The CHIANTI Database

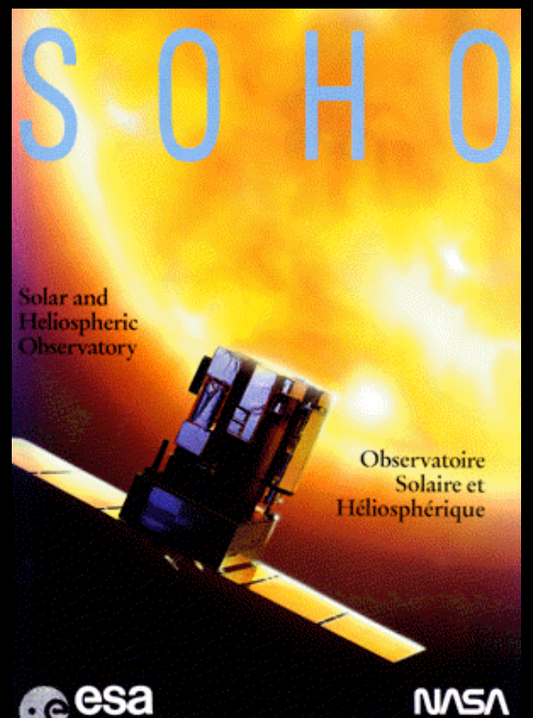
Dr Peter Young

George Mason University
NASA Goddard Space Flight Center
University of Northumbria

Summary

- Website: http://chiantidatabase.org
- First released in 1996
- Software and data are freely available
- Summary of current database: → Young et al. (2016, J. Phys. B)
- Current version: 8.0.2 → Del Zanna et al. (2015, A&A)
- Five person team:

  Ken Dere, Enrico Landi, Helen Mason, Peter Young, Giulio Del Zanna



Recent updates

Version 6 (2009)

- Now have an official CHIANTI equilibrium ionization fraction table
- Distribute ionization and recombination rates

Versions 7 & 8 (2011-2015)

- Major updates of coronal iron ions
- APAP atomic data for several isoelectronic sequences

Atomic data

Primary

- Electron excitation effective collision strengths
- Radiative decay rates
- Energy levels (observed, where available)
- Ion-to-ion ionization and recombination rates

} *Only fine structure data included*

Secondary

- Proton excitation rate coefficients
- Level-resolved ionization and recombination rates (selected ions)
- Dielectronic capture rates (selected ions)
- Autoionization rates (selected ions)
- Two photon decays (H, He-like)

Coverage

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV	XXVI	XXVII	XXVIII	XXIX	XXX
H	25																													
He	49	25																												
C	42	204	20	331	49	25																								
N	47	58	204	20	268	49	25																							
O	7	35	46	204	166	268	49	25																						
Ne	-	138	86	22	49	204	46	243	49	36																				
Na	-	209	195	10	13	20	204	10	204	49	25																			
Mg	-	161	209	195	86	72	46	204	108	243	49	25																		
Al	-	20	161	209	195	10	15	20	204	10	243	49	25																	
Si	-	29	20	161	209	195	86	72	46	204	92	243	49	25																
P	-	-	-	-	161	209	3	10	15	20	204	10	204	45	25															
S	60	70	53	52	16	161	209	195	86	72	72	204	92	243	49	25														
Cl	-	5	5	5	-	-	-	-	-	10	15	20	204	10	204	49	25													
Ar	-	-	5	30	5	-	16	161	209	195	86	72	15	204	92	243	49	24												
K	-	-	-	-	5	5	-	-	161	209	3	10	15	20	204	10	204	49	25											
Ca	-	41	-	-	5	5	27	40	283	161	209	195	86	91	46	204	92	243	49	25										
Ti	-	-	-	-	-	-	-	-	-	-	16	161	209	3	10	72	20	15	10	20	-	-								
Cr	-	-	-	-	-	-	13	31	48	-	-	-	16	161	209	3	10	15	20	204	10	243	-	-						
Mn	-	-	-	-	-	-	-	13	31	48	-	-	-	-	161	209	3	10	15	20	204	10	204	-	-					
Fe	-	142	322	37	34	96	9	536	915	552	996	912	749	739	283	161	267	337	636	375	620	548	196	243	49	25				
Ni	-	17	-	-	-	-	-	-	-	-	599	31	48	143	483	40	159	161	209	195	58	15	20	204	92	243	49	25		
Zn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	161	209	-	10	72	20	-	10	243	49	-

Ions in CHIANTI 8.0

- ≤ 10 levels
- < 100 levels
- ≥ 100 levels

Spectral modeling

Assumptions

- Electron-ionized plasma
- Optically thin
- Equilibrium

Software: IDL and Python (*ChiantiPy*)

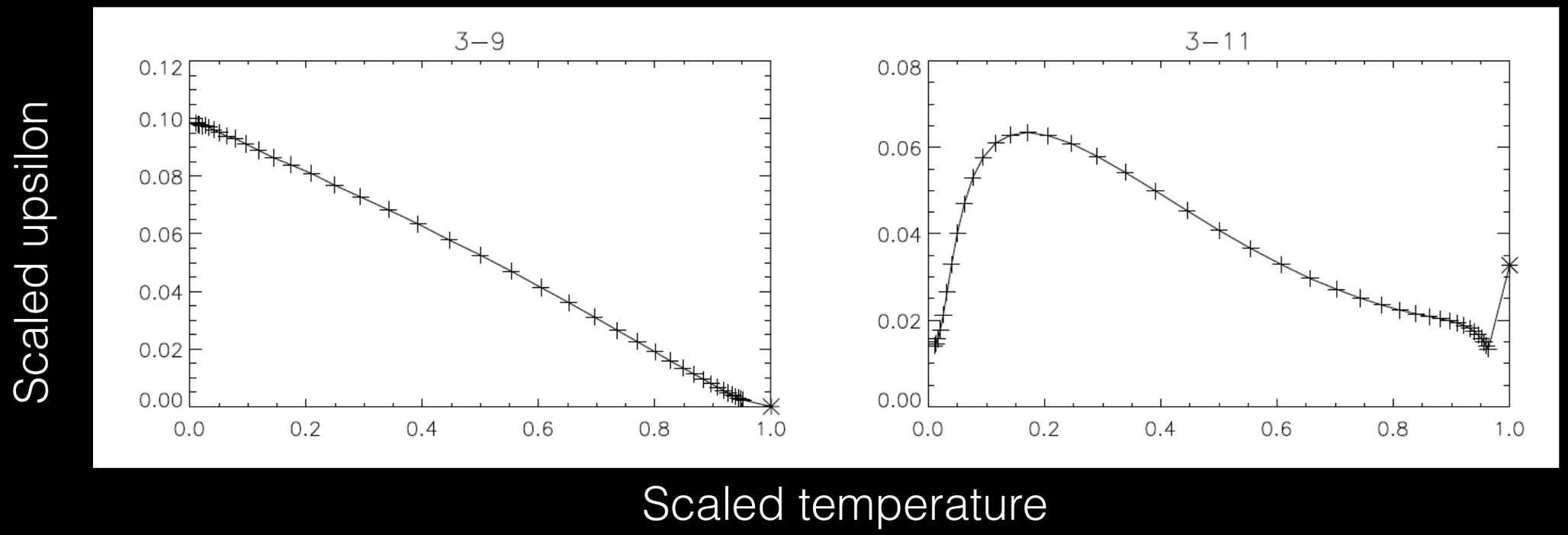
Spectra are computed directly from atomic data (no emissivity tables)

Data assessment

Data assessment is critical to CHIANTI's success

1. *Each transition is assessed graphically*
   - Burgess & Tully (1992) scaling used

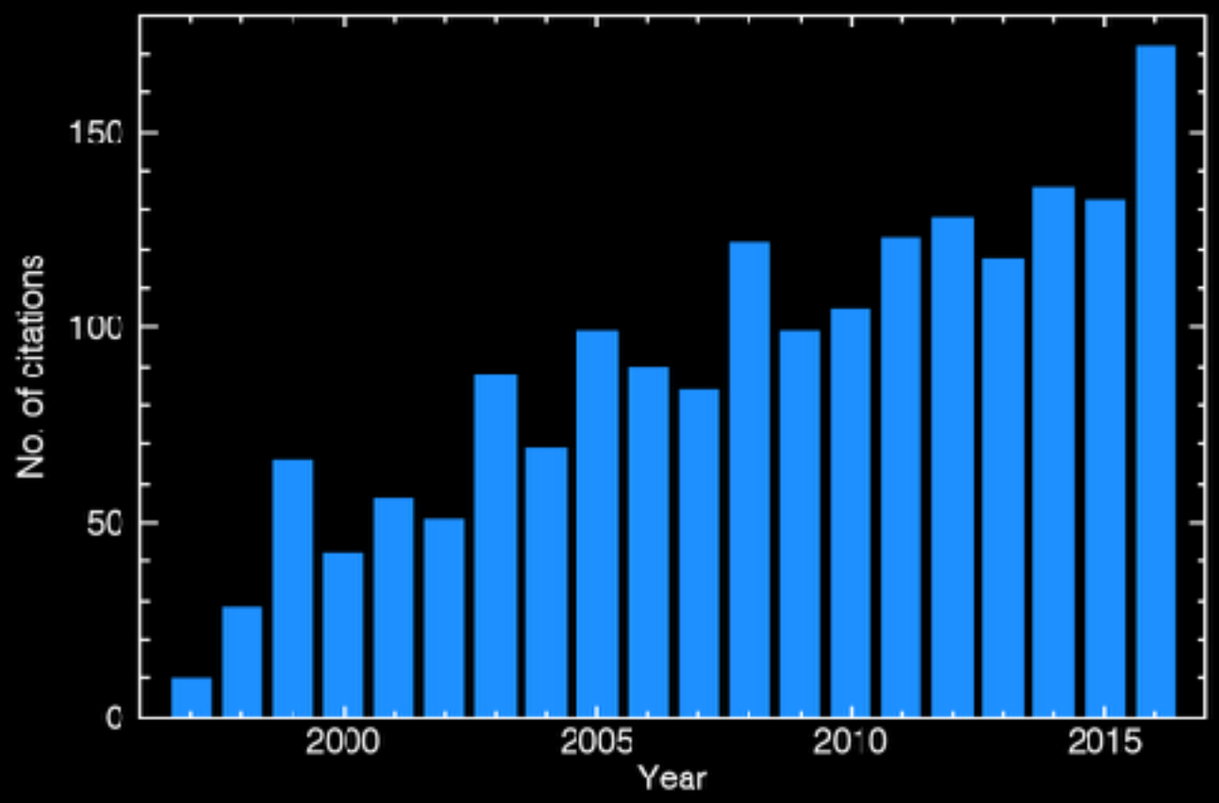
2. *Benchmark comparisons with solar and stellar spectra are performed*
   - intensities/fluxes predicted and compared with observations
   - gives confidence in data
   - identifies where new data are required



Applications

Applications roughly 60/40 split between solar/astro

- Spectroscopists: plasma diagnostics, DEM modeling
- Theoretical modelers: used for predicting emissions from codes
- Instrument teams: calibration activities; instrument response functions
- Plasma codes: atomic data ingested



2930 citations to CHIANTI papers