

ADAS Subroutine qvain

```
FUNCTION QVAIN(Z1,N1,N2,VION,PHI,ZP)
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C
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```
IMPLICIT REAL*8 (A-H,O-Z)
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```
***** FORTRAN77 FUNCTION: QVAIN *****
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```
C PURPOSE: CALCULATES ION COLLISION CROSS-SECTIONS FOR TRANSITIONS  
C BETWEEN PRINCIPAL QUANTUM SHELLS IN HYDROGEN AND  
C HYDROGENIC IONS.
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C INPUT
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```
C Z1 = TARGET ION CHARGE +1  
C N1 = INITIAL PRINCIPAL QUANTUM NUMBER  
C N2 = FINAL PRINCIPAL QUANTUM NUMBER  
C VION = VELOCITY OF INCIDENT ION (CM/SEC)  
C ZP = PROJECTILE CHARGE
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C OUTPUT
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C QVAIN=CROSS-SECTION IN PI*A0**2 UNITS
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C NOTES: THIS ROUTINE IS NOT YET PROPERLY ANNOTATED
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C UNIX-IDL PORT:
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```
C VERSION: 1.1 DATE: 16-1-96
```

```
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
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```
C - FIRST VERSION
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C
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```
C VERSION: 1.2 DATE: 16-05-07
```

```
C MODIFIED: Allan Whiteford
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```
C - Updated comments as part of subroutine documentation  
C procedure.
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```
ZZ1=Z1*Z1  
ZZP=ZP*ZP  
EN1=N1  
EN2=N2  
EIJRH=DABS(1/(EN1*EN1) - 1/(EN2*EN2))  
ALFA=1.0/137.036  
CLIG=2.998D+10  
CFAC=(CLIG/VION)**2  
BETA=0.5*ALFA*ALFA*CFAC*DSQRT(PHI)*EIJRH*ZP  
XFAC1=2*ALFA*ALFA*CFAC*PHI*ZP*ZP  
QVAIN=XFAC1*DEXP(-2*DSQRT(BETA))*RIFAC(BETA)  
RETURN  
END
```

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C
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```
FUNCTION RIFAC(BETA)
```

```
IMPLICIT REAL*8 (A-H,O-Z)
```

```
INTEGER N1, N2
```

REAL*8
REAL*8

PHI,
BETA IN

VION,

Z1,

ZP