

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

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SUMMARY: Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II multiplets as a function of temperature for perturber densities 10^{13} and $10^{16} - 10^{19} \text{ cm}^{-3}$.

1. INTRODUCTION

Calcium is one of the most abundant chemical elements in stellar plasmas. The well known resonance lines of Ca II are among the most important features in stellar spectra and are present in all spectra starting with B-type stars and reaching maximal intensity in the K0 spectral type. The knowledge of reliable Ca II Stark broadening parameters is of great importance for detailed investigation of stellar atmospheres. The astrophysical importance of Stark broadening data for the investigation of subphotospheric layers is discussed in Seaton (1987). Moreover, Ca II lines are of particular interest for the investigations of laboratory plasmas, since calcium is often present as an impurity. The present paper concerns singly ionized calcium: In order to provide reliable data for Ca II lines broadened by collisions with charged perturbers in stellar and laboratory plasmas, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 28 Ca II

multiplets, using the semiclassical-perturbation formalism (Sahal-Bréchet, 1969ab). The obtained results for perturber density of 10^{15} cm^{-3} , together with discussion, analysis and comparison with the existing experimental and theoretical data will be published in the principal article elsewhere (Dimitrijević, and Sahal-Bréchet, 1992). Since data are not linear with perturber density (N), due to the Debye screening effect, which is often important at high densities of interest for subphotospheric layers, we will present here the data for $N = 10^{16} - 10^{19} \text{ cm}^{-3}$. Moreover, we also will present the data for $N = 10^{13} \text{ cm}^{-3}$ of special interest for stellar atmospheres.

2. RESULTS AND DISCUSSION

All details of the calculation procedure has been described in Dimitrijević, Sahal-Bréchet, Bommier (1991) and will not be repeated here. En-

ergy levels for Ca II lines have been taken from Bashkin and Stoner (1975). Oscillator strengths have been calculated using the method of Bates and Damgaard (1949) and tables of Oertel and Shomo (1968). For the transitions including higher atomic energy levels, the method described by Van Regemorter et al. (1979) has been used.

In addition to the electron-impact full half-widths and shifts, Stark broadening parameters due to proton-, and ionized helium-impact have been calculated. In such a way we provide Stark broadening data for all important charged perturbers in stellar plasma. Our results are shown in Table 1 for perturber densities 10^{13} and $10^{16} - 10^{19} \text{ cm}^{-3}$ and temperatures of $T = 5,000; 10,000; 20,000; 30,000; 50,000$ and $100,000$ K. We also specify a parameter c (Dimitrijević and Sahal-Bréchet, 1984) which gives an estimate for the maximum perturber density for which the line may be treated as isolated when it is divided by the electron-impact full width at half maximum.

For each value given in Table 1, the collision volume (V) multiplied by the perturber density (N) is much less than one and the impact approximation is valid (Sahal-Bréchet, 1969ab). Values for $NV > 0.5$ are not given in Table 1; values for $0.1 < NV \leq 0.5$ are denoted by an asterisk. When the impact approximation is not valid, the ion broadening contribution may be estimated by using quasistatic formulae (cf. Sahal-Bréchet (1991) or Griem (1974)).

The analysis of present results and comparison with available experimental and theoretical data is given in Dimitrijević and Sahal - Bréchet (1992).

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Table 1. This table gives electron-, proton-, and ionized-helium- impact broadening parameters for Ca II lines, for perturber densities 10^{13} and $10^{16} - 10^{19} \text{ cm}^{-3}$ and temperatures from 5,000 K to 100,000 K. Transitions and averaged wavelengths for the multiplet (in Å) are also given. By dividing c by the electron-impact full halfwidth, we obtain an estimate for the maximum perturber density for which the line may be treated as isolated and tabulated data may be used. The asterisk identifies cases for which the collision volume multiplied by the perturber density (the condition for validity of the impact approximation) lies between 0.1 and 0.5.

PERTURBER DENSITY = $0.1D+14(\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 3D-4P 8581.1 Å C= 0.86E+17	5000.	0.134E-03	0.601E-05	0.404E-05	-0.765E-06	0.576E-05	-0.748E-06
	10000.	0.105E-03	0.298E-05	0.669E-05	-0.138E-05	0.834E-05	-0.128E-05
	20000.	0.856E-04	0.229E-05	0.928E-05	-0.212E-05	0.101E-04	-0.185E-05
	30000.	0.776E-04	0.881E-06	0.101E-04	-0.258E-05	0.109E-04	-0.222E-05
	50000.	0.707E-04	0.748E-06	0.112E-04	-0.310E-05	0.118E-04	-0.255E-05
	100000.	0.643E-04	0.792E-06	0.125E-04	-0.374E-05	0.128E-04	-0.307E-05
CA II 3D-5P 2132.3 Å C= 0.17E+16	5000.	0.303E-04	-0.387E-05	0.249E-05	-0.948E-06	0.291E-05	-0.820E-06
	10000.	0.241E-04	-0.235E-05	0.313E-05	-0.130E-05	0.332E-05	-0.108E-05
	20000.	0.207E-04	-0.231E-05	0.360E-05	-0.157E-05	0.373E-05	-0.130E-05
	30000.	0.196E-04	-0.185E-05	0.390E-05	-0.175E-05	0.390E-05	-0.144E-05
	50000.	0.189E-04	-0.147E-05	0.410E-05	-0.199E-05	0.402E-05	-0.162E-05
	100000.	0.183E-04	-0.132E-05	0.431E-05	-0.225E-05	0.439E-05	-0.186E-05
CA II 3D-6P 1644.1 Å C= 0.48E+15	5000.	0.413E-04	-0.140E-04	0.559E-05	-0.284E-05	0.586E-05	-0.232E-05
	10000.	0.358E-04	-0.107E-04	0.652E-05	-0.340E-05	0.667E-05	-0.280E-05
	20000.	0.333E-04	-0.813E-05	0.732E-05	-0.404E-05	0.723E-05	-0.328E-05
	30000.	0.328E-04	-0.654E-05	0.757E-05	-0.439E-05	0.747E-05	-0.365E-05
	50000.	0.332E-04	-0.556E-05	0.806E-05	-0.481E-05	0.746E-05	-0.375E-05
	100000.	0.334E-04	-0.439E-05	0.885E-05	-0.558E-05	0.776E-05	-0.440E-05
CA II 3D-7P 1474.4 Å C= 0.21E+15	5000.	0.721E-04	-0.317E-04	0.120E-04	-0.681E-05	0.121E-04	-0.560E-05
	10000.	0.645E-04	-0.266E-04	0.137E-04	-0.806E-05	0.135E-04	-0.670E-05
	20000.	0.619E-04	-0.202E-04	0.149E-04	-0.935E-05	0.141E-04	-0.753E-05
	30000.	0.631E-04	-0.169E-04	0.161E-04	-0.103E-04	0.143E-04	-0.816E-05
	50000.	0.649E-04	-0.143E-04	0.161E-04	-0.106E-04	0.153E-04	-0.881E-05
	100000.	0.660E-04	-0.104E-04	0.173E-04	-0.118E-04	0.174E-04	-0.110E-04
CA II 3D-4F 1839.2 Å C= 0.16E+16	5000.	0.174E-04	0.716E-05	0.133E-05	0.596E-06	0.160E-05	0.513E-06
	10000.	0.136E-04	0.550E-05	0.178E-05	0.825E-06	0.188E-05	0.695E-06
	20000.	0.116E-04	0.430E-05	0.206E-05	0.101E-05	0.213E-05	0.831E-06
	30000.	0.112E-04	0.384E-05	0.223E-05	0.112E-05	0.225E-05	0.920E-06
	50000.	0.109E-04	0.323E-05	0.242E-05	0.127E-05	0.239E-05	0.103E-05
	100000.	0.109E-04	0.258E-05	0.266E-05	0.148E-05	0.249E-05	0.119E-05
CA II 3D-5F 1554.1 Å C= 0.31E+14	5000.	0.784E-04	0.232E-04	0.145E-04	0.142E-04	0.125E-04	0.117E-04
	10000.	0.673E-04	0.198E-04	0.181E-04	0.167E-04	0.157E-04	0.132E-04
	20000.	0.591E-04	0.159E-04	0.210E-04	0.192E-04	0.171E-04	0.153E-04
	30000.	0.552E-04	0.137E-04	0.242E-04	0.213E-04	0.190E-04	0.166E-04
	50000.	0.512E-04	0.115E-04	0.238E-04	0.224E-04	0.228E-04	0.173E-04
	100000.	0.463E-04	0.888E-05	0.340E-04	0.265E-04	0.221E-04	0.189E-04

PERTURBER DENSITY = $0.1D+14(\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 3D-6F 1433.3 A C= 0.17E+14	5000.	0.170E-03	0.574E-04	0.413E-04	0.373E-04	0.339E-04	0.304E-04
	10000.	0.154E-03	0.490E-04	0.466E-04	0.419E-04	0.379E-04	0.327E-04
	20000.	0.139E-03	0.381E-04	0.551E-04	0.481E-04	0.415E-04	0.384E-04
	30000.	0.131E-03	0.329E-04	0.625E-04	0.532E-04	0.475E-04	0.412E-04
	50000.	0.122E-03	0.278E-04	0.692E-04	0.618E-04	0.543E-04	0.414E-04
	100000.	0.109E-03	0.197E-04	0.759E-04	0.660E-04	0.754E-04	0.486E-04
CA II 4S-4P 3946.3 A C= 0.18E+17	5000.	0.296E-04	-0.518E-05	0.108E-05	-0.375E-06	0.150E-05	-0.359E-06
	10000.	0.228E-04	-0.423E-05	0.174E-05	-0.634E-06	0.214E-05	-0.565E-06
	20000.	0.188E-04	-0.327E-05	0.238E-05	-0.901E-06	0.255E-05	-0.776E-06
	30000.	0.177E-04	-0.278E-05	0.259E-05	-0.106E-05	0.275E-05	-0.871E-06
	50000.	0.171E-04	-0.257E-05	0.287E-05	-0.122E-05	0.301E-05	-0.999E-06
	100000.	0.166E-04	-0.214E-05	0.321E-05	-0.145E-05	0.317E-05	-0.119E-05
CA II 4S-5P 1650.6 A C= 0.10E+16	5000.	0.191E-04	-0.182E-05	0.157E-05	-0.590E-06	0.181E-05	-0.512E-06
	10000.	0.151E-04	-0.153E-05	0.195E-05	-0.811E-06	0.207E-05	-0.672E-06
	20000.	0.129E-04	-0.166E-05	0.225E-05	-0.975E-06	0.232E-05	-0.809E-06
	30000.	0.122E-04	-0.144E-05	0.241E-05	-0.108E-05	0.242E-05	-0.900E-06
	50000.	0.118E-04	-0.129E-05	0.255E-05	-0.122E-05	0.253E-05	-0.985E-06
	100000.	0.115E-04	-0.118E-05	0.272E-05	-0.140E-05	0.274E-05	-0.115E-05
CA II 4S-6P 1342.1 A C= 0.32E+15	5000.	0.283E-04	-0.902E-05	0.377E-05	-0.190E-05	0.396E-05	-0.155E-05
	10000.	0.244E-04	-0.646E-05	0.439E-05	-0.228E-05	0.449E-05	-0.187E-05
	20000.	0.226E-04	-0.541E-05	0.494E-05	-0.271E-05	0.486E-05	-0.220E-05
	30000.	0.222E-04	-0.458E-05	0.510E-05	-0.293E-05	0.502E-05	-0.244E-05
	50000.	0.225E-04	-0.398E-05	0.543E-05	-0.322E-05	0.501E-05	-0.251E-05
	100000.	0.227E-04	-0.309E-05	0.594E-05	-0.372E-05	0.525E-05	-0.292E-05
CA II 4S-7P 1226.8 A C= 0.15E+15	5000.	0.506E-04	-0.220E-04	0.834E-05	-0.472E-05	0.842E-05	-0.388E-05
	10000.	0.451E-04	-0.184E-04	0.950E-05	-0.558E-05	0.937E-05	-0.465E-05
	20000.	0.432E-04	-0.142E-04	0.104E-04	-0.648E-05	0.979E-05	-0.522E-05
	30000.	0.440E-04	-0.119E-04	0.112E-04	-0.715E-05	0.998E-05	-0.566E-05
	50000.	0.452E-04	-0.101E-04	0.112E-04	-0.737E-05	0.106E-04	-0.610E-05
	100000.	0.460E-04	-0.744E-05	0.120E-04	-0.820E-05	0.121E-04	-0.765E-05
CA II 4P-5S 3727.6 A C= 0.12E+17	5000.	0.935E-04	0.385E-04	0.216E-05	0.298E-05	0.223E-05	0.259E-05
	10000.	0.671E-04	0.308E-04	0.364E-05	0.411E-05	0.356E-05	0.340E-05
	20000.	0.510E-04	0.246E-04	0.506E-05	0.493E-05	0.456E-05	0.410E-05
	30000.	0.456E-04	0.229E-04	0.585E-05	0.549E-05	0.511E-05	0.455E-05
	50000.	0.421E-04	0.194E-04	0.700E-05	0.620E-05	0.600E-05	0.502E-05
	100000.	0.391E-04	0.150E-04	0.806E-05	0.708E-05	0.682E-05	0.585E-05
CA II 4P-4D 3173.5 A C= 0.38E+16	5000.	0.605E-04	0.275E-04	0.237E-05	0.231E-05	0.273E-05	0.201E-05
	10000.	0.457E-04	0.208E-04	0.370E-05	0.317E-05	0.363E-05	0.261E-05
	20000.	0.368E-04	0.162E-04	0.468E-05	0.383E-05	0.440E-05	0.313E-05
	30000.	0.343E-04	0.143E-04	0.526E-05	0.422E-05	0.490E-05	0.348E-05
	50000.	0.320E-04	0.121E-04	0.594E-05	0.474E-05	0.539E-05	0.390E-05
	100000.	0.299E-04	0.940E-05	0.679E-05	0.552E-05	0.620E-05	0.454E-05

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PERTURBER DENSITY = $0.10 \times 10^{14} (\text{cm}^{-3})$							
TRANSITION	PERTURBERS ARE T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 4P-5D 2110.3 A C= 0.79E+15	5000.	0.588E-04	0.334E-04	0.581E-05	0.425E-05	0.582E-05	0.348E-05
	10000.	0.485E-04	0.272E-04	0.708E-05	0.509E-05	0.678E-05	0.417E-05
	20000.	0.438E-04	0.220E-04	0.833E-05	0.609E-05	0.793E-05	0.503E-05
	30000.	0.423E-04	0.194E-04	0.920E-05	0.665E-05	0.821E-05	0.538E-05
	50000.	0.418E-04	0.164E-04	0.102E-04	0.743E-05	0.935E-05	0.599E-05
	100000.	0.413E-04	0.127E-04	0.106E-04	0.821E-05	0.951E-05	0.657E-05
CA II 4D-5P 26778.0 A C= 0.27E+18	5000.	0.645E-02	-0.251E-02	0.362E-03	-0.267E-03	0.407E-03	-0.233E-03
	10000.	0.504E-02	-0.191E-02	0.484E-03	-0.349E-03	0.485E-03	-0.288E-03
	20000.	0.441E-02	-0.154E-02	0.586E-03	-0.418E-03	0.566E-03	-0.344E-03
	30000.	0.422E-02	-0.132E-02	0.656E-03	-0.467E-03	0.600E-03	-0.376E-03
	50000.	0.411E-02	-0.111E-02	0.709E-03	-0.515E-03	0.650E-03	-0.422E-03
	100000.	0.405E-02	-0.881E-03	0.815E-03	-0.606E-03	0.711E-03	-0.496E-03
CA II 4D-6P 5662.9 A C= 0.57E+16	5000.	0.551E-03	-0.218E-03	0.625E-04	-0.369E-04	0.646E-04	-0.302E-04
	10000.	0.471E-03	-0.174E-03	0.736E-04	-0.441E-04	0.732E-04	-0.361E-04
	20000.	0.437E-03	-0.138E-03	0.858E-04	-0.529E-04	0.819E-04	-0.426E-04
	30000.	0.433E-03	-0.119E-03	0.912E-04	-0.585E-04	0.850E-04	-0.458E-04
	50000.	0.440E-03	-0.101E-03	0.946E-04	-0.626E-04	0.871E-04	-0.502E-04
	100000.	0.445E-03	-0.791E-04	0.106E-03	-0.723E-04	0.946E-04	-0.595E-04
CA II 4D-7P 4055.2 A C= 0.16E+16	5000.	0.571E-03	-0.253E-03	0.882E-04	-0.525E-04	0.888E-04	-0.430E-04
	10000.	0.513E-03	-0.217E-03	0.102E-03	-0.622E-04	0.994E-04	-0.520E-04
	20000.	0.489E-03	-0.169E-03	0.111E-03	-0.720E-04	0.104E-03	-0.580E-04
	30000.	0.498E-03	-0.145E-03	0.120E-03	-0.791E-04	0.105E-03	-0.631E-04
	50000.	0.514E-03	-0.124E-03	0.122E-03	-0.833E-04	0.113E-03	-0.685E-04
	100000.	0.524E-03	-0.918E-04	0.130E-03	-0.928E-04	0.130E-03	-0.847E-04
CA II 4D-4F 8923.7 A C= 0.30E+17	5000.	0.407E-03	-0.141E-04	0.164E-04	-0.583E-05	0.203E-04	-0.539E-05
	10000.	0.350E-03	-0.127E-04	0.233E-04	-0.860E-05	0.257E-04	-0.755E-05
	20000.	0.334E-03	-0.116E-04	0.278E-04	-0.116E-04	0.293E-04	-0.948E-05
	30000.	0.339E-03	-0.131E-04	0.301E-04	-0.129E-04	0.313E-04	-0.106E-04
	50000.	0.352E-03	-0.127E-04	0.330E-04	-0.146E-04	0.331E-04	-0.121E-04
	100000.	0.365E-03	-0.112E-04	0.359E-04	-0.173E-04	0.347E-04	-0.137E-04
CA II 4D-5F 4720.6 A C= 0.29E+15	5000.	0.744E-03	0.163E-03	0.131E-03	0.129E-03	0.112E-03	0.107E-03
	10000.	0.640E-03	0.136E-03	0.165E-03	0.153E-03	0.143E-03	0.121E-03
	20000.	0.566E-03	0.111E-03	0.190E-03	0.175E-03	0.154E-03	0.140E-03
	30000.	0.534E-03	0.958E-04	0.217E-03	0.195E-03	0.171E-03	0.151E-03
	50000.	0.500E-03	0.784E-04	0.219E-03	0.205E-03	0.209E-03	0.159E-03
	100000.	0.457E-03	0.605E-04	0.307E-03	0.246E-03	0.206E-03	0.172E-03
CA II 4D-6F 3758.4 A C= 0.12E+15	5000.	0.118E-02	0.379E-03	0.282E-03	0.257E-03	0.232E-03	0.209E-03
	10000.	0.107E-02	0.317E-03	0.319E-03	0.288E-03	0.260E-03	0.225E-03
	20000.	0.969E-03	0.243E-03	0.376E-03	0.330E-03	0.285E-03	0.263E-03
	30000.	0.916E-03	0.208E-03	0.428E-03	0.366E-03	0.325E-03	0.284E-03
	50000.	0.855E-03	0.175E-03	0.473E-03	0.425E-03	0.373E-03	0.285E-03
	100000.	0.770E-03	0.123E-03	0.519E-03	0.455E-03	0.517E-03	0.335E-03

PERTURBER DENSITY = $0.10 \times 10^{14} (\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 5S-5P 11878.9 A C= 0.53E+17	5000.	0.141E-02	-0.545E-03	0.872E-04	-0.507E-04	0.978E-04	-0.442E-04
	10000.	0.107E-02	-0.425E-03	0.111E-03	-0.666E-04	0.113E-03	-0.548E-04
	20000.	0.903E-03	-0.339E-03	0.131E-03	-0.803E-04	0.130E-03	-0.661E-04
	30000.	0.857E-03	-0.296E-03	0.144E-03	-0.892E-04	0.136E-03	-0.716E-04
	50000.	0.834E-03	-0.250E-03	0.152E-03	-0.984E-04	0.144E-03	-0.800E-04
	100000.	0.824E-03	-0.195E-03	0.171E-03	-0.115E-03	0.154E-03	-0.931E-04
CA II 5S-6P 4475.8 A C= 0.36E+16	5000.	0.349E-03	-0.140E-03	0.426E-04	-0.229E-04	0.444E-04	-0.187E-04
	10000.	0.297E-03	-0.115E-03	0.496E-04	-0.274E-04	0.500E-04	-0.225E-04
	20000.	0.274E-03	-0.907E-04	0.573E-04	-0.329E-04	0.551E-04	-0.264E-04
	30000.	0.272E-03	-0.793E-04	0.607E-04	-0.361E-04	0.569E-04	-0.285E-04
	50000.	0.277E-03	-0.675E-04	0.624E-04	-0.391E-04	0.581E-04	-0.309E-04
	100000.	0.282E-03	-0.526E-04	0.691E-04	-0.446E-04	0.630E-04	-0.368E-04
CA II 5S-7P 3407.9 A C= 0.11E+16	5000.	0.405E-03	-0.178E-03	0.646E-04	-0.370E-04	0.654E-04	-0.303E-04
	10000.	0.362E-03	-0.151E-03	0.743E-04	-0.439E-04	0.726E-04	-0.367E-04
	20000.	0.345E-03	-0.121E-03	0.807E-04	-0.508E-04	0.762E-04	-0.408E-04
	30000.	0.352E-03	-0.104E-03	0.866E-04	-0.559E-04	0.769E-04	-0.444E-04
	50000.	0.364E-03	-0.884E-04	0.877E-04	-0.587E-04	0.817E-04	-0.483E-04
	100000.	0.372E-03	-0.663E-04	0.933E-04	-0.652E-04	0.946E-04	-0.598E-04
CA II 5P-5D 8235.7 A C= 0.12E+17	5000.	0.110E-02	0.509E-03	0.847E-04	0.710E-04	0.824E-04	0.579E-04
	10000.	0.897E-03	0.440E-03	0.105E-03	0.851E-04	0.996E-04	0.700E-04
	20000.	0.813E-03	0.378E-03	0.127E-03	0.101E-03	0.115E-03	0.819E-04
	30000.	0.787E-03	0.330E-03	0.140E-03	0.110E-03	0.127E-03	0.914E-04
	50000.	0.779E-03	0.278E-03	0.154E-03	0.120E-03	0.132E-03	0.936E-04
	100000.	0.777E-03	0.216E-03	0.173E-03	0.139E-03	0.141E-03	0.110E-03
CA II 5D-6P 56116.1 A C= 0.56E+18	5000.	0.736E-01	-0.347E-01	0.654E-02	-0.511E-02	0.641E-02	-0.424E-02
	10000.	0.631E-01	-0.285E-01	0.808E-02	-0.619E-02	0.750E-02	-0.505E-02
	20000.	0.589E-01	-0.240E-01	0.955E-02	-0.718E-02	0.885E-02	-0.593E-02
	30000.	0.577E-01	-0.215E-01	0.102E-01	-0.799E-02	0.894E-02	-0.627E-02
	50000.	0.587E-01	-0.181E-01	0.114E-01	-0.822E-02	0.102E-01	-0.709E-02
	100000.	0.594E-01	-0.141E-01	0.118E-01	-0.965E-02	0.114E-01	-0.775E-02
CA II 5D-7P 11385.3 A C= 0.13E+17	5000.	0.505E-02	-0.247E-02	0.671E-03	-0.458E-03	0.664E-03	-0.377E-03
	10000.	0.457E-02	-0.209E-02	0.794E-03	-0.544E-03	0.737E-03	-0.440E-03
	20000.	0.442E-02	-0.176E-02	0.906E-03	-0.633E-03	0.804E-03	-0.507E-03
	30000.	0.449E-02	-0.153E-02	0.974E-03	-0.691E-03	0.895E-03	-0.574E-03
	50000.	0.465E-02	-0.130E-02	0.102E-02	-0.749E-03	0.859E-03	-0.592E-03
	100000.	0.473E-02	-0.980E-03	0.110E-02	-0.820E-03	0.108E-02	-0.720E-03
CA II 5D-5F 18843.3 A C= 0.46E+16	5000.	0.130E-01	0.823E-03	0.198E-02	0.198E-02	0.163E-02	0.162E-02
	10000.	0.112E-01	0.822E-03	0.248E-02	0.231E-02	0.212E-02	0.190E-02
	20000.	0.102E-01	0.657E-03	0.287E-02	0.265E-02	0.232E-02	0.208E-02
	30000.	0.983E-02	0.552E-03	0.315E-02	0.300E-02	0.264E-02	0.234E-02
	50000.	0.942E-02	0.436E-03	0.341E-02	0.313E-02	0.314E-02	0.249E-02
	100000.	0.886E-02	0.314E-03	0.449E-02	0.384E-02	0.327E-02	0.260E-02

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1D+14(cm-3)							
TRANSITION	T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 5D-6F	5000.	0.748E-02	0.196E-02	0.169E-02	0.157E-02	0.140E-02	0.127E-02
9319.1 A	10000.	0.679E-02	0.160E-02	0.196E-02	0.175E-02	0.160E-02	0.136E-02
C= 0.71E+15	20000.	0.622E-02	0.121E-02	0.230E-02	0.202E-02	0.174E-02	0.160E-02
	30000.	0.593E-02	0.105E-02	0.261E-02	0.225E-02	0.192E-02	0.172E-02
	50000.	0.559E-02	0.863E-03	0.282E-02	0.258E-02	0.227E-02	0.175E-02
	100000.	0.510E-02	0.587E-03	0.308E-02	0.276E-02	0.311E-02	0.207E-02
PERTURBER DENSITY = 0.1D+17(cm-3)							
CA II 3D-4P	5000.	0.134	0.569E-02	0.403E-02	-0.724E-03	0.574E-02	-0.707E-03
8581.1 A	10000.	0.105	0.311E-02	0.669E-02	-0.137E-02	0.833E-02	-0.126E-02
C= 0.86E+20	20000.	0.856E-01	0.218E-02	0.928E-02	-0.212E-02	0.101E-01	-0.185E-02
	30000.	0.776E-01	0.895E-03	0.101E-01	-0.258E-02	0.109E-01	-0.222E-02
	50000.	0.707E-01	0.748E-03	0.112E-01	-0.310E-02	0.118E-01	-0.255E-02
	100000.	0.643E-01	0.792E-03	0.125E-01	-0.374E-02	0.128E-01	-0.307E-02
CA II 3D-5P	5000.	0.303E-01	-0.383E-02	0.248E-02	-0.879E-03	0.288E-02	-0.750E-03
2132.3 A	10000.	0.241E-01	-0.232E-02	0.312E-02	-0.128E-02	0.332E-02	-0.106E-02
C= 0.17D+19	20000.	0.207E-01	-0.230E-02	0.360E-02	-0.157E-02	0.373E-02	-0.130E-02
	30000.	0.196E-01	-0.184E-02	0.390E-02	-0.175E-02	0.390E-02	-0.144E-02
	50000.	0.189E-01	-0.147E-02	0.410E-02	-0.199E-02	0.402E-02	-0.162E-02
	100000.	0.183E-01	-0.132E-02	0.431E-02	-0.225E-02	0.439E-02	-0.186E-02
CA II 3D-6P	5000.	0.413E-01	-0.137E-01	0.555E-02	-0.251E-02	*0.574E-02	*-0.199E-02
1644.1 A	10000.	0.358E-01	-0.104E-01	0.651E-02	-0.328E-02	*0.665E-02	*-0.267E-02
C= 0.48D+18	20000.	0.333E-01	-0.810E-02	0.732E-02	-0.402E-02	*0.722E-02	*-0.326E-02
	30000.	0.329E-01	-0.652E-02	0.756E-02	-0.437E-02	0.746E-02	-0.364E-02
	50000.	0.332E-01	-0.553E-02	0.806E-02	-0.481E-02	0.746E-02	-0.375E-02
	100000.	0.334E-01	-0.439E-02	0.885E-02	-0.558E-02	0.776E-02	-0.440E-02
CA II 3D-7P	5000.	0.721E-01	-0.304E-01	*0.117E-01	*-0.560E-02		
1474.4 A	10000.	0.645E-01	-0.259E-01	*0.135E-01	*-0.762E-02		
C= 0.21D+18	20000.	0.619E-01	-0.199E-01	*0.149E-01	*-0.926E-02	*0.141E-01	*-0.744E-02
	30000.	0.631E-01	-0.168E-01	*0.161E-01	*-0.103E-01	*0.143E-01	*-0.809E-02
	50000.	0.649E-01	-0.142E-01	0.161E-01	-0.106E-01	*0.153E-01	*-0.881E-02
	100000.	0.660E-01	-0.104E-01	0.173E-01	-0.118E-01	*0.174E-01	*-0.110E-01
CA II 3D-4F	5000.	0.174E-01	0.712E-02	0.132E-02	0.554E-03	0.159E-02	0.471E-03
1839.2 A	10000.	0.136E-01	0.549E-02	0.178E-02	0.809E-03	0.188E-02	0.680E-03
C= 0.16D+19	20000.	0.116E-01	0.430E-02	0.206E-02	0.101E-02	0.213E-02	0.828E-03
	30000.	0.112E-01	0.384E-02	0.223E-02	0.112E-02	0.225E-02	0.918E-03
	50000.	0.109E-01	0.323E-02	0.242E-02	0.127E-02	0.239E-02	0.103E-02
	100000.	0.109E-01	0.258E-02	0.266E-02	0.148E-02	0.249E-02	0.119E-02
CA II 3D-5F	5000.	0.781E-01	0.194E-01	*0.143E-01	*0.109E-01		
1554.1 A	10000.	0.671E-01	0.184E-01	*0.180E-01	*0.155E-01		
C= 0.31D+17	20000.	0.589E-01	0.157E-01	*0.210E-01	*0.190E-01	*0.171E-01	*0.151E-01
	30000.	0.551E-01	0.136E-01	*0.242E-01	*0.211E-01	*0.189E-01	*0.165E-01
	50000.	0.511E-01	0.115E-01	*0.238E-01	*0.224E-01	*0.228E-01	*0.173E-01
	100000.	0.462E-01	0.888E-02	*0.340E-01	*0.265E-01	*0.221E-01	*0.189E-01

PERTURBER DENSITY = $0.10 \times 10^{17} (\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 3D-6F 1433.3 A C= 0.17D+17	5000.	0.166	0.408E-01				
	10000.	0.151	0.390E-01				
	20000.	0.137	0.371E-01				
	30000.	0.129	0.320E-01				
	50000.	0.121	0.271E-01				
	100000.	0.108	0.197E-01				
CA II 4S-4P 3946.3 A C= 0.18E+20	5000.	0.296E-01	-0.516E-02	0.108E-02	-0.355E-03	0.150E-02	-0.338E-03
	10000.	0.228E-01	-0.422E-02	0.174E-02	-0.626E-03	0.214E-02	-0.557E-03
	20000.	0.188E-01	-0.329E-02	0.238E-02	-0.900E-03	0.255E-02	-0.775E-03
	30000.	0.177E-01	-0.281E-02	0.259E-02	-0.106E-02	0.275E-02	-0.869E-03
	50000.	0.171E-01	-0.257E-02	0.287E-02	-0.122E-02	0.301E-02	-0.999E-03
	100000.	0.166E-01	-0.214E-02	0.321E-02	-0.145E-02	0.317E-02	-0.119E-02
CA II 4S-5P 1650.6 A C= 0.10D+19	5000.	0.191E-01	-0.184E-02	0.156E-02	-0.546E-03	0.180E-02	-0.468E-03
	10000.	0.151E-01	-0.150E-02	0.194E-02	-0.795E-03	0.207E-02	-0.656E-03
	20000.	0.129E-01	-0.165E-02	0.225E-02	-0.973E-03	0.232E-02	-0.806E-03
	30000.	0.122E-01	-0.143E-02	0.241E-02	-0.108E-02	0.242E-02	-0.898E-03
	50000.	0.118E-01	-0.129E-02	0.255E-02	-0.122E-02	0.253E-02	-0.985E-03
	100000.	0.115E-01	-0.118E-02	0.272E-02	-0.140E-02	0.274E-02	-0.115E-02
CA II 4S-6P 1342.1 A C= 0.32D+18	5000.	0.283E-01	-0.880E-02	0.375E-02	-0.168E-02	*0.387E-02	*-0.133E-02
	10000.	0.244E-01	-0.635E-02	0.438E-02	-0.219E-02	*0.447E-02	*-0.179E-02
	20000.	0.226E-01	-0.540E-02	0.494E-02	-0.269E-02	*0.486E-02	*-0.218E-02
	30000.	0.222E-01	-0.456E-02	0.510E-02	-0.292E-02	0.502E-02	-0.243E-02
	50000.	0.225E-01	-0.395E-02	0.543E-02	-0.322E-02	0.501E-02	-0.251E-02
	100000.	0.227E-01	-0.309E-02	0.594E-02	-0.372E-02	0.525E-02	-0.292E-02
CA II 4S-7P 1226.8 A C= 0.15D+18	5000.	0.506E-01	-0.211E-01	*0.812E-02	*-0.388E-02		
	10000.	0.451E-01	-0.179E-01	*0.940E-02	*-0.528E-02		
	20000.	0.432E-01	-0.140E-01	*0.104E-01	*-0.642E-02	*0.978E-02	*-0.516E-02
	30000.	0.440E-01	-0.118E-01	*0.112E-01	*-0.711E-02	*0.997E-02	*-0.561E-02
	50000.	0.452E-01	-0.101E-01	0.112E-01	-0.737E-02	*0.106E-01	*-0.610E-02
	100000.	0.460E-01	-0.744E-02	0.120E-01	-0.820E-02	*0.121E-01	*-0.765E-02
CA II 4P-5S 3727.6 A C= 0.12D+20	5000.	0.934E-01	0.383E-01	0.216E-02	0.276E-02	0.222E-02	0.237E-02
	10000.	0.671E-01	0.307E-01	0.364E-02	0.402E-02	0.356E-02	0.332E-02
	20000.	0.510E-01	0.246E-01	0.506E-02	0.492E-02	0.456E-02	0.408E-02
	30000.	0.456E-01	0.228E-01	0.585E-02	0.548E-02	0.511E-02	0.454E-02
	50000.	0.421E-01	0.194E-01	0.700E-02	0.620E-02	0.600E-02	0.502E-02
	100000.	0.391E-01	0.150E-01	0.806E-02	0.708E-02	0.682E-02	0.585E-02
CA II 4P-4D 3173.5 A C= 0.38D+19	5000.	0.605E-01	0.273E-01	0.237E-02	0.213E-02	0.271E-02	0.184E-02
	10000.	0.457E-01	0.207E-01	0.370E-02	0.311E-02	0.362E-02	0.254E-02
	20000.	0.368E-01	0.162E-01	0.468E-02	0.381E-02	0.440E-02	0.312E-02
	30000.	0.343E-01	0.143E-01	0.526E-02	0.421E-02	0.490E-02	0.347E-02
	50000.	0.320E-01	0.121E-01	0.594E-02	0.474E-02	0.539E-02	0.390E-02
	100000.	0.299E-01	0.940E-02	0.679E-02	0.552E-02	0.620E-02	0.454E-02

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = $0.10 \times 10^{17} (\text{cm}^{-3})$							
TRANSITION	PERTURBERS ARE T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 4P-5D 2110.3 A C= 0.790+18	5000.	0.587E-01	0.329E-01	0.574E-02	0.375E-02	0.572E-02	0.300E-02
	10000.	0.485E-01	0.270E-01	0.707E-02	0.491E-02	0.676E-02	0.399E-02
	20000.	0.438E-01	0.220E-01	0.833E-02	0.606E-02	0.793E-02	0.499E-02
	30000.	0.423E-01	0.194E-01	0.920E-02	0.662E-02	0.821E-02	0.535E-02
	50000.	0.418E-01	0.164E-01	0.102E-01	0.743E-02	0.935E-02	0.599E-02
100000.	0.413E-01	0.127E-01	0.106E-01	0.821E-02	0.951E-02	0.657E-02	
CA II 4D-5P 26778.0 A C= 0.270+21	5000.	6.44	-2.49	0.359	-0.244	0.405	-0.210
	10000.	5.04	-1.89	0.484	-0.341	0.484	-0.280
	20000.	4.41	-1.54	0.586	-0.417	0.566	-0.342
	30000.	4.22	-1.32	0.656	-0.465	0.600	-0.375
	50000.	4.11	-1.11	0.709	-0.515	0.650	-0.422
100000.	4.05	-0.881	0.815	-0.606	0.711	-0.496	
CA II 4D-6P 5662.9 A C= 0.570+19	5000.	0.551	-0.214	0.617E-01	-0.324E-01	*0.632E-01	*-0.255E-01
	10000.	0.472	-0.172	0.735E-01	-0.425E-01	*0.728E-01	*-0.344E-01
	20000.	0.437	-0.138	0.857E-01	-0.526E-01	0.818E-01	-0.423E-01
	30000.	0.433	-0.118	0.912E-01	-0.583E-01	0.850E-01	-0.455E-01
	50000.	0.440	-0.101	0.946E-01	-0.626E-01	0.871E-01	-0.502E-01
100000.	0.445	-0.791E-01	0.106	-0.723E-01	0.946E-01	-0.595E-01	
CA II 4D-7P 4055.2 A C= 0.160+19	5000.	0.571	-0.243	*0.860E-01	-0.427E-01		
	10000.	0.513	-0.211	*0.101	*-0.586E-01		
	20000.	0.489	-0.166	*0.111	*-0.713E-01	*0.104	*-0.573E-01
	30000.	0.499	-0.145	*0.120	*-0.786E-01	*0.105	*-0.626E-01
	50000.	0.514	-0.124	0.122	-0.833E-01	*0.113	*-0.685E-01
100000.	0.524	-0.918E-01	0.130	-0.928E-01	*0.130	*-0.847E-01	
CA II 4D-4F 8923.7 A C= 0.300+20	5000.	0.407	-0.150E-01	0.164E-01	-0.547E-02	0.202E-01	-0.503E-02
	10000.	0.350	-0.122E-01	0.233E-01	-0.846E-02	0.257E-01	-0.742E-02
	20000.	0.334	-0.114E-01	0.278E-01	-0.116E-01	0.293E-01	-0.945E-02
	30000.	0.339	-0.130E-01	0.301E-01	-0.129E-01	0.313E-01	-0.106E-01
	50000.	0.352	-0.127E-01	0.330E-01	-0.146E-01	0.331E-01	-0.121E-01
100000.	0.365	-0.112E-01	0.359E-01	-0.173E-01	0.347E-01	-0.137E-01	
CA II 4D-5F 4720.6 A C= 0.290+18	5000.	0.742	0.133	*0.129	*0.991E-01		
	10000.	0.638	0.124	*0.162	*0.141		
	20000.	0.565	0.108	*0.190	*0.173	*0.154	*0.138
	30000.	0.532	0.939E-01	*0.217	*0.193	*0.171	*0.149
	50000.	0.499	0.784E-01	*0.219	*0.205	*0.209	*0.159
100000.	0.457	0.605E-01	*0.307	*0.246	*0.206	*0.172	
CA II 4D-6F 3758.4 A C= 0.120+18	5000.	1.16	0.267				
	10000.	1.05	0.249				
	20000.	0.955	0.236				
	30000.	0.905	0.203				
	50000.	0.847	0.170				
100000.	0.764	0.123					

PERTURBER DENSITY = 0.1D+17(cm-3)							
TRANSITION	PERTURBERS ARE T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 5S-5P	5000.	1.41	-0.540	0.865E-01	-0.464E-01	0.974E-01	-0.398E-01
11878.9 A	10000.	1.07	-0.423	0.110	-0.650E-01	0.113	-0.532E-01
C= 0.53D+20	20000.	0.903	-0.339	0.131	-0.800E-01	0.130	-0.658E-01
	30000.	0.857	-0.296	0.144	-0.889E-01	0.136	-0.713E-01
	50000.	0.834	-0.250	0.152	-0.984E-01	0.144	-0.800E-01
	100000.	0.824	-0.195	0.171	-0.115	0.154	-0.931E-01
CA II 5S-6P	5000.	0.349	-0.137	0.419E-01	-0.202E-01	*0.433E-01	*-0.158E-01
4475.8 A	10000.	0.297	-0.113	0.496E-01	-0.264E-01	*0.497E-01	*-0.214E-01
C= 0.36D+19	20000.	0.274	-0.904E-01	0.573E-01	-0.327E-01	*0.551E-01	*-0.263E-01
	30000.	0.272	-0.791E-01	0.606E-01	-0.359E-01	0.569E-01	-0.283E-01
	50000.	0.277	-0.675E-01	0.624E-01	-0.391E-01	0.581E-01	-0.309E-01
	100000.	0.282	-0.526E-01	0.691E-01	-0.446E-01	0.630E-01	-0.368E-01
CA II 5S-7P	5000.	0.405	-0.171	*0.629E-01	*-0.302E-01		
3407.9 A	10000.	0.362	-0.147	*0.736E-01	*-0.413E-01		
C= 0.11D+19	20000.	0.345	-0.119	*0.807E-01	*-0.503E-01	*0.761E-01	*-0.403E-01
	30000.	0.352	-0.104	*0.866E-01	*-0.555E-01	*0.768E-01	*-0.441E-01
	50000.	0.364	-0.881E-01	0.877E-01	-0.587E-01	*0.817E-01	*-0.483E-01
	100000.	0.372	-0.663E-01	0.933E-01	-0.652E-01	*0.946E-01	*-0.598E-01
CA II 5P-5D	5000.	1.10	0.501	0.843E-01	0.627E-01	0.821E-01	0.497E-01
8235.7 A	10000.	0.897	0.435	0.105	0.820E-01	0.993E-01	0.669E-01
C= 0.12D+20	20000.	0.813	0.377	0.127	0.101	0.115	0.813E-01
	30000.	0.787	0.330	0.140	0.109	0.127	0.910E-01
	50000.	0.779	0.278	0.154	0.120	0.132	0.936E-01
	100000.	0.777	0.216	0.173	0.139	0.141	0.110
CA II 5D-7P	5000.	5.05	-2.37	*0.664	*-0.368		
11385.3 A	10000.	4.57	-2.03	*0.795	*-0.511		
C= 0.13D+20	20000.	4.42	-1.74	*0.906	*-0.627	*0.803	*-0.501
	30000.	4.49	-1.53	*0.974	*-0.686	*0.896	*-0.570
	50000.	4.65	-1.30	1.02	-0.749	*0.859	*-0.592
	100000.	4.73	-0.980	1.10	-0.820	* 1.08	*-0.720
CA II 5D-5F	5000.	13.0	0.297	*1.94	*1.49		
18843.3 A	10000.	11.2	0.638	*2.50	*2.12		
C= 0.46D+19	20000.	10.2	0.624	*2.87	*2.62	*2.32	*2.05
	30000.	9.81	0.528	*3.15	*2.97	*2.64	*2.31
	50000.	9.41	0.436	*3.41	*3.13	*3.14	*2.49
	100000.	8.85	0.314	*4.49	*3.84	*3.27	*2.60
CA II 5D-6F	5000.	7.31	1.28				
9319.1 A	10000.	6.67	1.35				
C= 0.71D+18	20000.	6.14	1.16				
	30000.	5.86	1.01				
	50000.	5.54	0.863				
	100000.	5.06	0.587				

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1D+18(cm-3)							
PERTURBERS ARE ALL ELECTRONS							
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	PROTONS WIDTH(A)	SHIFT(A)	IONIZED HELIUM WIDTH(A)	SHIFT(A)
CA II 3D-4P	5000.	1.34	0.595E-01	0.397E-01	-0.642E-02	0.562E-01	-0.625E-02
8581.1 A	10000.	1.05	0.308E-01	0.666E-01	-0.129E-01	0.828E-01	-0.119E-01
C= 0.86E+21	20000.	0.856	0.228E-01	0.927E-01	-0.209E-01	0.101	-0.182E-01
	30000.	0.776	0.913E-02	0.101	-0.255E-01	0.109	-0.220E-01
	50000.	0.707	0.736E-02	0.112	-0.309E-01	0.118	-0.254E-01
	100000.	0.643	0.792E-02	0.125	-0.374E-01	0.128	-0.307E-01
CA II 3D-5P	5000.	0.303	-0.363E-01	0.238E-01	-0.737E-02	*0.269E-01	*-0.607E-02
2132.3 A	10000.	0.241	-0.220E-01	0.308E-01	-0.115E-01	*0.323E-01	*-0.926E-02
C= 0.17E+20	20000.	0.207	-0.224E-01	0.359E-01	-0.152E-01	*0.371E-01	*-0.124E-01
	30000.	0.196	-0.182E-01	0.391E-01	-0.170E-01	*0.387E-01	*-0.139E-01
	50000.	0.189	-0.146E-01	0.410E-01	-0.198E-01	0.402E-01	-0.161E-01
	100000.	0.183	-0.132E-01	0.431E-01	-0.225E-01	0.439E-01	-0.186E-01
CA II 3D-6P	5000.	0.413	-0.129				
1644.1 A	10000.	0.358	-0.988E-01				
C= 0.48E+19	20000.	0.333	-0.783E-01	*0.730E-01	*-0.374E-01		
	30000.	0.328	-0.634E-01	*0.762E-01	*-0.415E-01		
	50000.	0.332	-0.552E-01	*0.806E-01	*-0.477E-01		
	100000.	0.334	-0.436E-01	*0.885E-01	*-0.558E-01	*0.776E-01	*-0.440E-01
CA II 3D-7P	5000.	0.721	-0.273				
1474.4 A	10000.	0.645	-0.237				
C= 0.21E+19	20000.	0.619	-0.184				
	30000.	0.631	-0.160				
	50000.	0.649	-0.141				
	100000.	0.660	-0.103				
CA II 3D-4F	5000.	0.174	0.702E-01	0.128E-01	0.469E-02	*0.151E-01	*0.385E-02
1839.2 A	10000.	0.136	0.540E-01	0.177E-01	0.729E-02	*0.184E-01	*0.602E-02
C= 0.16E+20	20000.	0.116	0.426E-01	0.206E-01	0.978E-02	*0.213E-01	*0.796E-02
	30000.	0.112	0.381E-01	0.223E-01	0.109E-01	0.223E-01	0.887E-02
	50000.	0.109	0.322E-01	0.242E-01	0.127E-01	0.239E-01	0.103E-01
	100000.	0.109	0.257E-01	0.266E-01	0.148E-01	0.249E-01	0.119E-01
CA II 3D-5F	5000.	0.705	0.116				
1554.1 A	10000.	0.621	0.118				
C= 0.31E+18	20000.	0.554	0.110				
	30000.	0.523	0.111				
	50000.	0.490	0.110				
	100000.	0.447	0.853E-01				
CA II 3D-6F	5000.	1.26	0.165				
1433.3 A	10000.	1.24	0.203				
C= 0.17E+18	20000.	1.19	0.202				
	30000.	1.15	0.229				
	50000.	1.09	0.256				
	100000.	1.00	0.182				

PERTURBER DENSITY = 0.10+18							
TRANSITION	T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 4S-4P 3946.3 A C= 0.18E+21	5000.	0.296	-0.507E-01	0.106E-01	-0.313E-02	0.146E-01	-0.297E-02
	10000.	0.228	-0.418E-01	0.173E-01	-0.588E-02	0.212E-01	-0.519E-02
	20000.	0.188	-0.324E-01	0.238E-01	-0.884E-02	0.254E-01	-0.759E-02
	30000.	0.177	-0.275E-01	0.259E-01	-0.105E-01	0.275E-01	-0.856E-02
	50000.	0.171	-0.257E-01	0.287E-01	-0.121E-01	0.301E-01	-0.996E-02
100000.	0.166	-0.214E-01	0.321E-01	-0.145E-01	0.317E-01	-0.119E-01	
CA II 4S-5P 1650.6 A C= 0.10E+20	5000.	0.191	-0.168E-01	0.150E-01	-0.457E-02	*0.168E-01	*-0.378E-02
	10000.	0.151	-0.143E-01	0.192E-01	-0.713E-02	*0.201E-01	*-0.571E-02
	20000.	0.129	-0.162E-01	0.224E-01	-0.938E-02	*0.230E-01	*-0.772E-02
	30000.	0.122	-0.142E-01	0.242E-01	-0.106E-01	*0.240E-01	*-0.865E-02
	50000.	0.118	-0.128E-01	0.254E-01	-0.121E-01	*0.253E-01	*-0.979E-02
100000.	0.115	-0.118E-01	0.272E-01	-0.140E-01	0.274E-01	-0.115E-01	
CA II 4S-6P 1342.1 A C= 0.32E+19	5000.	0.283	-0.825E-01				
	10000.	0.244	-0.593E-01				
	20000.	0.226	-0.522E-01	*0.493E-01	*-0.251E-01		
	30000.	0.222	-0.442E-01	*0.515E-01	*-0.277E-01		
	50000.	0.225	-0.395E-01	*0.542E-01	*-0.319E-01		
100000.	0.227	-0.306E-01	*0.594E-01	*-0.372E-01	*0.525E-01	*-0.292E-01	
CA II 4S-7P 1226.8 A C= 0.15E+19	5000.	0.505	-0.189				
	10000.	0.451	-0.164				
	20000.	0.432	-0.134				
	30000.	0.440	-0.113				
	50000.	0.452	-0.100				
100000.	0.460	-0.736E-01					
CA II 4P-5S 3727.6 A C= 0.12E+21	5000.	0.935	0.377	0.214E-01	0.231E-01	0.218E-01	0.191E-01
	10000.	0.671	0.303	0.365E-01	0.361E-01	0.353E-01	0.289E-01
	20000.	0.510	0.242	0.506E-01	0.475E-01	0.456E-01	0.391E-01
	30000.	0.455	0.227	0.584E-01	0.534E-01	0.511E-01	0.438E-01
	50000.	0.421	0.194	0.700E-01	0.617E-01	0.600E-01	0.499E-01
100000.	0.391	0.150	0.806E-01	0.708E-01	0.682E-01	0.585E-01	
CA II 4P-4D 3173.5 A C= 0.38E+20	5000.	0.605	0.269	0.233E-01	0.178E-01	0.264E-01	0.148E-01
	10000.	0.457	0.204	0.366E-01	0.277E-01	0.360E-01	0.222E-01
	20000.	0.368	0.160	0.467E-01	0.368E-01	0.438E-01	0.298E-01
	30000.	0.343	0.142	0.526E-01	0.411E-01	0.488E-01	0.335E-01
	50000.	0.320	0.121	0.594E-01	0.472E-01	0.539E-01	0.387E-01
100000.	0.299	0.939E-01	0.679E-01	0.552E-01	0.620E-01	0.454E-01	
CA II 4P-5D 2110.3 A C= 0.79E+19	5000.	0.587	0.317	*0.549E-01	*0.280E-01		
	10000.	0.485	0.261	*0.695E-01	*0.405E-01		
	20000.	0.438	0.213	*0.834E-01	*0.570E-01		
	30000.	0.423	0.191	*0.908E-01	*0.626E-01	*0.813E-01	*0.501E-01
	50000.	0.417	0.163	*0.102	*0.737E-01	*0.934E-01	*0.592E-01
100000.	0.413	0.127	0.106	0.821E-01	*0.951E-01	*0.657E-01	

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1D+18							
TRANSITION	T(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 4D-6P	5000.	5.51	-2.03				
5662.9 A	10000.	4.71	-1.63	*0.712	*-0.342		
C= 0.57E+20	20000.	4.37	-1.32	*0.855	*-0.493		
	30000.	4.33	-1.16	*0.905	*-0.552		
	50000.	4.40	-1.00	*0.946	*-0.620		
	100000.	4.45	-0.788	*1.06	*-0.723	*0.946	*-0.595
CA II 4D-7P	5000.	5.71	-2.19				
4055.2 A	10000.	5.13	-1.94				
C= 0.16E+20	20000.	4.89	-1.55				
	30000.	4.98	-1.38				
	50000.	5.14	-1.23				
	100000.	5.24	-0.909				
CA II 4D-4F	5000.	4.07	-0.132	0.160	-0.475E-01	0.194	-0.431E-01
8923.7 A	10000.	3.50	-0.120	0.231	-0.781E-01	0.253	-0.677E-01
C= 0.30E+21	20000.	3.34	-0.112	0.278	-0.113	0.292	-0.917E-01
	30000.	3.39	-0.130	0.300	-0.127	0.312	-0.103
	50000.	3.52	-0.127	0.330	-0.146	0.331	-0.121
	100000.	3.65	-0.112	0.359	-0.173	0.347	-0.137
CA II 4D-5F	5000.	6.72	0.579				
4720.6 A	10000.	5.91	0.651				
C= 0.29E+19	20000.	5.33	0.821				
	30000.	5.07	0.895				
	50000.	4.79	0.738				
	100000.	4.42	0.605				
CA II 4D-6F	5000.	8.79	0.985				
3758.4 A	10000.	8.68	1.24				
C= 0.12E+19	20000.	8.29	1.60				
	30000.	8.03	1.40				
	50000.	7.68	1.60				
	100000.	7.08	1.12				
CA II 5S-5P	5000.	14.1	-5.29	*0.835	*-0.375	*0.908	*-0.310
11878.9 A	10000.	10.7	-4.15	1.09	-0.566	*1.11	*-0.454
C= 0.53E+21	20000.	9.04	-3.34	1.30	-0.767	*1.29	*-0.624
	30000.	8.57	-2.93	1.43	-0.857	*1.36	*-0.680
	50000.	8.34	-2.49	1.52	-0.979	*1.44	*-0.795
	100000.	8.24	-1.95	1.71	-1.15	1.54	-0.931
CA II 5S-6P	5000.	3.49	-1.30				
4475.8 A	10000.	2.97	-1.08				
C= 0.36E+20	20000.	2.74	-0.868	*0.569	*-0.307		
	30000.	2.72	-0.773	*0.601	*-0.341		
	50000.	2.77	-0.672	*0.624	*-0.387		
	100000.	2.82	-0.523	*0.691	*-0.446	*0.630	*-0.368

PERTURBER DENSITY = $0.10 \times 10^{18} (\text{cm}^{-3})$							
TRANSITION	TEMP(K)	ELECTRONS		PROTONS		IONIZED HELIUM	
		WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 5S-7P 3407.9 A C= 0.11E+20	5000.	4.04	-1.54				
	10000.	3.62	-1.34				
	20000.	3.45	-1.11				
	30000.	3.52	-0.997				
	50000.	3.64	-0.875				
	100000.	3.72	-0.655				
CA II 5P-5D 8235.7 A C= 0.12E+21	5000.	11.0	4.80	*0.806	*0.456		
	10000.	8.97	4.20	*1.03	*0.660		
	20000.	8.13	3.66	*1.27	*0.937		
	30000.	7.87	3.25	*1.38	*1.04	*1.25	*0.855
	50000.	7.79	2.77	*1.54	*1.19	*1.32	*0.925
	100000.	7.77	2.15	*1.73	*1.39	*1.41	*1.10
PERTURBER DENSITY = $0.10 \times 10^{19} (\text{cm}^{-3})$							
CA II 3D-4P 8581.1 A C= 0.86E+22	5000.	13.4	0.592	0.327	-0.420E-01	*0.428	*-0.403E-01
	10000.	10.5	0.323	0.644	-0.111	*0.785	*-0.101
	20000.	8.56	0.248	0.918	-0.192	0.991	-0.165
	30000.	7.76	0.105	1.01	-0.243	1.08	-0.208
	50000.	7.07	0.857E-01	1.11	-0.303	1.18	-0.248
	100000.	6.43	0.813E-01	1.25	-0.372	1.28	-0.306
CA II 3D-5P 2132.3 A C= 0.17E+21	5000.	3.03	-0.303				
	10000.	2.41	-0.180				
	20000.	2.07	-0.195				
	30000.	1.96	-0.158	*0.379	*-0.152		
	50000.	1.89	-0.134	*0.407	*-0.188		
	100000.	1.83	-0.131	*0.430	*-0.223		
CA II 3D-6P 1644.1 A C= 0.48E+20	5000.	*4.09	*-0.988				
	10000.	3.57	-0.794				
	20000.	3.32	-0.628				
	30000.	3.28	-0.528				
	50000.	3.32	-0.499				
	100000.	3.34	-0.429				
CA II 3D-7P 1474.4 A C= 0.21E+20	5000.						
	10000.	*6.21	*-1.59				
	20000.	6.05	-1.28				
	30000.	6.20	-1.11				
	50000.	6.41	-1.20				
	100000.	6.54	-1.00				
CA II 3D-4F 1839.2 A C= 0.16E+21	5000.	1.73	0.666	*0.822E-01	*0.238E-01		
	10000.	1.36	0.517	*0.161	*0.544E-01		
	20000.	1.16	0.408	*0.200	*0.804E-01		
	30000.	1.12	0.367	*0.219	*0.972E-01		
	50000.	1.09	0.311	*0.241	*0.120		
	100000.	1.09	0.257	*0.265	*0.147	*0.249	*0.117

STARK BROADENING PARAMETER TABLES FOR Ca II LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = $0.10^{+19}(\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 3D-5F	5000.	4.28	0.411				
1554.1 A	10000.	4.37	0.563				
C= 0.31E+19	20000.	4.31	0.586				
	30000.	4.24	0.563				
	50000.	4.14	0.736				
	100000.	3.93	0.788				
CA II 3D-6F	5000.	*5.28	*0.225				
1433.3 A	10000.	*6.61	*0.700				
C= 0.17E+19	20000.	7.74	0.807				
	30000.	8.12	0.823				
	50000.	8.36	0.988				
	100000.	8.22	1.63				
CA II 4S-4P	5000.	2.96	-0.491	0.865E-01	-0.200E-01	*0.109	*-0.184E-01
3946.3 A	10000.	2.28	-0.408	0.167	-0.497E-01	*0.200	*-0.428E-01
C= 0.18E+22	20000.	1.88	-0.317	0.236	-0.800E-01	*0.248	*-0.671E-01
	30000.	1.77	-0.271	0.258	-0.991E-01	0.273	-0.794E-01
	50000.	1.71	-0.253	0.287	-0.118	0.300	-0.965E-01
	100000.	1.66	-0.213	0.321	-0.144	0.317	-0.119
CA II 4S-5P	5000.	1.91	-0.132				
1650.6 A	10000.	1.51	-0.119				
C= 0.10E+21	20000.	1.29	-0.142				
	30000.	1.22	-0.128				
	50000.	1.18	-0.122	*0.253	*-0.114		
	100000.	1.15	-0.116	*0.272	*-0.139		
CA II 4S-6P	5000.	*2.81	*-0.623				
1342.1 A	10000.	2.43	-0.464				
C= 0.32E+20	20000.	2.25	-0.420				
	30000.	2.22	-0.372				
	50000.	2.25	-0.358				
	100000.	2.26	-0.302				
CA II 4S-7P	5000.						
1226.8 A	10000.	*4.34	*-1.10				
C= 0.15E+20	20000.	4.22	-0.921				
	30000.	4.32	-0.846				
	50000.	4.47	-0.856				
	100000.	4.56	-0.716				
CA II 4P-5S	5000.	9.35	3.59	*0.187	*0.109	*0.167	*0.702E-01
3727.6 A	10000.	6.71	2.91	*0.356	*0.261	*0.340	*0.191
C=*0.12E+22	20000.	5.10	2.34	*0.504	*0.387	*0.447	*0.298
	30000.	4.56	2.19	*0.593	*0.476	*0.510	*0.372
	50000.	4.21	1.88	*0.708	*0.583	*0.592	*0.465
	100000.	3.91	1.47	*0.806	*0.702	*0.682	*0.579

PERTURBER DENSITY = $0.10 \times 10^{19} (\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CA II 4P-4D	5000.	6.05	2.54	*0.179	*0.815E-01		
3173.5 A	10000.	4.57	1.94	*0.353	*0.201		
C= *0.38E+21	20000.	3.68	1.53	*0.462	*0.294		
	30000.	3.43	1.36	*0.521	*0.358		
	50000.	3.20	1.16	*0.590	*0.444	*0.540	*0.362
	100000.	2.99	0.934	*0.679	*0.547	*0.620	*0.449
CA II 4P-5D	5000.	*5.85	*2.75				
2110.3 A	10000.	4.84	2.34				
C= 0.79E+20	20000.	4.37	1.94				
	30000.	4.23	1.74				
	50000.	4.17	1.50				
	100000.	4.13	1.22				
PERTURBER DENSITY = $0.10 \times 10^{20} (\text{cm}^{-3})$							
CA II 3D-4F	5000.	0.289E-01	-0.393E-02				
1839.2 A	10000.	13.6	4.32				
C= 0.160+22	20000.	11.6	3.54				
	30000.	11.2	3.23				
	50000.	10.9	2.78				
	100000.	10.8	2.31				
CA II 4S-4P	5000.	*29.5	*-4.19	*0.193	*-0.432E-01		
3946.3 A	10000.	22.8	-3.68	*1.00	*-0.256		
C= 0.18E+23	20000.	18.8	-2.91	*2.14	*-0.597		
	30000.	17.7	-2.50	*2.41	*-0.800		
	50000.	17.1	-2.36	*2.79	*-1.01		
	100000.	16.6	-2.06	*3.18	*-1.37		
CA II 4S-5P	5000.	0.271E-01	0.162E-02				
1650.6 A	10000.	14.8	-0.234				
C= 0.100+22	20000.	12.7	-0.821				
	30000.	12.1	-0.784				
	50000.	11.7	-0.790				
	100000.	11.5	-1.00				

ТАБЕЛЕ ПАРАМЕТАРА ШТАРКОВОГ ШИРЕЊА ЛИНИЈА Ca II ОД
ЗНАЧАЈА У АСТРОФИЗИЦИ

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Користећи семикласичан прилаз, израчуна-
те су ширине и помераји спектралних линија, про-
узроковани сударима са електронима, протонима

и јонима хелијума, за 28 мултиплета јонизованог
калцијума. Резултати су дати у функцији темпер-
атуре и концентрације пертурбера.