0647        real(dl), INTENT(IN) :: m
0648        real(dl), ALLOCATABLE ::
0649        INTEGER, INTENT(IN) :: n
0650
0651        !Allocate the array, and
0652        IF(ALLOCATED(arr)) DEALLO
0653        ALLOCATE(arr(n))
0654        arr=0.
0655
0656        IF(n==1) THEN
0657            arr(1)=min
0658        ELSE IF(n>1) THEN
0659            DO i=1,n
0660                arr(i)=min+(max-m
0661            END DO
0662        END IF
0663
0664        END SUBROUTINE fill_table
0665
0666        SUBROUTINE fill_plintab(i
0667
0668        !Fills internal HMcode HM
0669        TYPE(MatterPowerData), IN
0670        INTEGER, INTENT(IN) :: iz
0671        TYPE(HM_cosmology) :: cos
0672        INTEGER :: i
0673        REAL :: z, g
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 674

```
0674        INTEGER, PARAMETER :: ime
0675        REAL, PARAMETER :: pi=3.1
0676        REAL, PARAMETER :: kmin=1
0677        REAL, PARAMETER :: kmax=1
0678        INTEGER, PARAMETER :: nk=
0679
0680        IF(HM_verbose) WRITE(*,*)
0681
0682        !Fill arrays
0683        IF(ALLOCATED(cosm%k_plin)
0684        IF(ALLOCATED(cosm%plin))
0685        IF(ALLOCATED(cosm%plinc))
0686
0687        IF(imeth==1) THEN
0688
0689            !Fill k-table with th
0690            !If a user has specif
0691            !calculation chug
0692            cosm%nk=CAMB_PK%num_k
0693            ALLOCATE(cosm%k_plin(
0694            DO i=1,cosm%nk
0695                cosm%k_plin(i)=ex
0696            END DO
0697
0698        ELSE IF(imeth==2) THEN
0699
0700            !Fill a k-table with
0701            !Note that the minimu
0702            cosm%nk=nk
0703            CALL fill_table(log(k
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

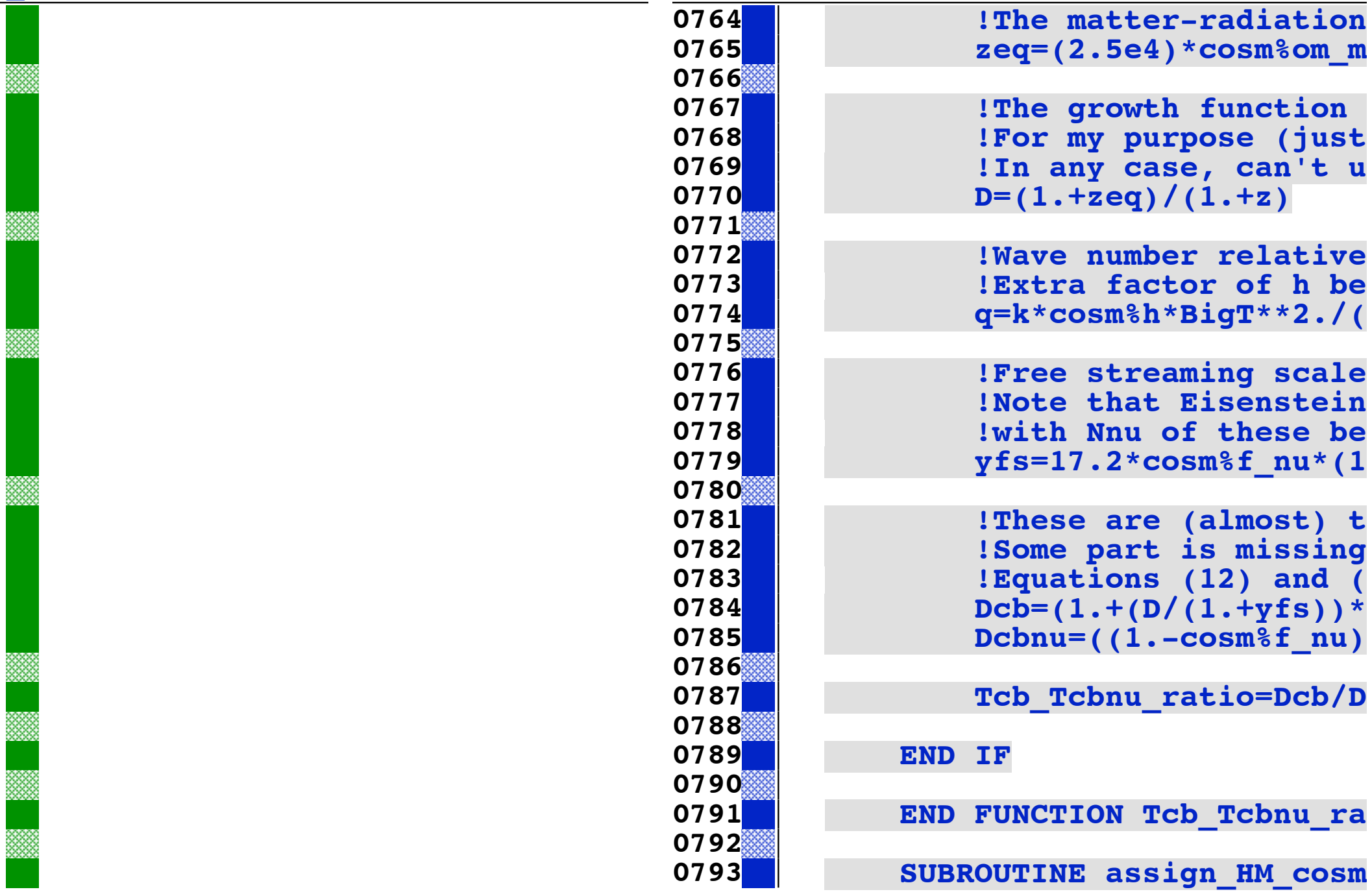
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 704

```
0704            cosm%k_plin=exp(cosm%
0705
0706        END IF
0707
0708        IF(HM_verbose) WRITE(*,*)
0709        IF(HM_verbose) WRITE(*,*)
0710        IF(HM_verbose) WRITE(*,*)
0711
0712        ALLOCATE(cosm%plin(nk),co
0713
0714        !Find the redshift
0715        z=CAMB_Pk%Redshifts(iz)
0716        IF(HM_verbose) WRITE(*,*)
0717
0718        !Fill power table, both c
0719        DO i=1,nk
0720            !Take the power from
0721            cosm%plin(i)=MatterPo
0722            cosm%plinc(i)=cosm%pl
0723        END DO
0724
0725        !Calculate the growth fac
0726        g=grow(z,cosm)
0727
0728        !Grow the power to z=0
0729        cosm%plin=cosm%plin/(g**2
0730        cosm%plinc=cosm%plinc/(g*
0731
0732        !Check sigma_8 value
0733        IF(HM_verbose) WRITE(*,*)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 734

```
0734     IF(HM_verbose) WRITE(*,*)
0735     IF(HM_verbose) WRITE(*,*)
0736
0737     END SUBROUTINE fill_plint
0738
0739     FUNCTION Tcb_Tcbnu_ratio(
0740
0741     !Calculates the ratio of
0742     !Uses approximations in E
0743     !Note that this assumes t
0744     !Nnu<=3 of these being ma
0745
0746     REAL :: Tcb_Tcbnu_ratio
0747     REAL, INTENT(IN) :: k, z
0748     REAL :: D, Dcb, Dcbnu, pc
0749     REAL :: BigT
0750     TYPE(HM_cosmology) :: cos
0751
0752     IF(cosm%f_nu==0.) THEN
0753
0754         Tcb_Tcbnu_ratio=1.
0755
0756     ELSE
0757
0758         !Growth exponent unde
0759         pcb=(5.-sqrt(1.+24.*(
0760
0761         !Theta for temperatur
0762         BigT=cosm%Tcmb/2.7
0763
```


/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 764
0764 !The matter-radiation
0765 zeq=(2.5e4)*cosm%om_m
0766
0767 !The growth function
0768 !For my purpose (just
0769 !In any case, can't u
0770 D=(1.+zeq)/(1.+z)
0771
0772 !Wave number relative
0773 !Extra factor of h be
0774 q=k*cosm%h*BigT**2.//(
0775
0776 !Free streaming scale
0777 !Note that Eisenstein
0778 !with Nnu of these be
0779 yfs=17.2*cosm%f_nu*(1
0780
0781 !These are (almost) t
0782 !Some part is missing
0783 !Equations (12) and (
0784 Dcb=(1.+(D/(1.+yfs))*
0785 Dcbnu=((1.-cosm%f_nu)
0786
0787 Tcb_Tcbnu_ratio=Dcb/D
0788
0789 END IF
0790
0791 END FUNCTION Tcb_Tcbnu_ra
0792
0793 SUBROUTINE assign_HM_cosm

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 794

```
0794
0795      !Assigns the internal HMc
0796      TYPE(HM_cosmology) :: cos
0797
0798      !Converts CAMB parameters
0799      cosm%om_m=CP%omegac+CP%om
0800      cosm%om_v=CP%omegav
0801      cosm%w=w_lam
0802      cosm%wa=wa_ppf
0803      cosm%f_nu=CP%omegan/cosm%
0804      cosm%h=CP%H0/100.
0805      cosm%Tcmb=CP%tcmb
0806      cosm%Nnu=CP%Num_Nu_massiv
0807
0808      !n_s is read in here. The
0809      !one value in this array,
0810      cosm%ns=CP%InitPower%an(1
0811
0812      !Write out cosmological p
0813      IF(HM_verbose) WRITE(*,*)
0814      IF(HM_verbose) WRITE(*,*)
0815      IF(HM_verbose) WRITE(*,*)
0816      IF(HM_verbose) WRITE(*,*)
0817      IF(HM_verbose) WRITE(*,*)
0818      IF(HM_verbose) WRITE(*,*)
0819      IF(HM_verbose) WRITE(*,*)
0820      IF(HM_verbose) WRITE(*,*)
0821      IF(HM_verbose) WRITE(*,*)
0822      IF(HM_verbose) WRITE(*,*)
0823      IF(HM_verbose) WRITE(*,*)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 824

```
0824     IF(HM_verbose) WRITE(*,*)
0825
0826     END SUBROUTINE assign_HM_
0827
0828     SUBROUTINE initialise_HM_
0829
0830     !Sets up HM_tables of sig
0831     TYPE(MatterPowerData), IN
0832     TYPE(HM_cosmology) :: cos
0833     INTEGER, INTENT(IN) :: iz
0834
0835     !Fill linear power table
0836     CALL fill_plintab(iz,cosm
0837
0838     !Fill sigma(r) table
0839     CALL fill_sigtab(cosm)
0840
0841     END SUBROUTINE initialise
0842
0843     SUBROUTINE allocate_LUT(l
0844
0845     !Allocates memory for the
0846     TYPE(HM_tables) :: lut
0847     INTEGER :: n
0848
0849     n=lut%n
0850     ALLOCATE(lut%zc(n),lut%m(
0851     ALLOCATE(lut%nu(n),lut%rr
0852
0853     lut%zc=0.
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 854

```
0854        lut%m=0.
0855        lut%c=0.
0856        lut%rv=0.
0857        lut%nu=0.
0858        lut%rr=0.
0859        lut%sigf=0.
0860        lut%sig=0.
0861
0862     END SUBROUTINE allocate_L
0863
0864     SUBROUTINE deallocate_LUT
0865
0866        !Deallocates HMcode look-
0867        TYPE(HM_tables) :: lut
0868
0869        DEALLOCATE(lut%zc,lut%m,l
0870
0871     END SUBROUTINE deallocate
0872
0873     SUBROUTINE halomod_init(z
0874
0875        !Halo-model initialisatio
0876        !Computes look-up HM_tabl
0877        REAL, INTENT(IN) :: z
0878        INTEGER :: i
0879        REAL :: Dv, dc, f, m, nu,
0880        TYPE(HM_cosmology) :: cos
0881        TYPE(HM_tables) :: lut
0882        REAL, PARAMETER :: mmin=1
0883        REAL, PARAMETER :: mmax=1
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 884

```
0884        INTEGER, PARAMETER :: n=2
0885
0886        IF(HM_verbose) WRITE(*,*)
0887        IF(HM_verbose) WRITE(*,*)
0888
0889        !Find value of sigma_v, s
0890
0891        lut%sigv=sqrt(dispint(0.,
0892        IF(HM_verbose) WRITE(*,*)
0893        lut%sigv100=sqrt(dispint(
0894        IF(HM_verbose) WRITE(*,*)
0895        lut%sig8z=sigma(8.,z,0,co
0896        IF(HM_verbose) WRITE(*,*)
0897
0898        IF(ALLOCATED(lut%rr)) CAL
0899
0900        lut%n=n
0901        CALL allocate_lut(lut)
0902
0903        IF(HM_verbose) WRITE(*,*)
0904        IF(HM_verbose) WRITE(*,*)
0905
0906        dc=delta_c(z,lut,cosm)
0907
0908        !$OMP PARALLEL DO default
0909        DO i=1,n
0910
0911            m=exp(log(mmin)+log(m
0912            r=radius_m(m,cosm)
0913            sig=sigmac(r,z,cosm)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 914

```
0914            nu=dc/sig
0915
0916            lut%m(i)=m
0917            lut%rr(i)=r
0918            lut%sig(i)=sig
0919            lut%nu(i)=nu
0920
0921        END DO
0922        !$OMP END PARALLEL DO
0923
0924        IF(HM_verbose) WRITE(*,*)
0925
0926        !Fills up a table for sig
0927        !This is the f=0.01 param
0928        f=0.01**(1./3.)
0929        DO i=1,lut%n
0930            lut%sigf(i)=sigmac(lu
0931        END DO
0932        IF(HM_verbose) WRITE(*,*)
0933
0934        !Fill virial radius table
0935        Dv=Delta_v(z,lut,cosm)
0936        lut%rv=lut%rr/(Dv**(1./3.
0937
0938        IF(HM_verbose) WRITE(*,*)
0939        IF(HM_verbose) WRITE(*,*)
0940        IF(HM_verbose) WRITE(*,*)
0941        IF(HM_verbose) WRITE(*,*)
0942        IF(HM_verbose) WRITE(*,*)
0943        IF(HM_verbose) WRITE(*,*)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 944

```
0944        IF(HM_verbose) WRITE(*,*)
0945
0946        !Find non-linear radius a
0947        lut%rnl=r_nl(lut)
0948        lut%knl=1./lut%rnl
0949
0950        IF(HM_verbose) WRITE(*,*)
0951        IF(HM_verbose) WRITE(*,*)
0952
0953        !Calcuate the effective s
0954        lut%neff=neff(lut,cosm)
0955
0956        IF(HM_verbose) WRITE(*,*)
0957
0958        !Get the concentration fo
0959        CALL conc_bull(z,lut,cosm
0960
0961        IF(HM_verbose) WRITE(*,*)
0962        IF(HM_verbose) WRITE(*,*)
0963        IF(HM_verbose) WRITE(*,*)
0964        IF(HM_verbose) WRITE(*,*)
0965        IF(HM_verbose) WRITE(*,*)
0966        IF(HM_verbose) CALL write
0967
0968        !Switch off verbose mode
0969        HM_verbose= .false.
0970
0971        END SUBROUTINE halomod_in
0972
0973        SUBROUTINE write_paramete
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 974

```
0974
0975      !This subroutine writes o
0976      REAL, INTENT(IN) :: z
0977      TYPE(HM_cosmology), INTEN
0978      TYPE(HM_tables), INTENT(I
0979
0980      IF(HM_verbose) WRITE(*,*)
0981      IF(HM_verbose) WRITE(*,*)
0982      IF(HM_verbose) WRITE(*,fm
0983      IF(HM_verbose) WRITE(*,fm
0984      IF(HM_verbose) WRITE(*,fm
0985      IF(HM_verbose) WRITE(*,fm
0986      IF(HM_verbose) WRITE(*,fm
0987      IF(HM_verbose) WRITE(*,fm
0988      IF(HM_verbose) WRITE(*,fm
0989      IF(HM_verbose) WRITE(*,fm
0990      IF(HM_verbose) WRITE(*,*)
0991      IF(HM_verbose) WRITE(*,*)
0992
0993   END SUBROUTINE write_para
0994
0995   PURE FUNCTION radius_m(m,
0996
0997      !Calculates the co-moving
0998      REAL :: radius_m
0999      REAL, INTENT(IN) :: m
1000      TYPE(HM_cosmology), INTEN
1001      REAL, PARAMETER :: pi=3.1
1002
1003      radius_m=(3.*m/(4.*pi*cos
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1004

```
1004
1005        END FUNCTION radius_m
1006
1007        FUNCTION neff(lut,cosm)
1008
1009        !Finds the effective spec
1010        !Where nu(r_nl)=1.
1011        REAL :: neff
1012        REAL :: ns
1013        TYPE(HM_cosmology), INTEN
1014        TYPE(HM_tables), INTENT(I
1015
1016        !Numerical differentiatio
1017        neff=-3.-derivative_table
1018
1019        !For some bizarre cosmolo
1020        !In this case the n_eff c
1021        ns=cosm%ns
1022        IF(neff<ns-4.) neff=ns-4.
1023        IF(neff>ns)    neff=ns
1024
1025        END FUNCTION neff
1026
1027        SUBROUTINE conc_bull(z,lu
1028
1029        !Calculates the Bullock e
1030        REAL, INTENT(IN) :: z
1031        TYPE(HM_cosmology) :: cos
1032        TYPE(HM_tables) :: lut
1033        REAL :: A, zf, ainf, zinf
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1034

```
1034        INTEGER :: i
1035
1036        !Amplitude of relation (4
1037        A=As(z,lut,cosm)
1038
1039        !Fill the collapse time l
1040        CALL zcoll_bull(z,cosm,lu
1041
1042        !Fill the concentration l
1043        DO i=1,lut%n
1044            zf=lut%zc(i)
1045            lut%c(i)=A*(1.+zf)/(1
1046        END DO
1047
1048        !Dolag (2004) prescriptio
1049
1050        !This is approximately z=
1051        zinf=10.
1052        g_wcdm=grow(zinf,cosm)
1053
1054        !Make a LCDM HM_cosmology
1055        !Only need to make sure m
1056        !This is *only* used for
1057        cos_lcdm=cosm
1058        DEALLOCATE(cos_lcdm%growt
1059        DEALLOCATE(cos_lcdm%a_gro
1060        cos_lcdm%w=-1.
1061        cos_lcdm%wa=0.
1062        cos_lcdm%om_v=1.-cosm%om_
1063
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1064

```
1064        ainf=1./(1.+zinf)
1065
1066        !Needs to use grow_int ex
1067        g_lcdm=growint(ainf,cos_l
1068
1069        !This is the Dolag et al.
1070        IF(imead==0 .OR. imead==1
1071            pow=1.
1072        ELSE IF(imead==2) THEN
1073            pow=1.5
1074        END IF
1075        lut%c=lut%c*((g_wcdm/g_lc
1076
1077        END SUBROUTINE conc_bull
1078
1079        FUNCTION growint(a,cosm)
1080
1081        !Integrates between a and
1082        !Stores information to re
1083        IMPLICIT NONE
1084        REAL :: growint
1085        REAL, INTENT(IN) :: a
1086        TYPE(HM_cosmology), INTEN
1087        REAL :: b
1088        INTEGER :: i, j
1089        INTEGER :: n
1090        REAL :: x, dx
1091        REAL :: f1, f2, fx
1092        real(dl) :: sum_n, sum_2n
1093        INTEGER, PARAMETER :: jmi
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1094

```
1094        INTEGER, PARAMETER :: jma
1095        real(dl), PARAMETER :: ac
1096        INTEGER, PARAMETER :: ior
1097
1098        !Integration range for in
1099        !Note a -> 1
1100        b=1.d0
1101
1102        IF(a==b) THEN
1103
1104            !Fix the answer to ze
1105            growint=exp(0.d0)
1106
1107        ELSE
1108
1109            !Reset the sum variab
1110            sum_2n=0.d0
1111            sum_n=0.d0
1112            sum_old=0.d0
1113            sum_new=0.d0
1114
1115            DO j=1,jmax
1116
1117                !Note, you need t
1118                !j=1 n=2; j=2 n=3
1119                n=1+2**(j-1)
1120
1121                !Calculate the dx
1122                dx=(b-a)/REAL(n-1
1123
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1124

```
1124                    IF(j==1) THEN
1125
1126                        !The first go
1127                        f1=growint_in
1128                        f2=growint_in
1129                        sum_2n=0.5d0*
1130                        sum_new=sum_2
1131
1132                    ELSE
1133
1134                        !Loop over on
1135                        DO i=2,n,2
1136                            x=a+(b-a)
1137                            fx=growin
1138                            sum_2n=su
1139                        END DO
1140
1141                        !Now create t
1142                        sum_2n=sum_n/
1143
1144                        !Now calculat
1145                        IF(iorder==1)
1146                            sum_new=s
1147                        ELSE IF(iorde
1148                            sum_new=(
1149                        ELSE
1150                            STOP 'GRO
1151                        END IF
1152
1153                    END IF
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1154

```
1154
1155                    IF((j>=jmin) .AND
1156                        !jmin avoids
1157                        growint=exp(s
1158                        EXIT
1159                    ELSE IF(j==jmax)
1160                        STOP 'GROWINT
1161                    ELSE
1162                        !Integral has
1163                        sum_old=sum_n
1164                        sum_n=sum_2n
1165                        sum_2n=0.d0
1166                    END IF
1167
1168                END DO
1169
1170            END IF
1171
1172            END FUNCTION growint
1173
1174            FUNCTION growint_integran
1175
1176            !Integrand for the approx
1177            IMPLICIT NONE
1178            REAL :: growint_integrand
1179            REAL, INTENT(IN) :: a
1180            TYPE(HM_cosmology), INTEN
1181            REAL :: gam
1182
1183            IF(cosm%w<-1.) THEN
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1184

```
1184            gam=0.55+0.02*(1.+cos
1185        ELSE IF(cosm%w>-1) THEN
1186            gam=0.55+0.05*(1.+cos
1187        ELSE
1188            gam=0.55
1189        END IF
1190
1191        !Note the minus sign here
1192        growint_integrand=-(Omega
1193
1194        END FUNCTION growint_inte
1195
1196        SUBROUTINE zcoll_bull(z,c
1197
1198        !Calcuates the halo colla
1199        REAL, INTENT(IN) :: z
1200        TYPE(HM_cosmology) :: cos
1201        TYPE(HM_tables) :: lut
1202        REAL :: dc
1203        REAL :: af, zf, RHS, a, g
1204        INTEGER :: i
1205
1206        !This fills up the halo f
1207
1208        !Needs to interpolate g(z
1209        !in 'g(a) vs a' space for
1210
1211        dc=delta_c(z,lut,cosm)
1212
1213        !Find the growth function
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1214

```
1214        a=1./(1.+z)
1215        growz=find(a,cosm%a_growt
1216
1217        !Do numerical inversion
1218        DO i=1,lut%n
1219
1220            RHS=dc*grow(z,cosm)/l
1221
1222            IF(RHS>growz) THEN
1223                !This is the case
1224                !in this case set
1225                zf=z
1226            ELSE
1227                af=find(RHS,cosm%
1228                zf=-1.+1./af
1229            END IF
1230
1231            lut%zc(i)=zf
1232
1233        END DO
1234
1235        END SUBROUTINE zcoll_bull
1236
1237        FUNCTION mass_r(r,cosm)
1238
1239        !Calcuates the average ma
1240        REAL :: mass_r, r
1241        TYPE(HM_cosmology) :: cos
1242        REAL, PARAMETER :: pi=3.1
1243
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1244

```
1244        !Relation between mean co
1245        mass_r=(4.*pi/3.)*cosmic_
1246
1247        END FUNCTION mass_r
1248
1249        PURE FUNCTION cosmic_dens
1250
1251        !The z=0 cosmological mat
1252        REAL :: cosmic_density
1253        TYPE(HM_cosmology), INTEN
1254
1255        !In M_sun per Mpc^3 with
1256        cosmic_density=(2.775e11)
1257
1258        END FUNCTION cosmic_densi
1259
1260        FUNCTION find_pk(k,itype,
1261
1262        !Look-up and interpolatio
1263        REAL :: find_pk
1264        REAL :: kmax, ns
1265        REAL, INTENT(IN) :: k
1266        INTEGER, INTENT(IN) :: it
1267        INTEGER :: n
1268        TYPE(HM_cosmology), INTEN
1269
1270        !Set number of k points a
1271        !Note that the min k valu
1272        n=SIZE(cosm%k_plin)
1273        kmax=cosm%k_plin(n)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1274

```
1274
1275        !Spectral index used in t
1276        ns=cosm%ns
1277
1278        IF(k>kmax) THEN
1279            !Do some interpolatio
1280            IF(itype==0) THEN
1281                find_pk=cosm%plin
1282            ELSE IF(itype==1) THE
1283                find_pk=cosm%plin
1284            END IF
1285        ELSE
1286            !Otherwise use the st
1287            IF(itype==0) THEN
1288                find_pk=exp(find(
1289            ELSE IF(itype==1) THE
1290                find_pk=exp(find(
1291            END IF
1292        END IF
1293
1294        !Old method, works fine f
1295        !IF(itype==1) find_pk=fin
1296
1297        END FUNCTION find_pk
1298
1299        FUNCTION p_lin(k,z,itype,
1300
1301        !Looks up the value for t
1302        REAL :: p_lin
1303        REAL, INTENT (IN) :: k, z
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1304

```
1304         INTEGER, INTENT(IN) :: it
1305         TYPE(HM_cosmology), INTEN
1306
1307         !This gives the linear po
1308         !P(k) should have been pr
1309
1310         p_lin=(grow(z,cosm)**2.)*
1311
1312         END FUNCTION p_lin
1313
1314         FUNCTION p_2h(k,z,plin,lu
1315
1316         !Calculates the 2-halo te
1317         REAL :: p_2h
1318         REAL, INTENT(IN) :: k, pl
1319         REAL :: sigv, frac
1320         REAL, INTENT(IN) :: z
1321         TYPE(HM_tables), INTENT(I
1322         TYPE(HM_cosmology), INTEN
1323
1324         !Damping function
1325         frac=fdamp(z,lut,cosm)
1326
1327         IF(imead==0 .OR. frac<1.e
1328             p_2h=plin
1329         ELSE
1330             sigv=lut%sigv
1331             p_2h=plin*(1.-frac*(t
1332         END IF
1333
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1334

```
1334        !For some strange cosmolo
1335        IF(p_2h<0.) p_2h=0.
1336
1337        END FUNCTION p_2h
1338
1339        FUNCTION p_1h(k,z,lut,cos
1340
1341        !Calculates the 1-halo te
1342        REAL :: p_1h
1343        REAL, INTENT(IN) :: k, z
1344        TYPE(HM_tables), INTENT(I
1345        TYPE(HM_cosmology), INTEN
1346        REAL :: Dv, g, fac, et, k
1347        REAL :: integrand(lut%n)
1348        REAL :: sum
1349        INTEGER :: i
1350        REAL, PARAMETER :: pi=3.1
1351
1352        !Does the one-halo power
1353
1354           !Only call eta once
1355        et=eta(z,lut,cosm)
1356
1357        !Calculates the value of
1358        DO i=1,lut%n
1359            g=gnu(lut%nu(i))
1360            wk=win(k*(lut%nu(i)**
1361            integrand(i)=(lut%rv(
1362        END DO
1363
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1364

```
1364        !Carries out the integrat
1365        sum=REAL(inttab(lut%nu,RE
1366
1367        !Virial density
1368        Dv=Delta_v(z,lut,cosm)
1369
1370        !These are just numerical
1371        p_1h=sum*2.*Dv*(k**3.)/(3
1372
1373        !Damping of the 1-halo te
1374        ks=kstar(z,lut,cosm)
1375
1376        !Prevents problems if k/k
1377        IF(ks==0.) THEN
1378            fac=0.
1379        ELSE IF((k/ks)**2.>7.) TH
1380            fac=0.
1381        ELSE
1382            fac=exp(-((k/ks)**2.)
1383        END IF
1384
1385        !Damping of the one-halo
1386        p_1h=p_1h*(1.-fac)
1387
1388        END FUNCTION p_1h
1389
1390        SUBROUTINE fill_sigtab(co
1391
1392        !Fills look-up HM_tables
1393        REAL :: r, sig
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1394

```
1394        INTEGER :: i
1395        TYPE(HM_cosmology) :: cos
1396        REAL, PARAMETER :: rmin=1
1397        REAL, PARAMETER :: rmax=1
1398        INTEGER, PARAMETER :: nsi
1399
1400        !This fills up HM_tables
1401        !It is used only in look-
1402        !and prevents a large num
1403        !rmin and rmax need to be
1404        !R vs. sigma(R) is approx
1405        !This wouldn't be appropr
1406
1407        !Allocate arrays
1408        IF(ALLOCATED(cosm%r_sigma
1409        IF(ALLOCATED(cosm%sigma))
1410
1411        !These values of 'r' work
1412        !Having nsig as a 2** num
1413        cosm%nsig=nsig
1414        ALLOCATE(cosm%r_sigma(nsi
1415
1416        IF(HM_verbose) WRITE(*,*)
1417        IF(HM_verbose) WRITE(*,*)
1418        IF(HM_verbose) WRITE(*,*)
1419        IF(HM_verbose) WRITE(*,*)
1420
1421        !$OMP PARALLEL DO default
1422        DO i=1,nsig
1423
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1424

```
1424                !Equally spaced r in
1425                r=exp(log(rmin)+log(r
1426
1427                sig=sigma(r,0.,1,cosm
1428
1429                cosm%r_sigma(i)=r
1430                cosm%sigma(i)=sig
1431
1432            END DO
1433            !$OMP END PARALLEL DO
1434
1435            IF(HM_verbose) WRITE(*,*)
1436            IF(HM_verbose) WRITE(*,*)
1437            IF(HM_verbose) WRITE(*,*)
1438            IF(HM_verbose) WRITE(*,*)
1439
1440        END SUBROUTINE fill_sigta
1441
1442        FUNCTION sigmac(r,z,cosm)
1443
1444            !Finds sigma_cold(R) from
1445            REAL :: sigmac
1446            REAL, INTENT(IN) :: r, z
1447            TYPE(HM_cosmology), INTEN
1448
1449            !Assumes scale-independet
1450            !Uses the approximation s
1451
1452            sigmac=grow(z,cosm)*exp(f
1453
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1454

```
1454        END FUNCTION sigmac
1455
1456        FUNCTION wk_tophat(x)
1457
1458        !The normlaised Fourier T
1459        REAL :: wk_tophat, x
1460
1461        !Taylor expansion used fo
1462        IF(x<0.01) THEN
1463            wk_tophat=1.-(x**2.)/
1464        ELSE
1465            wk_tophat=3.*(sin(x)-
1466        END IF
1467
1468        END FUNCTION wk_tophat
1469
1470        FUNCTION inttab(x,y,n,ior
1471
1472        !Integrates tables y(x)dx
1473        REAL :: inttab
1474        INTEGER, INTENT(IN) :: n
1475        REAL, INTENT(IN) :: x(n),
1476        REAL :: a, b, c, d, h
1477        REAL :: q1, q2, q3, qi, q
1478        REAL :: x1, x2, x3, x4, y
1479        real(dl) :: sum
1480        INTEGER :: i, i1, i2, i3,
1481        INTEGER, INTENT(IN) :: io
1482
1483        sum=0.d0
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1484

```
1484
1485        IF(iorder==1) THEN
1486
1487            !Sums over all Trapez
1488            DO i=1,n-1
1489                a=y(i+1)
1490                b=y(i)
1491                h=x(i+1)-x(i)
1492                sum=sum+(a+b)*h/2
1493            END DO
1494
1495        ELSE IF(iorder==2) THEN
1496
1497            DO i=1,n-2
1498
1499                x1=x(i)
1500                x2=x(i+1)
1501                x3=x(i+2)
1502
1503                y1=y(i)
1504                y2=y(i+1)
1505                y3=y(i+2)
1506
1507                CALL fit_quadrati
1508
1509                q1=a*(x1**3.)/3.+
1510                q2=a*(x2**3.)/3.+
1511                q3=a*(x3**3.)/3.+
1512
1513                !Takes value for
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1514

```
1514                    !have two indepen
1515                    IF(n==3) THEN
1516                        sum=sum+q3-q1
1517                    ELSE IF(i==1) THE
1518                        sum=sum+(q2-q
1519                    ELSE IF(i==n-2) T
1520                        sum=sum+(q2-q
1521                    ELSE
1522                        sum=sum+(q3-q
1523                    END IF
1524
1525                END DO
1526
1527            ELSE IF(iorder==3) THEN
1528
1529                DO i=1,n-1
1530
1531                    !First choose the
1532                    !First and last a
1533
1534                    IF(i==1) THEN
1535
1536                        i1=1
1537                        i2=2
1538                        i3=3
1539                        i4=4
1540
1541                    ELSE IF(i==n-1) T
1542
1543                        i1=n-3
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1544

```
1544                        i2=n-2
1545                        i3=n-1
1546                        i4=n
1547
1548                    ELSE
1549
1550                        i1=i-1
1551                        i2=i
1552                        i3=i+1
1553                        i4=i+2
1554
1555                    END IF
1556
1557                    x1=x(i1)
1558                    x2=x(i2)
1559                    x3=x(i3)
1560                    x4=x(i4)
1561
1562                    y1=y(i1)
1563                    y2=y(i2)
1564                    y3=y(i3)
1565                    y4=y(i4)
1566
1567                    CALL fit_cubic(a,
1568
1569                    !These are the li
1570                    xi=x(i)
1571                    xf=x(i+1)
1572
1573                    qi=a*(xi**4.)/4.+
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1574

```
1574                qf=a*(xf**4.)/4.+
1575
1576                sum=sum+qf-qi
1577
1578             END DO
1579
1580          ELSE
1581
1582             ERROR STOP 'INTTAB: E
1583
1584          END IF
1585
1586          inttab=REAL(sum)
1587
1588          END FUNCTION inttab
1589
1590          FUNCTION sigma(r,z,itype,
1591
1592          !Gets sigma(R)
1593          IMPLICIT NONE
1594          REAL :: sigma
1595          REAL, INTENT(IN) :: r, z
1596          INTEGER, INTENT(IN) :: it
1597          TYPE(HM_cosmology), INTEN
1598          REAL, PARAMETER :: acc=1d
1599          INTEGER, PARAMETER :: ior
1600          REAL, PARAMETER :: rsplit
1601
1602          IF(r>=rsplit) THEN
1603             sigma=sqrt(sigint0(r,
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1604

```
1604         ELSE IF(r<rsplit) THEN
1605             sigma=sqrt(sigint1(r,
1606         ELSE
1607             STOP 'SIGMA: Error, s
1608         END IF
1609
1610         END FUNCTION sigma
1611
1612         FUNCTION sigma_integrand(
1613
1614         !The integrand for the si
1615         IMPLICIT NONE
1616         REAL :: sigma_integrand
1617         REAL, INTENT(IN) :: k, R,
1618         INTEGER, INTENT(IN) :: it
1619         TYPE(HM_cosmology), INTEN
1620         REAL :: y, w_hat
1621
1622         IF(k==0.d0) THEN
1623             sigma_integrand=0.d0
1624         ELSE
1625             y=k*R
1626             w_hat=wk_tophat(y)
1627             sigma_integrand=p_lin
1628         END IF
1629
1630         END FUNCTION sigma_integr
1631
1632         FUNCTION sigma_integrand_
1633
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1634

```
1634        !The integrand for the si
1635        IMPLICIT NONE
1636        REAL :: sigma_integrand_t
1637        REAL, INTENT(IN) :: t, R,
1638        INTEGER, INTENT(IN) :: it
1639        TYPE(HM_cosmology), INTEN
1640        REAL :: k, y, w_hat
1641
1642        INTERFACE
1643        FUNCTION f(x)
1644        REAL :: f
1645        REAL, INTENT(IN) :: x
1646        END FUNCTION f
1647        END INTERFACE
1648
1649        !Integrand to the sigma i
1650
1651        IF(t==0.d0) THEN
1652            !t=0 corresponds to k
1653            sigma_integrand_trans
1654        ELSE IF(t==1.d0) THEN
1655            !t=1 corresponds to k
1656            sigma_integrand_trans
1657        ELSE
1658            !f(R) can be *any* fu
1659            k=(-1.d0+1.d0/t)/f(R)
1660            y=k*R
1661            w_hat=wk_tophat(y)
1662            sigma_integrand_trans
1663        END IF
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1664

```
1664
1665        END FUNCTION sigma_integr
1666
1667        FUNCTION sigint0(r,z,ityp
1668
1669            !Integrates between a and
1670            !Stores information to re
1671            IMPLICIT NONE
1672            REAL :: sigint0
1673            REAL, INTENT(IN) :: r, z
1674            INTEGER, INTENT(IN) :: it
1675            TYPE(HM_cosmology), INTEN
1676            REAL, INTENT(IN) :: acc
1677            INTEGER, INTENT(IN) :: io
1678            INTEGER :: i, j
1679            INTEGER :: n
1680            REAL :: x, dx
1681            REAL :: f1, f2, fx
1682            real(dl) :: sum_n, sum_2n
1683            INTEGER, PARAMETER :: jmi
1684            INTEGER, PARAMETER :: jma
1685            REAL, PARAMETER :: a=0.d0
1686            REAL, PARAMETER :: b=1.d0
1687
1688            IF(a==b) THEN
1689
1690                !Fix the answer to ze
1691                sigint0=0.d0
1692
1693            ELSE
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1694

```
1694
1695            !Reset the sum variab
1696            sum_2n=0.d0
1697            sum_n=0.d0
1698            sum_old=0.d0
1699            sum_new=0.d0
1700
1701            DO j=1,jmax
1702
1703                !Note, you need t
1704                !j=1 n=2; j=2 n=3
1705                n=1+2**(j-1)
1706
1707                !Calculate the dx
1708                dx=(b-a)/REAL(n-1
1709
1710                IF(j==1) THEN
1711
1712                    !The first go
1713                    f1=sigma_inte
1714                    f2=sigma_inte
1715                    sum_2n=0.5d0*
1716                    sum_new=sum_2
1717
1718                ELSE
1719
1720                    !Loop over on
1721                    DO i=2,n,2
1722                        x=a+(b-a)
1723                        fx=sigma_
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1724

```
1724                                sum_2n=su
1725                            END DO
1726
1727                            !Now create t
1728                            sum_2n=sum_n/
1729
1730                            !Now calculat
1731                            IF(iorder==1)
1732                                sum_new=s
1733                            ELSE IF(iorde
1734                                sum_new=(
1735                            ELSE
1736                                STOP 'SIG
1737                            END IF
1738
1739                        END IF
1740
1741                        IF((j>=jmin) .AND
1742                            !jmin avoids
1743                            sigint0=REAL(
1744                            EXIT
1745                        ELSE IF(j==jmax)
1746                            STOP 'SIGINT0
1747                        ELSE
1748                            !Integral has
1749                            sum_old=sum_n
1750                            sum_n=sum_2n
1751                            sum_2n=0.d0
1752                        END IF
1753
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1754

```
1754            END DO
1755
1756        END IF
1757
1758        END FUNCTION sigint0
1759
1760        FUNCTION f0_rapid(r)
1761
1762        !This is the 'rapidising'
1763        !for sigma(R). Found by t
1764        IMPLICIT NONE
1765        REAL :: f0_rapid
1766        REAL, INTENT(IN) :: r
1767        REAL :: alpha
1768        REAL, PARAMETER :: rsplit
1769
1770        IF(r>rsplit) THEN
1771            !alpha 0.3-0.5 works
1772            alpha=0.5d0
1773        ELSE
1774            !If alpha=1 this goes
1775            !alpha 0.7-0.9 works
1776            alpha=0.8d0
1777        END IF
1778
1779        f0_rapid=r**alpha
1780
1781        END FUNCTION f0_rapid
1782
1783        FUNCTION sigint1(r,z,ityp
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1784

```
1784
1785        !Integrates between a and
1786        !Stores information to re
1787        IMPLICIT NONE
1788        REAL :: sigint1
1789        REAL, INTENT(IN) :: r, z
1790        INTEGER, INTENT(IN) :: it
1791        TYPE(HM_cosmology), INTEN
1792        REAL, INTENT(IN) :: acc
1793        INTEGER, INTENT(IN) :: io
1794        REAL :: a, b
1795        INTEGER :: i, j
1796        INTEGER :: n
1797        REAL :: x, dx
1798        REAL :: f1, f2, fx
1799        real(dl) :: sum_n, sum_2n
1800        INTEGER, PARAMETER :: jmi
1801        INTEGER, PARAMETER :: jma
1802
1803        a=r/(r+r**.5d0)
1804        b=1.d0
1805
1806        IF(a==b) THEN
1807
1808            !Fix the answer to ze
1809            sigint1=0.d0
1810
1811        ELSE
1812
1813            !Reset the sum variab
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1814

```
1814            sum_2n=0.d0
1815            sum_n=0.d0
1816            sum_old=0.d0
1817            sum_new=0.d0
1818
1819            DO j=1,jmax
1820
1821                !Note, you need t
1822                !j=1 n=2; j=2 n=3
1823                n=1+2**(j-1)
1824
1825                !Calculate the dx
1826                dx=(b-a)/REAL(n-1
1827
1828                IF(j==1) THEN
1829
1830                    !The first go
1831                    f1=sigma_inte
1832                    f2=sigma_inte
1833                    sum_2n=0.5d0*
1834                    sum_new=sum_2
1835
1836                ELSE
1837
1838                    !Loop over on
1839                    DO i=2,n,2
1840                        x=a+(b-a)
1841                        fx=sigma_
1842                        sum_2n=su
1843                    END DO
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1844

```
1844
1845                        !Now create t
1846                        sum_2n=sum_n/
1847
1848                        !Now calculat
1849                        IF(iorder==1)
1850                            sum_new=s
1851                        ELSE IF(iorde
1852                            sum_new=(
1853                        ELSE
1854                            STOP 'SIG
1855                        END IF
1856
1857                    END IF
1858
1859                    IF((j>=jmin) .AND
1860                        !jmin avoids
1861                        sigint1=REAL(
1862                        EXIT
1863                    ELSE IF(j==jmax)
1864                        STOP 'SIGINT1
1865                    ELSE
1866                        !Integral has
1867                        sum_old=sum_n
1868                        sum_n=sum_2n
1869                        sum_2n=0.d0
1870                    END IF
1871
1872                END DO
1873
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1874

```
1874        END IF
1875
1876        END FUNCTION sigint1
1877
1878        FUNCTION f1_rapid(r)
1879
1880        !This is the 'rapidising'
1881        !for sigma(R). Found by t
1882        IMPLICIT NONE
1883        REAL :: f1_rapid
1884        REAL, INTENT(IN) :: r
1885        REAL, PARAMETER :: alpha=
1886
1887        f1_rapid=r**alpha
1888
1889        END FUNCTION f1_rapid
1890
1891        FUNCTION sigint2(r,z,ityp
1892
1893        !Integrates between a and
1894        !Stores information to re
1895        IMPLICIT NONE
1896        REAL :: sigint2
1897        REAL, INTENT(IN) :: r, z
1898        INTEGER, INTENT(IN) :: it
1899        TYPE(HM_cosmology), INTEN
1900        REAL, INTENT(IN) :: acc
1901        INTEGER, INTENT(IN) :: io
1902        REAL :: a, b
1903        INTEGER :: i, j
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1904

```
1904        INTEGER :: n
1905        REAL :: x, dx
1906        REAL :: f1, f2, fx
1907        real(dl) :: sum_n, sum_2n
1908        INTEGER, PARAMETER :: jmi
1909        INTEGER, PARAMETER :: jma
1910        REAL, PARAMETER :: C=10.d
1911
1912        a=1.d0/r
1913        b=C/r
1914
1915        IF(a==b) THEN
1916
1917            !Fix the answer to ze
1918            sigint2=0.d0
1919
1920        ELSE
1921
1922            !Reset the sum variab
1923            sum_2n=0.d0
1924            sum_n=0.d0
1925            sum_old=0.d0
1926            sum_new=0.d0
1927
1928            DO j=1,jmax
1929
1930                !Note, you need t
1931                !j=1 n=2; j=2 n=3
1932                n=1+2**(j-1)
1933
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1934

```
1934                !Calculate the dx
1935                dx=(b-a)/REAL(n-1
1936
1937                IF(j==1) THEN
1938
1939                    !The first go
1940                    f1=sigma_inte
1941                    f2=sigma_inte
1942                    sum_2n=0.5d0*
1943                    sum_new=sum_2
1944
1945                ELSE
1946
1947                    !Loop over on
1948                    DO i=2,n,2
1949                        x=a+(b-a)
1950                        fx=sigma_
1951                        sum_2n=su
1952                    END DO
1953
1954                    !Now create t
1955                    sum_2n=sum_n/
1956
1957                    !Now calculat
1958                    IF(iorder==1)
1959                        sum_new=s
1960                    ELSE IF(iorde
1961                        sum_new=(
1962                    ELSE
1963                        STOP 'SIG
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1964

```
1964                        END IF
1965
1966                    END IF
1967
1968                    IF((j>=jmin) .AND
1969                        !jmin avoids
1970                        sigint2=REAL(
1971                        !WRITE(*,*) '
1972                        EXIT
1973                    ELSE IF(j==jmax)
1974                        STOP 'SIGINT2
1975                    ELSE
1976                        !Integral has
1977                        sum_old=sum_n
1978                        sum_n=sum_2n
1979                        sum_2n=0.d0
1980                    END IF
1981
1982                END DO
1983
1984            END IF
1985
1986            END FUNCTION sigint2
1987
1988            FUNCTION win(k,rv,c)
1989
1990            !Selects the halo window
1991            REAL :: win
1992            REAL, INTENT(IN) :: k, rv
1993
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 1994

```
1994        !Choose the NFW analytic
1995        win=winnfw(k,rv,c)
1996
1997        !Correct for the case of
1998        IF(win>1.) win=1.
1999        IF(win<0.) win=0.
2000
2001        END FUNCTION win
2002
2003        FUNCTION winnfw(k,rv,c)
2004
2005        !The analytic Fourier Tra
2006        REAL :: winnfw
2007        REAL, INTENT(IN) :: k, rv
2008        REAL :: si1, si2, ci1, ci
2009        REAL :: p1, p2, p3
2010
2011        !Define the scale wavenum
2012        ks=k*rv/c
2013
2014        !Sine and cosine integral
2015        si1=Si(ks)
2016        si2=Si((1.+c)*ks)
2017        ci1=Ci(ks)
2018        ci2=Ci((1.+c)*ks)
2019
2020        !These three parts sum to
2021        p1=cos(ks)*(ci2-ci1)
2022        p2=sin(ks)*(si2-si1)
2023        p3=sin(ks*c)/(ks*(1.+c))
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2024

```
2024
2025        !Create full W(k) and div
2026        winnfw=p1+p2-p3
2027        winnfw=winnfw/mass(c)
2028
2029        END FUNCTION winnfw
2030
2031        FUNCTION mass(c)
2032
2033        !This calculates the (nor
2034        !The 'normalised' mass is
2035        !where rho_n is the profi
2036        REAL :: mass
2037        REAL, INTENT(IN) :: c
2038
2039        mass=log(1.+c)-c/(1.+c)
2040
2041        END FUNCTION mass
2042
2043        FUNCTION gnu(nu)
2044
2045        !Select the mass function
2046        REAL :: gnu
2047        REAL, INTENT(IN) :: nu
2048
2049        !Sheth & Torman (1999)
2050        gnu=gst(nu)
2051
2052        END FUNCTION gnu
2053
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2054

```
2054       FUNCTION gst(nu)
2055
2056       !Sheth & Tormen (1999) ma
2057       REAL :: gst
2058       REAL, INTENT(IN) :: nu
2059       REAL :: p, a, bigA
2060
2061       !Note I use nu=dc/sigma w
2062       !This accounts for the di
2063       !f(nu^2)d(nu^2)=2*nu*f(nu
2064
2065       !Sheth & Tormen fitting n
2066       p=0.3
2067       a=0.707
2068       bigA=0.21616
2069
2070       !Full mass function. Note
2071       gst=bigA*(1.+((a*nu*nu)**
2072
2073       END FUNCTION gst
2074
2075       FUNCTION Hubble2(z,cosm)
2076
2077       !This calculates the dime
2078       !Ignores contributions fr
2079       REAL :: Hubble2
2080       REAL, INTENT(IN) :: z
2081       TYPE(HM_cosmology), INTEN
2082       REAL :: a
2083
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2084

```
2084        a=1./(1.+z)
2085
2086        Hubble2=cosm%om_m*(1.+z)*
2087
2088        END FUNCTION Hubble2
2089
2090        FUNCTION X_de(a,cosm)
2091
2092        !The time evolution for d
2093        !X(a)=1 for LCDM but chan
2094        REAL :: X_de
2095        REAL, INTENT(IN) :: a
2096        TYPE(HM_cosmology), INTEN
2097
2098        X_de=(a**(-3.*(1.+cosm%w+
2099
2100        END FUNCTION X_de
2101
2102        FUNCTION w_de_hm(a,cosm)
2103
2104        !The dark energy w(a) fun
2105        REAL :: w_de_hm
2106        REAL, INTENT(IN) :: a
2107        TYPE(HM_cosmology), INTEN
2108
2109        w_de_hm=cosm%w+(1.-a)*cos
2110
2111        END FUNCTION w_de_hm
2112
2113        FUNCTION Omega_m_hm(z,cos
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2114

```
2114
2115        !This calculates omega_m
2116        REAL :: Omega_m_hm
2117        REAL, INTENT(IN) :: z
2118        REAL :: om_m, a
2119        TYPE(HM_cosmology), INTEN
2120
2121        om_m=cosm%om_m
2122        Omega_m_hm=(om_m*(1.+z)**
2123
2124        END FUNCTION Omega_m_hm
2125
2126        FUNCTION grow(z,cosm)
2127
2128        !Finds the scale-independ
2129        REAL :: grow
2130        REAL, INTENT(IN) :: z
2131        REAL :: a
2132        TYPE(HM_cosmology), INTEN
2133
2134        IF(z==0.) THEN
2135            grow=1.
2136        ELSE
2137            a=1./(1.+z)
2138            grow=find(a,cosm%a_gr
2139        END IF
2140
2141        END FUNCTION grow
2142
2143        FUNCTION dispint(R,z,cosm
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2144

```
2144
2145        !Integrates between a and
2146        !Stores information to re
2147        IMPLICIT NONE
2148        REAL :: dispint
2149        REAL, INTENT(IN) :: z, R
2150        TYPE(HM_cosmology), INTEN
2151        REAL :: a, b
2152        INTEGER :: i, j
2153        INTEGER :: n
2154        REAL :: x, dx
2155        REAL :: f1, f2, fx
2156        real(dl) :: sum_n, sum_2n
2157        INTEGER, PARAMETER :: jmi
2158        INTEGER, PARAMETER :: jma
2159        REAL, PARAMETER :: acc=1d
2160        INTEGER, PARAMETER :: ior
2161
2162        !Integration range for in
2163        !Note 0 -> infinity in k
2164        a=0.d0
2165        b=1.d0
2166
2167        IF(a==b) THEN
2168
2169            !Fix the answer to ze
2170            dispint=0.
2171
2172        ELSE
2173
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2174

```
2174            !Reset the sum variab
2175            sum_2n=0.d0
2176            sum_n=0.d0
2177            sum_old=0.d0
2178            sum_new=0.d0
2179
2180            DO j=1,jmax
2181
2182                !Note, you need t
2183                !j=1 n=2; j=2 n=3
2184                n=1+2**(j-1)
2185
2186                !Calculate the dx
2187                dx=(b-a)/REAL(n-1
2188
2189                IF(j==1) THEN
2190
2191                    !The first go
2192                    f1=dispint_in
2193                    f2=dispint_in
2194                    sum_2n=0.5d0*
2195                    sum_new=sum_2
2196
2197                ELSE
2198
2199                    !Loop over on
2200                    DO i=2,n,2
2201                        x=a+(b-a)
2202                        fx=dispin
2203                        sum_2n=su
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2204

```
2204                        END DO
2205
2206                        !Now create t
2207                        sum_2n=sum_n/
2208
2209                        !Now calculat
2210                        IF(iorder==1)
2211                            sum_new=s
2212                        ELSE IF(iorde
2213                            sum_new=(
2214                        ELSE
2215                            STOP 'DIS
2216                        END IF
2217
2218                    END IF
2219
2220                    IF((j>=jmin) .AND
2221                        !jmin avoids
2222                        dispint=REAL(
2223                        EXIT
2224                    ELSE IF(j==jmax)
2225                        STOP 'DISPINT
2226                    ELSE
2227                        !Integral has
2228                        sum_old=sum_n
2229                        sum_n=sum_2n
2230                        sum_2n=0.d0
2231                    END IF
2232
2233                END DO
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2234

```
2234
2235        END IF
2236
2237        END FUNCTION dispint
2238
2239        FUNCTION dispint_integran
2240
2241        !This is the integrand fo
2242        IMPLICIT NONE
2243        REAL :: dispint_integrand
2244        REAL, INTENT(IN) :: theta
2245        TYPE(HM_cosmology), INTEN
2246        REAL :: k
2247        REAL, PARAMETER :: alpha=
2248        REAL, PARAMETER :: Rsplit
2249
2250        !Note that I have not inc
2251        !The choice of alpha=1.65
2252        !Rsplit=10 is thoughlessl
2253        !Including this seems to
2254
2255        IF(theta==0. .OR. theta==
2256            dispint_integrand=0.
2257        ELSE
2258            !IF(r>Rsplit) THEN
2259            !   k=(-1.d0+1.d0/the
2260            !ELSE
2261            k=(-1.+1./theta)
2262            !END IF
2263            dispint_integrand=(p_
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2264

```
2264       END IF
2265
2266       END FUNCTION dispint_inte
2267
2268       FUNCTION Si(x)
2269
2270       !Calculates the 'sine int
2271       REAL :: Si
2272       REAL, INTENT(IN) :: x
2273       REAL(dl) :: x2, y, f, g,
2274       REAL(dl), PARAMETER :: pi
2275
2276       !Expansions for high and
2277       IF(ABS(x)<=4.) THEN
2278
2279          x2=x*x
2280
2281          si8 = x*(1.d0+x2*(-4.
2282              +x2*(-1.410185368
2283              +x2*(7.0824028227
2284              (1.+x2*(1.0116214
2285              x2*(1.55654986308
2286              +x2*(3.2110705119
2287
2288          Si=si8
2289
2290       ELSE IF(ABS(x)>4.) THEN
2291
2292          y=1.d0/(x*x)
2293
```


/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2294
2294 f = (1.d0 + y*(7.4443
2295 y*(2.377503101254
2296 + y*(6.4053383057
2297 y*(1.007951829803
2298 y*(-4.94701168645
2299 y*(1.978652470315
2300 y*(1.474789521929
2301 y*(7.085013081495
2302 y*(1.434685491715
2303
2304
2305 g = y*(1.d0 + y*(8.13
2306 y*(3.125575707957
2307 y*(1.090495284503
2308 y*(6.432916131430
2309 (1. + y*(8.195952
2310 + y*(2.2335554327
2311 + y*(1.1716472337
2312
2313 Si=pi/2.d0-f*cos(x)-g
2314
2315 END IF
2316
2317 END FUNCTION Si
2318
2319 FUNCTION Ci(x)
2320
2321 !Calculates the 'cosine i
2322 REAL :: Ci
2323 REAL, INTENT(IN) :: x


```
2324        REAL(dl) :: x2, y, f, g,
2325        REAL(dl), PARAMETER :: em
2326
2327        !Expansions for high and
2328        IF(ABS(x)<=4.) THEN
2329
2330            x2=x*x
2331
2332            ci8=em_const+log(x)+x
2333                +x2*(1.0529736384
2334                +x2*(-9.937284888
2335                x2*(6.72126800814
2336                x2*(1.38536352772
2337
2338            Ci=ci8
2339
2340        ELSE IF(ABS(x)>4.) THEN
2341
2342            y=1./(x*x)
2343
2344            f = (1.d0 + y*(7.4443
2345                y*(2.377503101254
2346                + y*(6.4053383057
2347                + y*(4.9481668819
2348                (x*(1. +y*(7.4643
2349                y*(2.415356701651
2350                y*(4.585951158477
2351                + y*(1.4346854917
2352
2353            g = y*(1.d0 + y*(8.13
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2354

```
2354                  + y*(2.0629759514
2355                  y*(1.090495284503
2356                  y*(1.810044874646
2357                  / (1. + y*(8.1959
2358                  y*(3.260266616470
2359                  + y*(1.3986671069
2360
2361              Ci=f*sin(x)-g*cos(x)
2362
2363          END IF
2364
2365          END FUNCTION Ci
2366
2367          FUNCTION derivative_table
2368
2369          !Takes the derivative y'(
2370          REAL :: derivative_table
2371          INTEGER, INTENT(IN) :: n
2372          REAL, INTENT(IN) :: x, xi
2373          REAL, ALLOCATABLE ::  xta
2374          REAL :: a, b, c, d
2375          REAL :: x1, x2, x3, x4
2376          REAL :: y1, y2, y3, y4
2377          INTEGER :: i
2378          INTEGER, INTENT(IN) :: im
2379
2380          !This version interpolate
2381          !Care should be chosen to
2382          !Results from the interpo
2383
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2384

```
2384        !imeth = 1 => find x in x
2385        !imeth = 2 => find x in x
2386        !imeth = 3 => find x in x
2387
2388        !iorder = 1 => linear int
2389        !iorder = 2 => quadratic
2390        !iorder = 3 => cubic inte
2391
2392        ALLOCATE(xtab(n),ytab(n))
2393
2394        xtab=xin
2395        ytab=yin
2396
2397        IF(xtab(1)>xtab(n)) THEN
2398            !Reverse the arrays i
2399            CALL reverse(xtab,n)
2400            CALL reverse(ytab,n)
2401        END IF
2402
2403        IF(iorder==1) THEN
2404
2405            IF(n<2) ERROR STOP 'D
2406
2407            IF(x<=xtab(2)) THEN
2408
2409                x2=xtab(2)
2410                x1=xtab(1)
2411
2412                y2=ytab(2)
2413                y1=ytab(1)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2414

```
2414
2415            ELSE IF (x>=xtab(n-1)
2416
2417                x2=xtab(n)
2418                x1=xtab(n-1)
2419
2420                y2=ytab(n)
2421                y1=ytab(n-1)
2422
2423            ELSE
2424
2425                i=table_integer(x
2426
2427                x2=xtab(i+1)
2428                x1=xtab(i)
2429
2430                y2=ytab(i+1)
2431                y1=ytab(i)
2432
2433            END IF
2434
2435            CALL fit_line(a,b,x1,
2436            derivative_table=a
2437
2438        ELSE IF(iorder==2) THEN
2439
2440            IF(n<3) ERROR STOP 'D
2441
2442            IF(x<=xtab(2) .OR. x>
2443
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2444

```
2444                    IF(x<=xtab(2)) TH
2445
2446                        x3=xtab(3)
2447                        x2=xtab(2)
2448                        x1=xtab(1)
2449
2450                        y3=ytab(3)
2451                        y2=ytab(2)
2452                        y1=ytab(1)
2453
2454                    ELSE IF (x>=xtab(
2455
2456                        x3=xtab(n)
2457                        x2=xtab(n-1)
2458                        x1=xtab(n-2)
2459
2460                        y3=ytab(n)
2461                        y2=ytab(n-1)
2462                        y1=ytab(n-2)
2463
2464                    END IF
2465
2466                    CALL fit_quadrati
2467
2468                    derivative_table=
2469
2470                ELSE
2471
2472                    i=table_integer(x
2473
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2474

```
2474                    x1=xtab(i-1)
2475                    x2=xtab(i)
2476                    x3=xtab(i+1)
2477                    x4=xtab(i+2)
2478
2479                    y1=ytab(i-1)
2480                    y2=ytab(i)
2481                    y3=ytab(i+1)
2482                    y4=ytab(i+2)
2483
2484                    !In this case tak
2485
2486                    derivative_table=
2487
2488                    CALL fit_quadrati
2489                    derivative_table=
2490
2491                    CALL fit_quadrati
2492                    derivative_table=
2493
2494                END IF
2495
2496            ELSE IF(iorder==3) THEN
2497
2498                IF(n<4) ERROR STOP 'D
2499
2500                IF(x<=xtab(3)) THEN
2501
2502                    x4=xtab(4)
2503                    x3=xtab(3)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2504

```
2504                    x2=xtab(2)
2505                    x1=xtab(1)
2506
2507                    y4=ytab(4)
2508                    y3=ytab(3)
2509                    y2=ytab(2)
2510                    y1=ytab(1)
2511
2512                ELSE IF (x>=xtab(n-2)
2513
2514                    x4=xtab(n)
2515                    x3=xtab(n-1)
2516                    x2=xtab(n-2)
2517                    x1=xtab(n-3)
2518
2519                    y4=ytab(n)
2520                    y3=ytab(n-1)
2521                    y2=ytab(n-2)
2522                    y1=ytab(n-3)
2523
2524                ELSE
2525
2526                    i=table_integer(x
2527
2528                    x1=xtab(i-1)
2529                    x2=xtab(i)
2530                    x3=xtab(i+1)
2531                    x4=xtab(i+2)
2532
2533                    y1=ytab(i-1)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2534

```
2534                 y2=ytab(i)
2535                 y3=ytab(i+1)
2536                 y4=ytab(i+2)
2537
2538             END IF
2539
2540             CALL fit_cubic(a,b,c,
2541             derivative_table=3.*a
2542
2543         ELSE
2544
2545             ERROR STOP 'DERIVATIV
2546
2547         END IF
2548
2549         END FUNCTION derivative_t
2550
2551         FUNCTION find(x,xin,yin,n
2552
2553         !Given two arrays x and y
2554         IMPLICIT NONE
2555         REAL :: find
2556         INTEGER, INTENT(IN) :: n
2557         REAL, INTENT(IN) :: x, xi
2558         REAL, ALLOCATABLE ::  xta
2559         REAL :: a, b, c, d
2560         REAL :: x1, x2, x3, x4
2561         REAL :: y1, y2, y3, y4
2562         INTEGER :: i
2563         INTEGER, INTENT(IN) :: io
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2564

```
2564
2565      !This version interpolate
2566      !Care should be chosen to
2567      !Results from the interpo
2568
2569      !If the value required is
2570
2571      !iorder = 1 => linear int
2572      !iorder = 2 => quadratic
2573      !iorder = 3 => cubic inte
2574
2575      !ifind = 1 => find x in x
2576      !ifind = 2 => find x in x
2577      !ifind = 3 => find x in x
2578
2579      !imeth = 1 => Uses cubic
2580      !imeth = 2 => Uses Lagran
2581
2582      ALLOCATE(xtab(n),ytab(n))
2583
2584      xtab=xin
2585      ytab=yin
2586
2587      IF(xtab(1)>xtab(n)) THEN
2588          !Reverse the arrays i
2589          CALL reverse(xtab,n)
2590          CALL reverse(ytab,n)
2591      END IF
2592
2593      IF(x<xtab(1)) THEN
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2594

```
2594
2595            !Do a linear interpol
2596
2597            x1=xtab(1)
2598            x2=xtab(2)
2599
2600            y1=ytab(1)
2601            y2=ytab(2)
2602
2603            IF(imeth==1) THEN
2604                CALL fit_line(a,b
2605                find=a*x+b
2606            ELSE IF(imeth==2) THE
2607                find=Lagrange_pol
2608            ELSE
2609                STOP 'FIND: Error
2610            END IF
2611
2612        ELSE IF(x>xtab(n)) THEN
2613
2614            !Do a linear interpol
2615
2616            x1=xtab(n-1)
2617            x2=xtab(n)
2618
2619            y1=ytab(n-1)
2620            y2=ytab(n)
2621
2622            IF(imeth==1) THEN
2623                CALL fit_line(a,b
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2624

```
2624                find=a*x+b
2625             ELSE IF(imeth==2) THE
2626                find=Lagrange_pol
2627             ELSE
2628                STOP 'FIND: Error
2629             END IF
2630
2631          ELSE IF(iorder==1) THEN
2632
2633             IF(n<2) STOP 'FIND: N
2634
2635             IF(x<=xtab(2)) THEN
2636
2637                x1=xtab(1)
2638                x2=xtab(2)
2639
2640                y1=ytab(1)
2641                y2=ytab(2)
2642
2643             ELSE IF (x>=xtab(n-1)
2644
2645                x1=xtab(n-1)
2646                x2=xtab(n)
2647
2648                y1=ytab(n-1)
2649                y2=ytab(n)
2650
2651             ELSE
2652
2653                i=table_integer(x
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2654

```
2654
2655                    x1=xtab(i)
2656                    x2=xtab(i+1)
2657
2658                    y1=ytab(i)
2659                    y2=ytab(i+1)
2660
2661                ENDIF
2662
2663                IF(imeth==1) THEN
2664                    CALL fit_line(a,b
2665                    find=a*x+b
2666                ELSE IF(imeth==2) THE
2667                    find=Lagrange_pol
2668                ELSE
2669                    STOP 'FIND: Error
2670                END IF
2671
2672            ELSE IF(iorder==2) THEN
2673
2674                IF(n<3) STOP 'FIND: N
2675
2676                IF(x<=xtab(2) .OR. x>
2677
2678                    IF(x<=xtab(2)) TH
2679
2680                        x1=xtab(1)
2681                        x2=xtab(2)
2682                        x3=xtab(3)
2683
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2684

```
2684                        y1=ytab(1)
2685                        y2=ytab(2)
2686                        y3=ytab(3)
2687
2688                    ELSE IF (x>=xtab(
2689
2690                        x1=xtab(n-2)
2691                        x2=xtab(n-1)
2692                        x3=xtab(n)
2693
2694                        y1=ytab(n-2)
2695                        y2=ytab(n-1)
2696                        y3=ytab(n)
2697
2698                    END IF
2699
2700                    IF(imeth==1) THEN
2701                        CALL fit_quad
2702                        find=a*(x**2)
2703                    ELSE IF(imeth==2)
2704                        find=Lagrange
2705                    ELSE
2706                        STOP 'FIND: E
2707                    END IF
2708
2709                ELSE
2710
2711                    i=table_integer(x
2712
2713                    x1=xtab(i-1)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2714

```
2714                    x2=xtab(i)
2715                    x3=xtab(i+1)
2716                    x4=xtab(i+2)
2717
2718                    y1=ytab(i-1)
2719                    y2=ytab(i)
2720                    y3=ytab(i+1)
2721                    y4=ytab(i+2)
2722
2723                    IF(imeth==1) THEN
2724                        !In this case
2725                        CALL fit_quad
2726                        find=(a*x**2+
2727                        CALL fit_quad
2728                        find=find+(a*
2729                    ELSE IF(imeth==2)
2730                        !In this case
2731                        find=(Lagrang
2732                    ELSE
2733                        STOP 'FIND: E
2734                    END IF
2735
2736                ELSE IF
2737
2738            ELSE IF(iorder==3) THEN
2739
2740                IF(n<4) STOP 'FIND: N
2741
2742                IF(x<=xtab(3)) THEN
2743
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2744

```
2744                    x1=xtab(1)
2745                    x2=xtab(2)
2746                    x3=xtab(3)
2747                    x4=xtab(4)
2748
2749                    y1=ytab(1)
2750                    y2=ytab(2)
2751                    y3=ytab(3)
2752                    y4=ytab(4)
2753
2754                ELSE IF (x>=xtab(n-2)
2755
2756                    x1=xtab(n-3)
2757                    x2=xtab(n-2)
2758                    x3=xtab(n-1)
2759                    x4=xtab(n)
2760
2761                    y1=ytab(n-3)
2762                    y2=ytab(n-2)
2763                    y3=ytab(n-1)
2764                    y4=ytab(n)
2765
2766                ELSE
2767
2768                    i=table_integer(x
2769
2770                    x1=xtab(i-1)
2771                    x2=xtab(i)
2772                    x3=xtab(i+1)
2773                    x4=xtab(i+2)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2774

```
2774
2775                y1=ytab(i-1)
2776                y2=ytab(i)
2777                y3=ytab(i+1)
2778                y4=ytab(i+2)
2779
2780            END IF
2781
2782            IF(imeth==1) THEN
2783                CALL fit_cubic(a,
2784                find=a*x**3+b*x**
2785            ELSE IF(imeth==2) THE
2786                find=Lagrange_pol
2787            ELSE
2788                STOP 'FIND: Error
2789            END IF
2790
2791        ELSE
2792
2793            STOP 'FIND: Error, in
2794
2795        END IF
2796
2797        END FUNCTION find
2798
2799        FUNCTION table_integer(x,
2800
2801        !Chooses between ways to
2802        IMPLICIT NONE
2803        INTEGER :: table_integer
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2804

```
2804        INTEGER, INTENT(IN) :: n
2805        REAL, INTENT(IN) :: x, xt
2806        INTEGER, INTENT(IN) :: im
2807
2808        IF(imeth==1) THEN
2809            table_integer=linear_
2810        ELSE IF(imeth==2) THEN
2811            table_integer=search_
2812        ELSE IF(imeth==3) THEN
2813            table_integer=int_spl
2814        ELSE
2815            STOP 'TABLE INTEGER:
2816        END IF
2817
2818        END FUNCTION table_intege
2819
2820        FUNCTION linear_table_int
2821
2822        !Assuming the table is ex
2823        IMPLICIT NONE
2824        INTEGER :: linear_table_i
2825        INTEGER, INTENT(IN) :: n
2826        REAL, INTENT(IN) :: x, xt
2827        REAL :: x1, x2, xn
2828        REAL, PARAMETER :: acc=1d
2829
2830        !Returns the integer (tab
2831        !eg. if x(3)=6. and x(4)=
2832        !Assumes table is organis
2833
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2834

```
2834        !n=SIZE(xtab)
2835        x1=xtab(1)
2836        x2=xtab(2)
2837        xn=xtab(n)
2838
2839        IF(x1>xn) STOP 'LINEAR_TA
2840        IF(ABS(-1.+float(n-1)*(x2
2841
2842        linear_table_integer=1+FL
2843
2844        END FUNCTION linear_table
2845
2846        FUNCTION search_int(x,xta
2847
2848        !Does a stupid search thr
2849        IMPLICIT NONE
2850        INTEGER :: search_int
2851        INTEGER, INTENT(IN) :: n
2852        REAL, INTENT(IN) :: x, xt
2853        INTEGER :: i
2854
2855        IF(xtab(1)>xtab(n)) STOP
2856
2857        DO i=1,n
2858            IF(x>=xtab(i) .AND. x
2859        END DO
2860
2861        search_int=i
2862
2863        END FUNCTION search_int
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2864

```
2864
2865        FUNCTION int_split(x,xtab
2866
2867        !Finds the position of th
2868        IMPLICIT NONE
2869        INTEGER :: int_split
2870        INTEGER, INTENT(IN) :: n
2871        REAL, INTENT(IN) :: x, xt
2872        INTEGER :: i1, i2, imid
2873
2874        IF(xtab(1)>xtab(n)) STOP
2875
2876        i1=1
2877        i2=n
2878
2879        DO
2880
2881            imid=NINT((i1+i2)/2.)
2882
2883            IF(x<xtab(imid)) THEN
2884                i2=imid
2885            ELSE
2886                i1=imid
2887            END IF
2888
2889            IF(i2==i1+1) EXIT
2890
2891        END DO
2892
2893        int_split=i1
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2894

```
2894
2895        END FUNCTION int_split
2896
2897        SUBROUTINE fit_line(a1,a0
2898
2899        !Given xi, yi i=1,2 fits
2900        IMPLICIT NONE
2901        REAL, INTENT(OUT) :: a0,
2902        REAL, INTENT(IN) :: x1, y
2903
2904        a1=(y2-y1)/(x2-x1)
2905        a0=y1-a1*x1
2906
2907        END SUBROUTINE fit_line
2908
2909        SUBROUTINE fit_quadratic(
2910
2911        !Given xi, yi i=1,2,3 fit
2912        IMPLICIT NONE
2913        REAL, INTENT(OUT) :: a0,
2914        REAL, INTENT(IN) :: x1, y
2915
2916        a2=((y2-y1)/(x2-x1)-(y3-y
2917        a1=(y2-y1)/(x2-x1)-a2*(x2
2918        a0=y1-a2*(x1**2)-a1*x1
2919
2920        END SUBROUTINE fit_quadra
2921
2922        SUBROUTINE fit_cubic(a,b,
2923
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2924

```
2924         !Given xi, yi i=1,2,3,4 f
2925         IMPLICIT NONE
2926         REAL, INTENT(OUT) :: a, b
2927         REAL, INTENT(IN) :: x1, y
2928         REAL :: f1, f2, f3
2929
2930         f1=(y4-y1)/((x4-x2)*(x4-x
2931         f2=(y3-y1)/((x3-x2)*(x3-x
2932         f3=(y2-y1)/((x2-x1)*(x4-x
2933
2934         a=f1-f2-f3
2935
2936         f1=(y3-y1)/((x3-x2)*(x3-x
2937         f2=(y2-y1)/((x2-x1)*(x3-x
2938         f3=a*(x3+x2+x1)
2939
2940         b=f1-f2-f3
2941
2942         f1=(y4-y1)/(x4-x1)
2943         f2=a*(x4**2+x4*x1+x1**2)
2944         f3=b*(x4+x1)
2945
2946         c=f1-f2-f3
2947
2948         d=y1-a*x1**3-b*x1**2-c*x1
2949
2950         END SUBROUTINE fit_cubic
2951
2952         FUNCTION Lagrange_polynom
2953
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2954

```
2954        !Computes the result of t
2955        IMPLICIT NONE
2956        REAL :: Lagrange_polynomi
2957        REAL, INTENT(IN) :: x, xv
2958        REAL :: l(n+1)
2959        INTEGER, INTENT(IN) :: n
2960        INTEGER :: i, j
2961
2962        !Initialise variables, on
2963        Lagrange_polynomial=0.
2964        l=1.
2965
2966        !Loops to find the polyno
2967        DO i=0,n
2968            DO j=0,n
2969                IF(i .NE. j) l(i+
2970            END DO
2971            Lagrange_polynomial=L
2972        END DO
2973
2974        END FUNCTION Lagrange_pol
2975
2976        SUBROUTINE reverse(arry,n
2977
2978        !This reverses the conten
2979        IMPLICIT NONE
2980        INTEGER, INTENT(IN) :: n
2981        REAL, INTENT(INOUT) :: ar
2982        INTEGER :: i
2983        REAL, ALLOCATABLE :: hold
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 2984

```
2984
2985        ALLOCATE(hold(n))
2986
2987        hold=arry
2988
2989        DO i=1,n
2990            arry(i)=hold(n-i+1)
2991        END DO
2992
2993        DEALLOCATE(hold)
2994
2995        END SUBROUTINE reverse
2996
2997        SUBROUTINE fill_growtab(c
2998
2999        !Fills a table of values
3000        TYPE(HM_cosmology) :: cos
3001        INTEGER :: i
3002        REAL :: a, norm
3003        REAL, ALLOCATABLE :: d_ta
3004        REAL :: ainit, amax, dini
3005        REAL :: acc
3006        INTEGER, PARAMETER :: n=6
3007
3008        !The calculation should s
3009        !of starting in the g\pro
3010        ainit=0.001
3011        !Final should be a=1. unl
3012        amax=1.
3013
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3014

```
3014        !These set the initial co
3015        dinit=ainit
3016        vinit=1.
3017
3018        !Overall accuracy for the
3019        acc=1d-3
3020
3021        IF(HM_verbose) WRITE(*,*)
3022        CALL ode_growth(d_tab,v_t
3023        IF(HM_verbose) WRITE(*,*)
3024
3025        !Normalise so that g(z=0)
3026        norm=find(1.,a_tab,d_tab,
3027        IF(HM_verbose) WRITE(*,*)
3028        d_tab=d_tab/norm
3029
3030        !Could use some table-int
3031        IF(ALLOCATED(cosm%a_growt
3032        IF(ALLOCATED(cosm%growth)
3033
3034        cosm%ng=n
3035        ALLOCATE(cosm%a_growth(n)
3036        DO i=1,n
3037            a=ainit+(amax-ainit)*
3038            cosm%a_growth(i)=a
3039            cosm%growth(i)=find(a
3040        END DO
3041
3042        IF(HM_verbose) WRITE(*,*)
3043        IF(HM_verbose) WRITE(*,*)
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3044

```
3044
3045      END SUBROUTINE fill_growt
3046
3047      SUBROUTINE ode_growth(x,v
3048
3049          !Solves 2nd order ODE x''
3050          IMPLICIT NONE
3051          REAL :: xi, ti, tf, dt, a
3052          REAL :: kx1, kx2, kx3, kx
3053          REAL(dl), ALLOCATABLE ::
3054          REAL, ALLOCATABLE :: x(:)
3055          INTEGER :: i, j, k, n, np
3056          TYPE(HM_cosmology) :: cos
3057          INTEGER, PARAMETER :: jma
3058          INTEGER, PARAMETER :: nin
3059
3060          !xi and vi are the initia
3061          !fx is what x' is equal t
3062          !fv is what v' is equal t
3063          !acc is the desired accur
3064          !imeth selects method
3065
3066          IF(ALLOCATED(x)) DEALLOCA
3067          IF(ALLOCATED(v)) DEALLOCA
3068          IF(ALLOCATED(t)) DEALLOCA
3069
3070          DO j=1,jmax
3071
3072              !Set the number of po
3073              n=ninit*(2**(j-1))
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3074

```
3074            n=n+1
3075
3076            !Allocate arrays
3077            ALLOCATE(x8(n),t8(n),
3078
3079            !Set the arrays to in
3080            x8=0.d0
3081            t8=0.d0
3082            v8=0.d0
3083
3084            !Set the intial condi
3085            x8(1)=xi
3086            v8(1)=vi
3087
3088            !Fill up a table for
3089            CALL fill_table8(DBLE
3090
3091            !Set the time interva
3092            dt=(tf-ti)/float(n-1)
3093
3094            !Intially fix this to
3095            ifail=0
3096
3097            DO i=1,n-1
3098
3099                x4=real(x8(i))
3100                v4=real(v8(i))
3101                t4=real(t8(i))
3102
3103                IF(imeth==1) THEN
```

```
3104
3105                                    !Crude method
3106                                    kx1=dt*fd(x4,
3107                                    kv1=dt*fv(x4,
3108
3109                                    x8(i+1)=x8(i)
3110                                    v8(i+1)=v8(i)
3111
3112                                ELSE IF(imeth==2)
3113
3114                                    !Mid-point me
3115                                    !2017/06/18 -
3116                                    kx1=dt*fd(x4,
3117                                    kv1=dt*fv(x4,
3118                                    kx2=dt*fd(x4+
3119                                    kv2=dt*fv(x4+
3120
3121                                    x8(i+1)=x8(i)
3122                                    v8(i+1)=v8(i)
3123
3124                                ELSE IF(imeth==3)
3125
3126                                    !4th order Ru
3127                                    kx1=dt*fd(x4,
3128                                    kv1=dt*fv(x4,
3129                                    kx2=dt*fd(x4+
3130                                    kv2=dt*fv(x4+
3131                                    kx3=dt*fd(x4+
3132                                    kv3=dt*fv(x4+
3133                                    kx4=dt*fd(x4+
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3134

```
3134                        kv4=dt*fv(x4+
3135
3136                        x8(i+1)=x8(i)
3137                        v8(i+1)=v8(i)
3138
3139                    END IF
3140
3141                    !t8(i+1)=t8(i)+dt
3142
3143                END DO
3144
3145                IF(j==1) ifail=1
3146
3147                IF(j .NE. 1) THEN
3148
3149                    np=1+(n-1)/2
3150
3151                    DO k=1,1+(n-1)/2
3152
3153                        kn=2*k-1
3154
3155                        IF(ifail==0)
3156
3157                            IF(xh(k)>
3158                            IF(vh(k)>
3159
3160                            IF(ifail=
3161                                DEALL
3162                                EXIT
3163                            END IF
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3164

```
3164
3165                        END IF
3166                    END DO
3167
3168                END IF
3169
3170                IF(ifail==0) THEN
3171                    ALLOCATE(x(n),t(n
3172                    x=real(x8)
3173                    v=real(v8)
3174                    t=real(t8)
3175                    EXIT
3176                END IF
3177
3178                ALLOCATE(xh(n),th(n),
3179                xh=x8
3180                vh=v8
3181                th=t8
3182                DEALLOCATE(x8,t8,v8)
3183
3184            END DO
3185
3186            END SUBROUTINE ode_growth
3187
3188            FUNCTION fv(d,v,k,a,cosm)
3189
3190            !v'=f(v) in ODE solver
3191            REAL :: fv
3192            REAL, INTENT(IN) :: d, v,
3193            REAL :: f1, f2, z
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

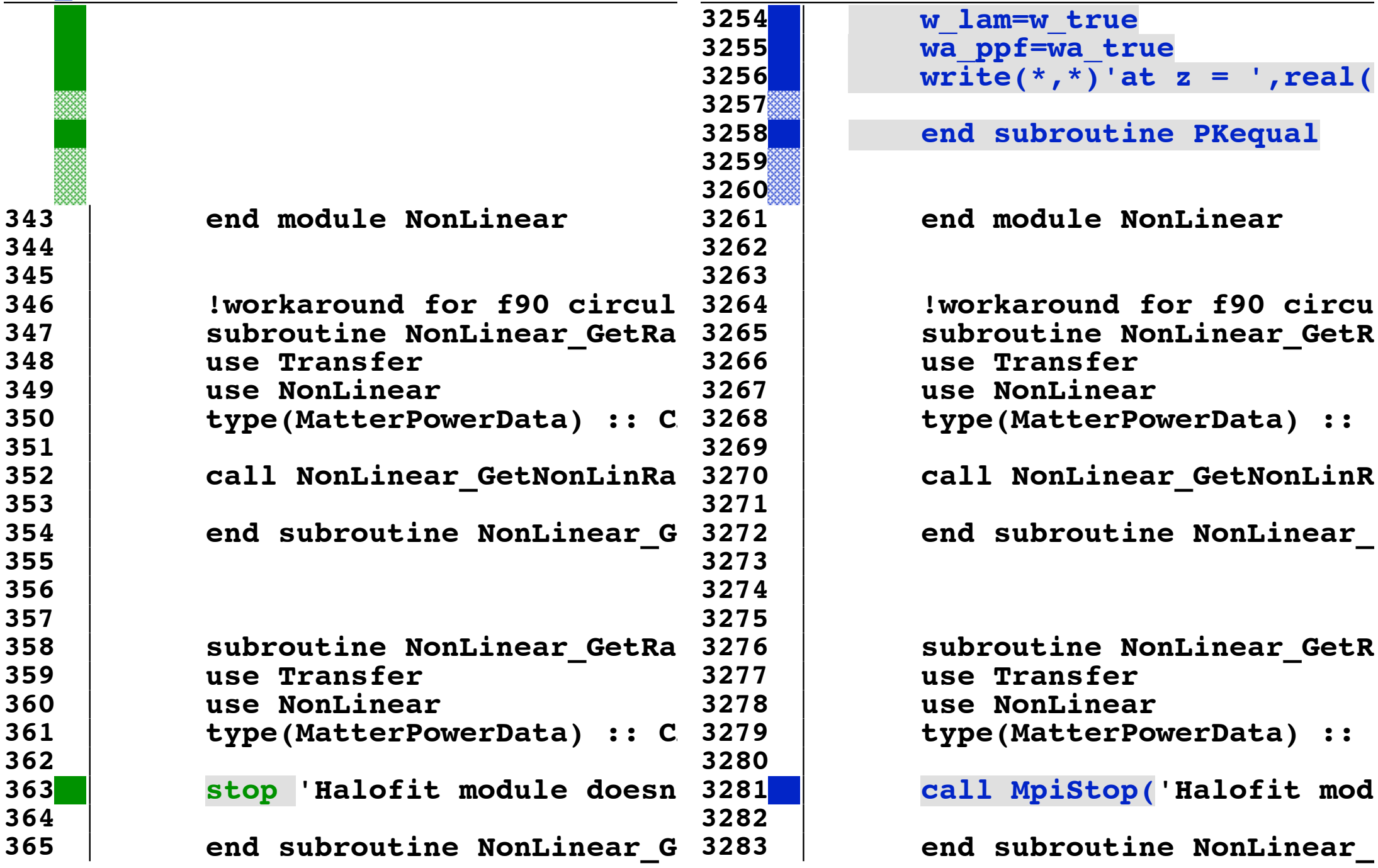
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3194

```
3194        TYPE(HM_cosmology), INTEN
3195
3196        z=-1.+(1./a)
3197
3198        f1=3.*Omega_m_hm(z,cosm)*
3199        f2=(2.+AH(z,cosm)/Hubble2
3200
3201        fv=f1-f2
3202
3203        END FUNCTION fv
3204
3205        FUNCTION fd(d,v,k,a,cosm)
3206
3207        !d'=f(d) in ODE solver
3208        REAL :: fd
3209        REAL, INTENT(IN) :: d, v,
3210        TYPE(HM_cosmology), INTEN
3211
3212        fd=v
3213
3214        END FUNCTION fd
3215
3216        FUNCTION AH(z,cosm)
3217
3218        !The Hubble acceleration
3219        REAL :: AH
3220        REAL, INTENT(IN) :: z
3221        REAL :: a
3222        TYPE(HM_cosmology), INTEN
3223
```

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3224

```
3224        a=1./(1.+z)
3225        AH=cosm%om_m*(a**(-3.))+c
3226        AH=-AH/2.
3227
3228        END FUNCTION AH
3229
3230        !!AM End HMcode
3231
3232        subroutine PKequal(redshi
3233        !used by halofit_casarini
3234        implicit none
3235        real(dl) :: redshift,w_la
3236        real(dl) :: z_star,tau_st
3237
3238        z_star=ThermoDerivedParam
3239        tau_star=TimeOfz(z_star)
3240        dlsb=TimeOfz(redshift)-ta
3241        w_true=w_lam
3242        wa_true=wa_ppf
3243        wa_ppf=0._dl
3244        do
3245            z_star=ThermoDerivedP
3246            tau_star=TimeOfz(z_st
3247            dlsb_eq=TimeOfz(redsh
3248            error=1.d0-dlsb_eq/dl
3249            if (abs(error).le.1e-
3250            w_lam=w_lam*(1+error)
3251        enddo
3252        w_hf=w_lam
3253        wa_hf=0._dl
```


/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 343
/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3254
343 end module NonLinear
344
345
346 !workaround for f90 circul
347 subroutine NonLinear_GetRa
348 use Transfer
349 use NonLinear
350 type(MatterPowerData) :: C
351
352 call NonLinear_GetNonLinRa
353
354 end subroutine NonLinear_G
355
356
357
358 subroutine NonLinear_GetRa
359 use Transfer
360 use NonLinear
361 type(MatterPowerData) :: C
362
363 stop 'Halofit module doesn
364
365 end subroutine NonLinear_G
3254 w_lam=w_true
3255 wa_ppf=wa_true
3256 write(*,*)'at z = ',real(
3257
3258 end subroutine PKequal
3259
3260
3261 end module NonLinear
3262
3263
3264 !workaround for f90 circu
3265 subroutine NonLinear_GetR
3266 use Transfer
3267 use NonLinear
3268 type(MatterPowerData) ::
3269
3270 call NonLinear_GetNonLinR
3271
3272 end subroutine NonLinear_
3273
3274
3275
3276 subroutine NonLinear_GetR
3277 use Transfer
3278 use NonLinear
3279 type(MatterPowerData) ::
3280
3281 call MpiStop('Halofit mod
3282
3283 end subroutine NonLinear_

/Users/lp1opa/Compare/camb_simdata/halofit_ppf.f90, Top line: 366

/Users/lp1opa/Compare/camb_des/halofit_ppf.f90, Top line: 3284