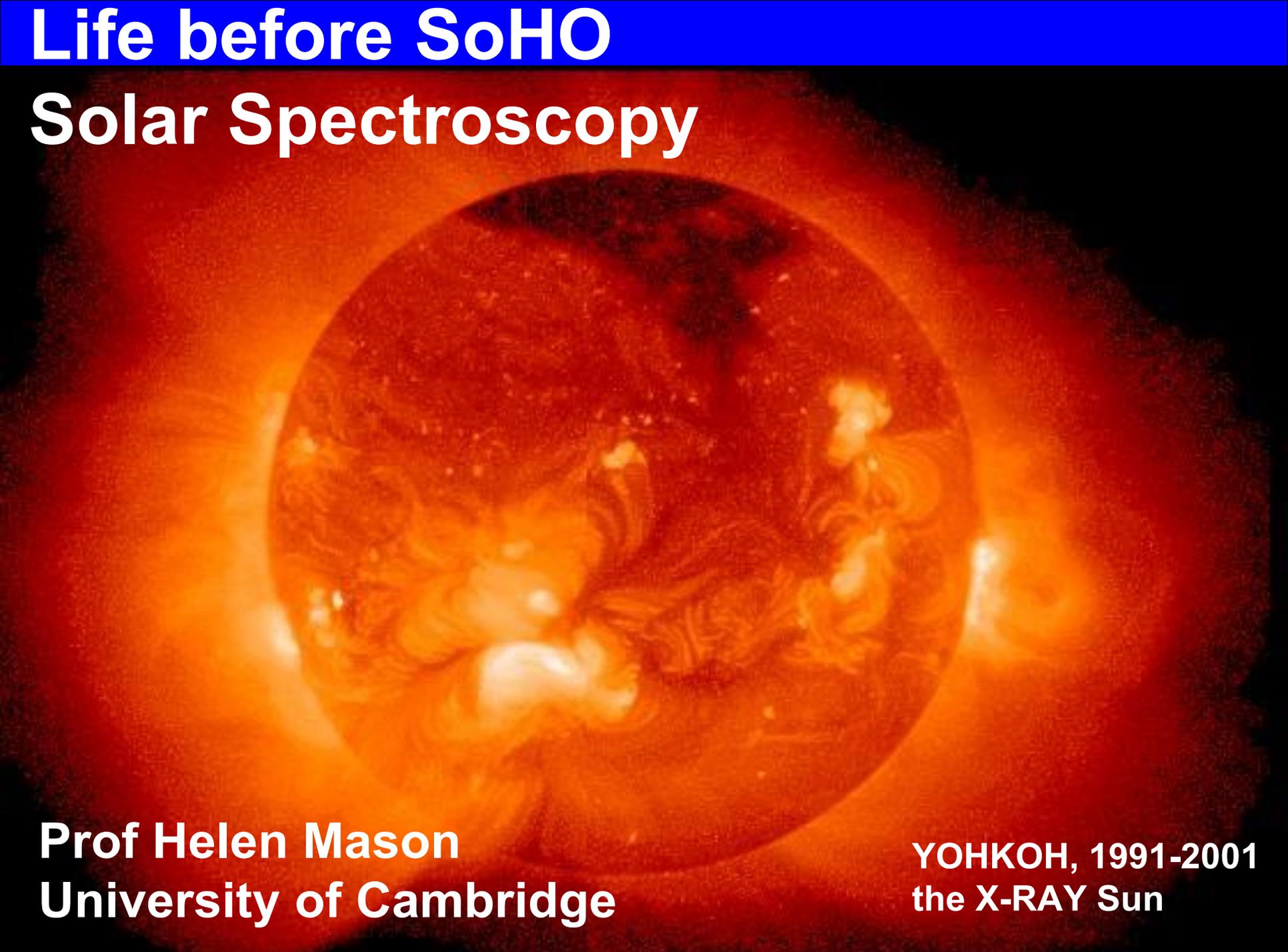


Life before SoHO

Solar Spectroscopy

Prof Helen Mason
University of Cambridge

YOHKOH, 1991-2001
the X-RAY Sun



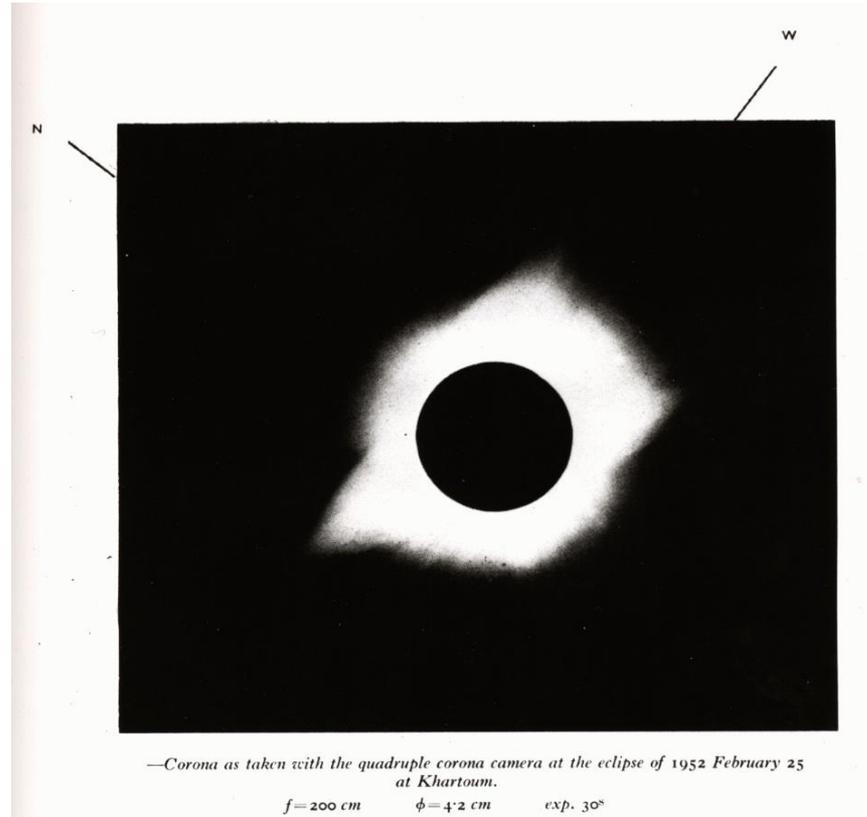
Atomic Physics Calculations

University College London

New calculations for the coronal iron ions
Mason (1974) Fe X, Fe XI, Fe XIV

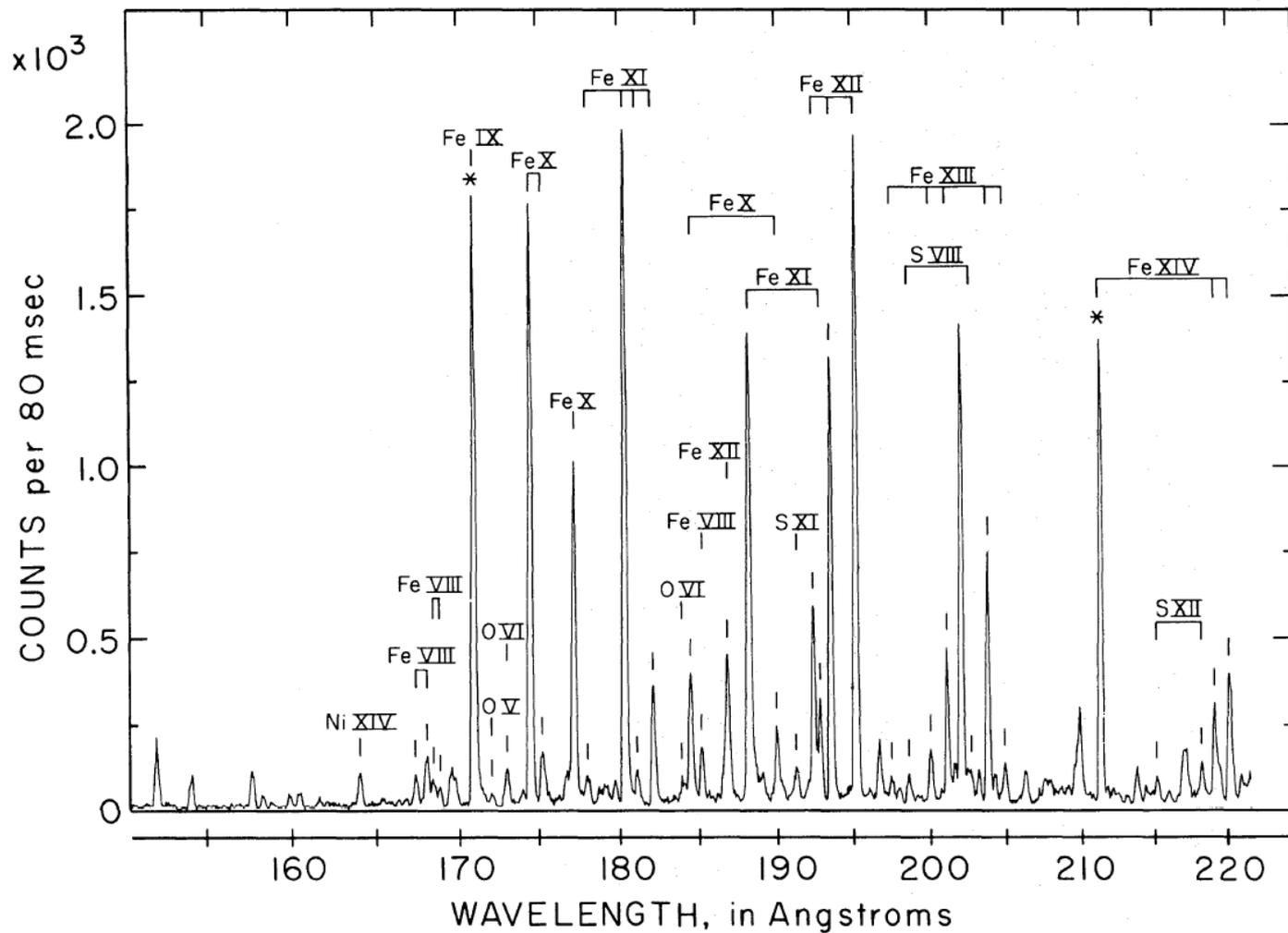


**Prof Mike Seaton (UCL) and
Dr Alan Burgess (Cambridge)**



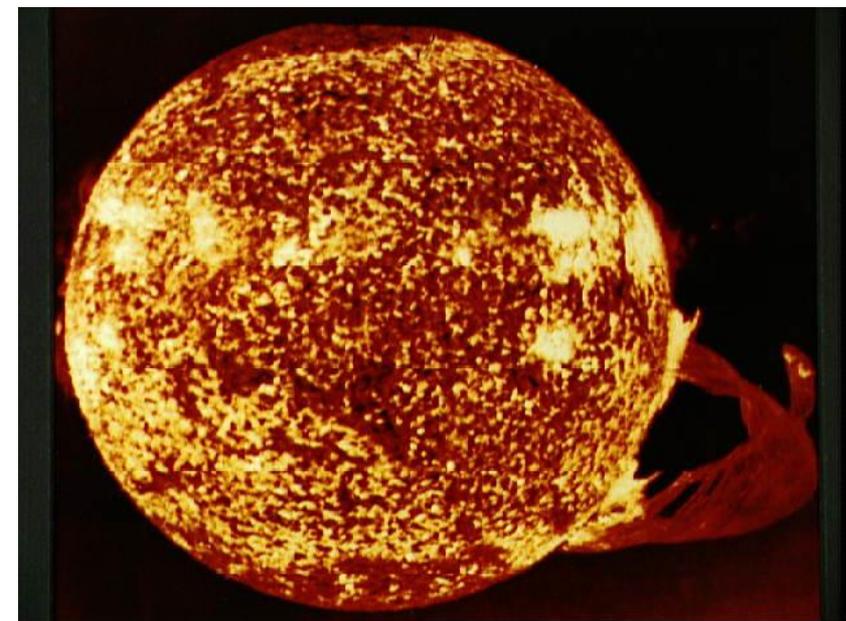
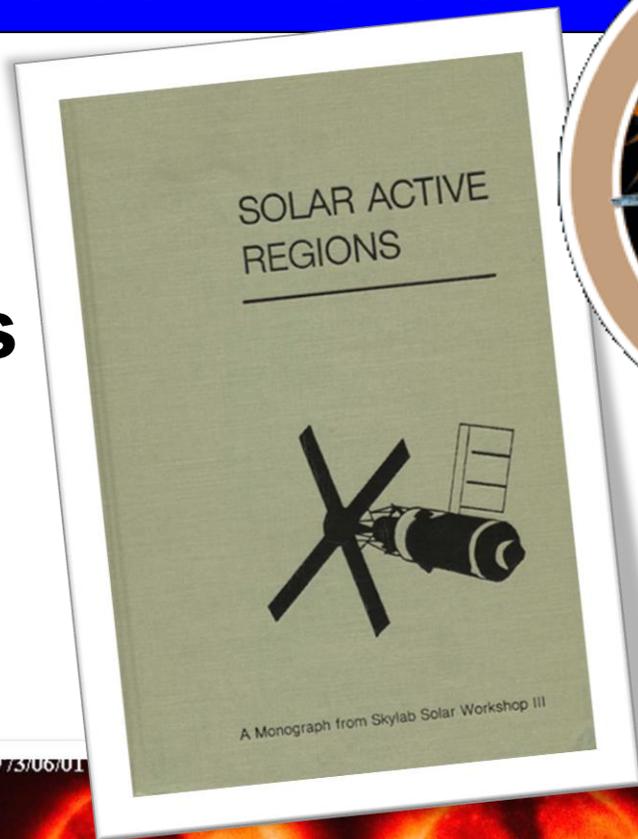
**Total Eclipse of the Sun
25th February 1952**

UV Spectra - Rocket Flights – 1970s



Malinovsky & Heroux (1973)

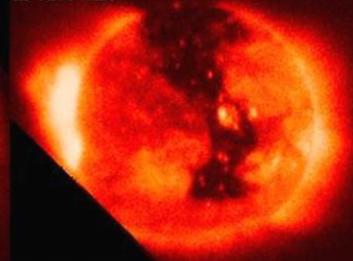
Coronal Holes Solar Flares Solar Active Regions



1973/06/01



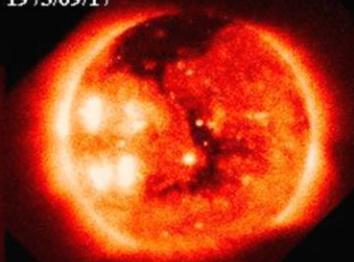
1973/07/26



1973/08/21



1973/09/17



1973/10/14



S0555 (HCO) 296-1340A
S082A (NRL) 171-630A
S082B (NRL) 970-3940A

Dere, Mason, Widing & Bhatia (1979) Skylab NRLA

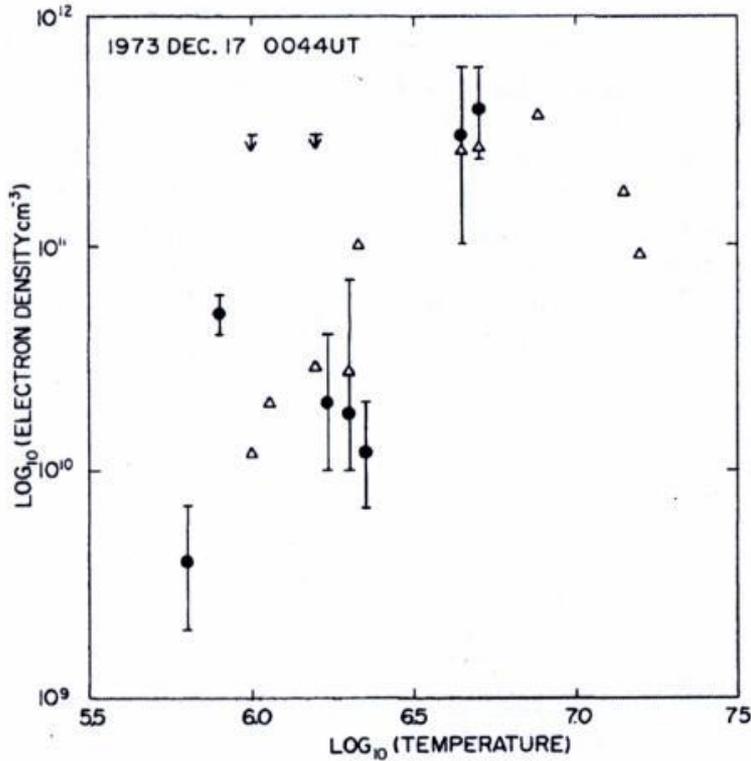
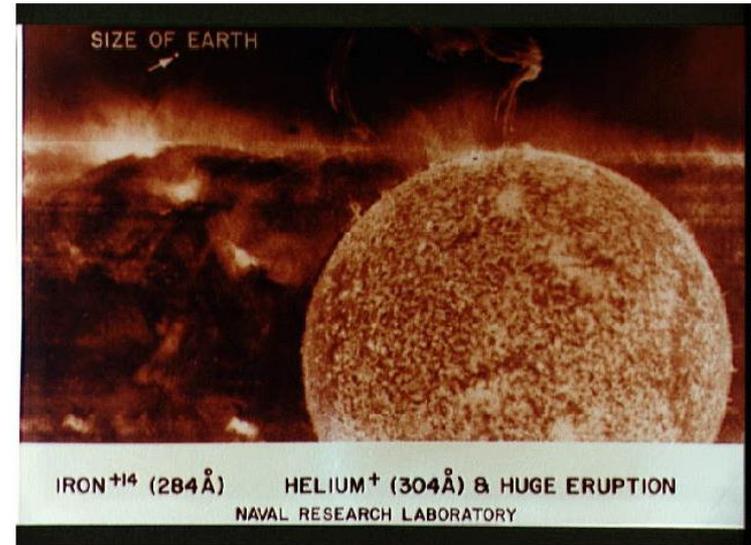


FIG. 13.—Electron density as a function of electron temperature for the 1973 December 17 flare. For meaning of symbols, see Fig. 12.

Skylab – NRL S082A – Overlappograph



Part of an "overlappograph" image taken by the S082A EUV spectroheliograph on the Skylab Apollo Telescope Mount, January 1, 1974 (*JSC Digital Image Collection*)

- up to 1" spatial resolution
- Electron density measurements for a small compact flare, 1973 Dec 17

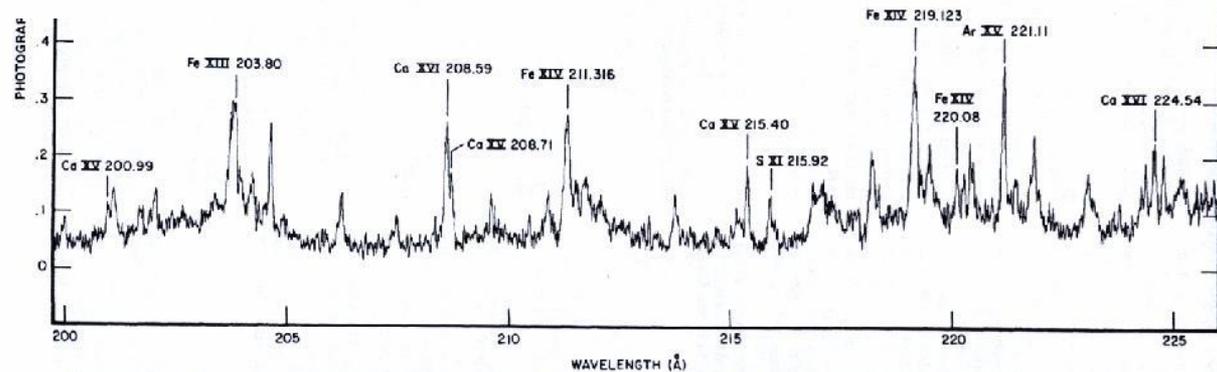


FIG. 3.—A portion of a microdensitometer tracing from a solar XUV spectroheliogram of the 1973 December 17 flare for the wavelength region 200–225 Å

Solar Flares – the Skylab Era – 1970's

George Doschek and I not only worked on solar flares, we actually wore flares!



Flares in the 1970's

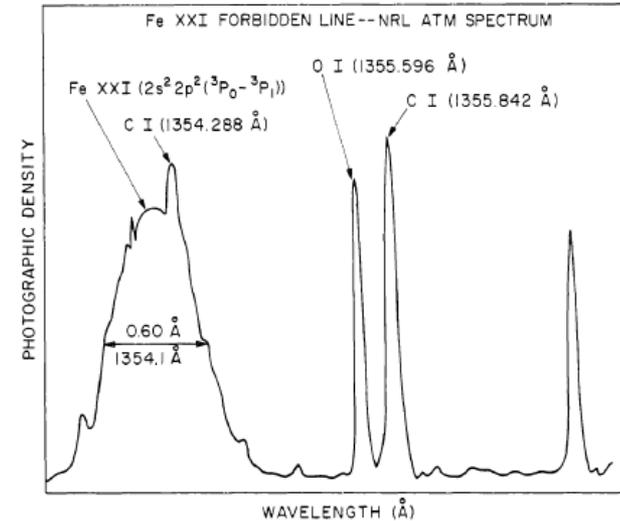
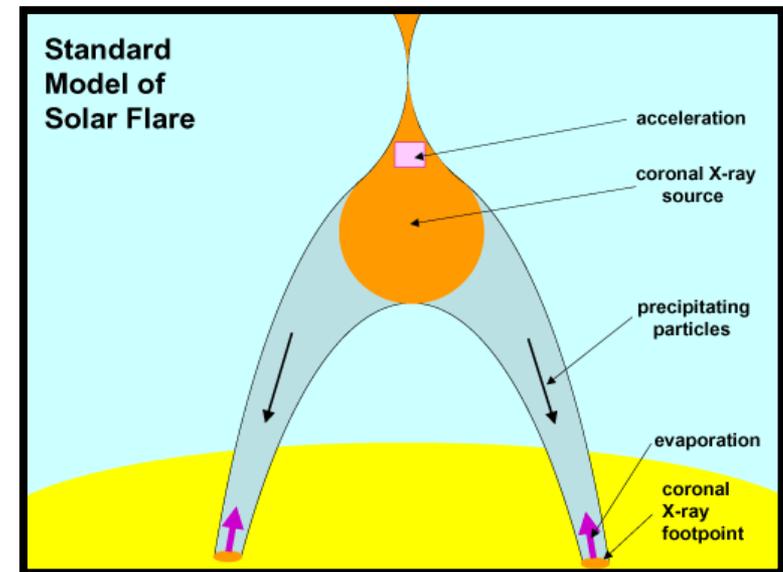
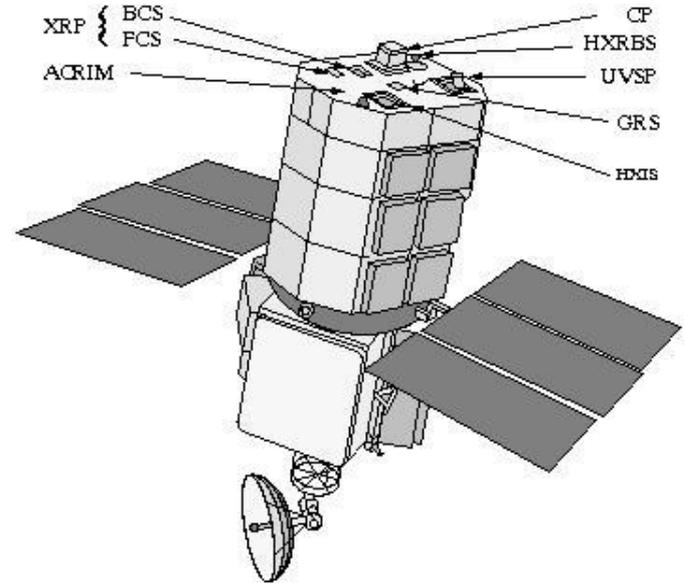
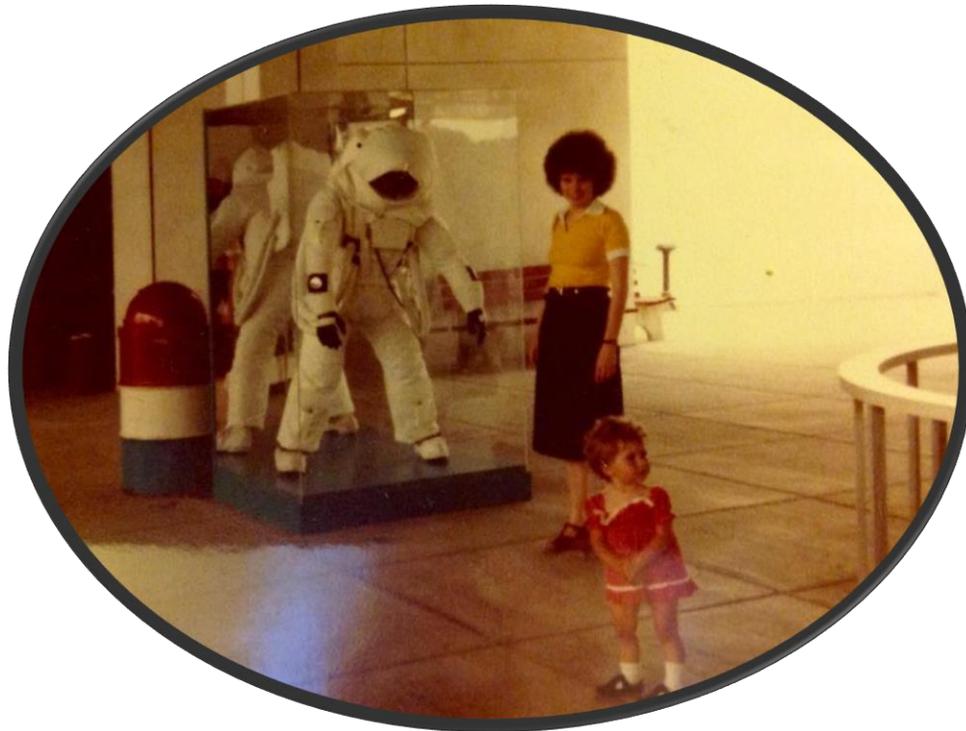


FIG. 1.—Densitometer tracing of the forbidden line of Fe XXI.

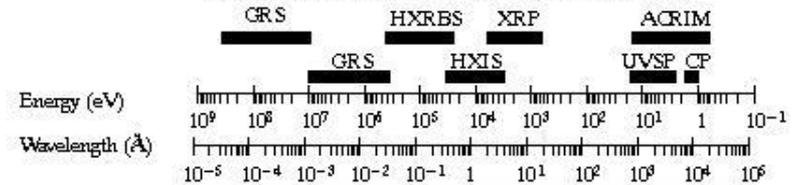


Benz, 2008, Living Rev. Sol. Phys

Solar Maximum Mission



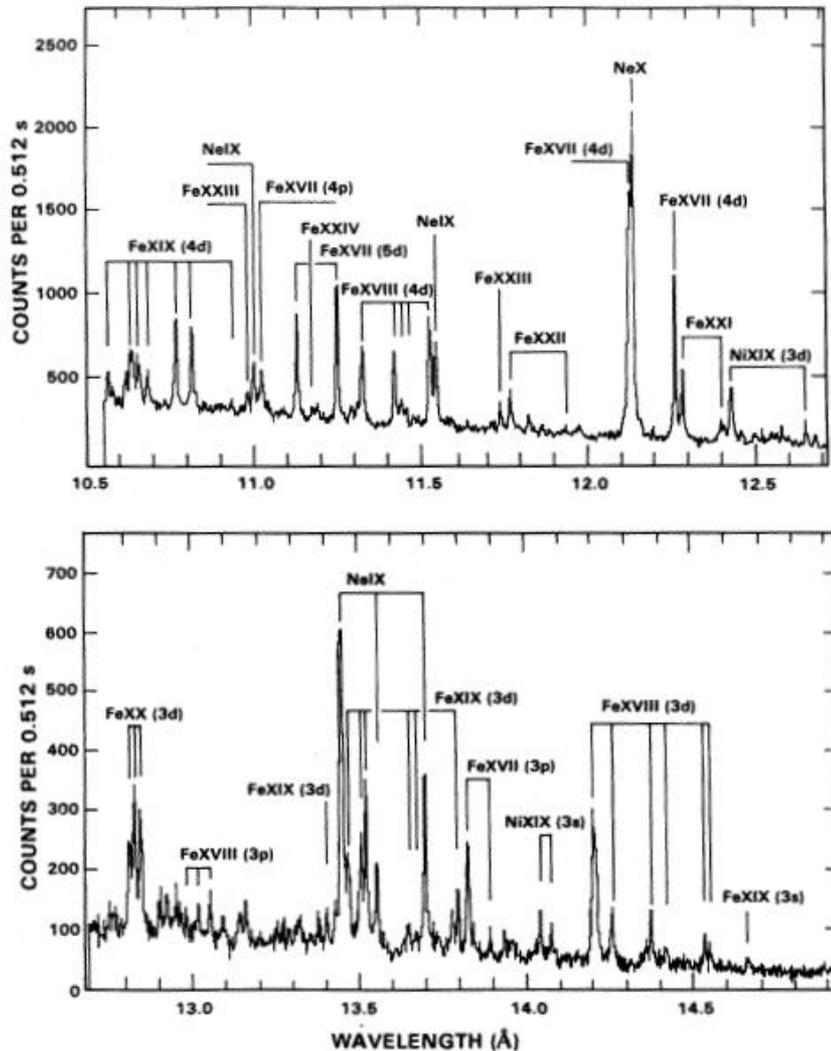
Energy/Spectral Ranges of the SMM Instruments



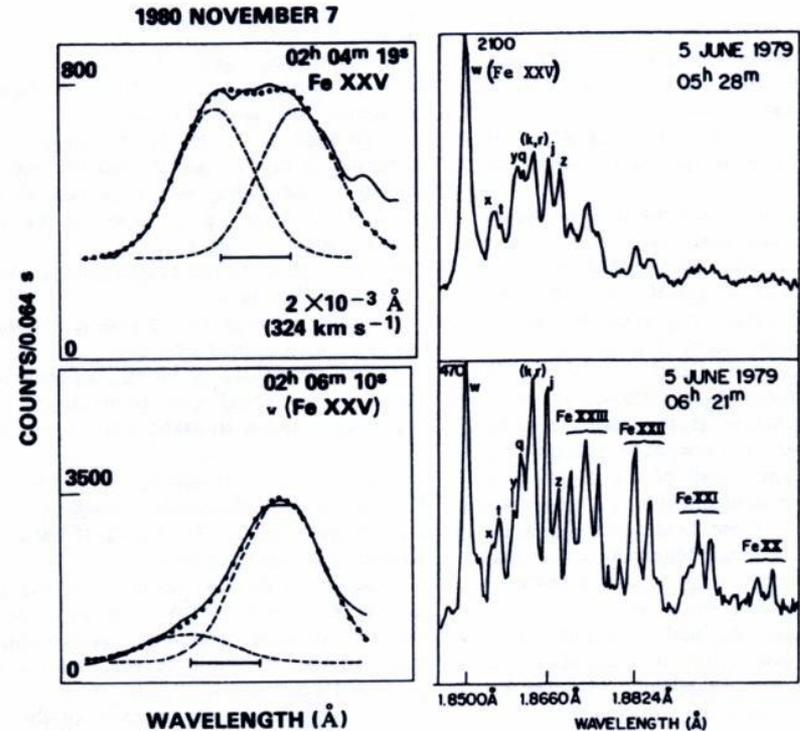
SMM was launched 1980, failed later that year but was repaired and continued working until 1989. I worked with two teams - UVSP, XRP. It was operated from NASA/ Goddard Space Flight Center



SMM/FCS and BCS – Flare spectra



Phillips, Mason et al, 1982
 10-14Å - many high temperature
 flare lines from FeXVII-XXVI



Chromospheric evaporation
 Blue-shifts in high temperature
 flare lines were seen with
 X-ray spectrometers studied by
 many scientists, Ester Antonucci +

HRTS – NRL - 1975-1992, 1170-1710A

Brueckner, Dere et al

HRTS-1 Sunspot Spectra

Sunspot

1548Å

C IV

1550Å



HRTS – Dere and Mason, 1993

Non-thermal velocities in Transition Region ions in the Quiet Sun, later studied with SUMER

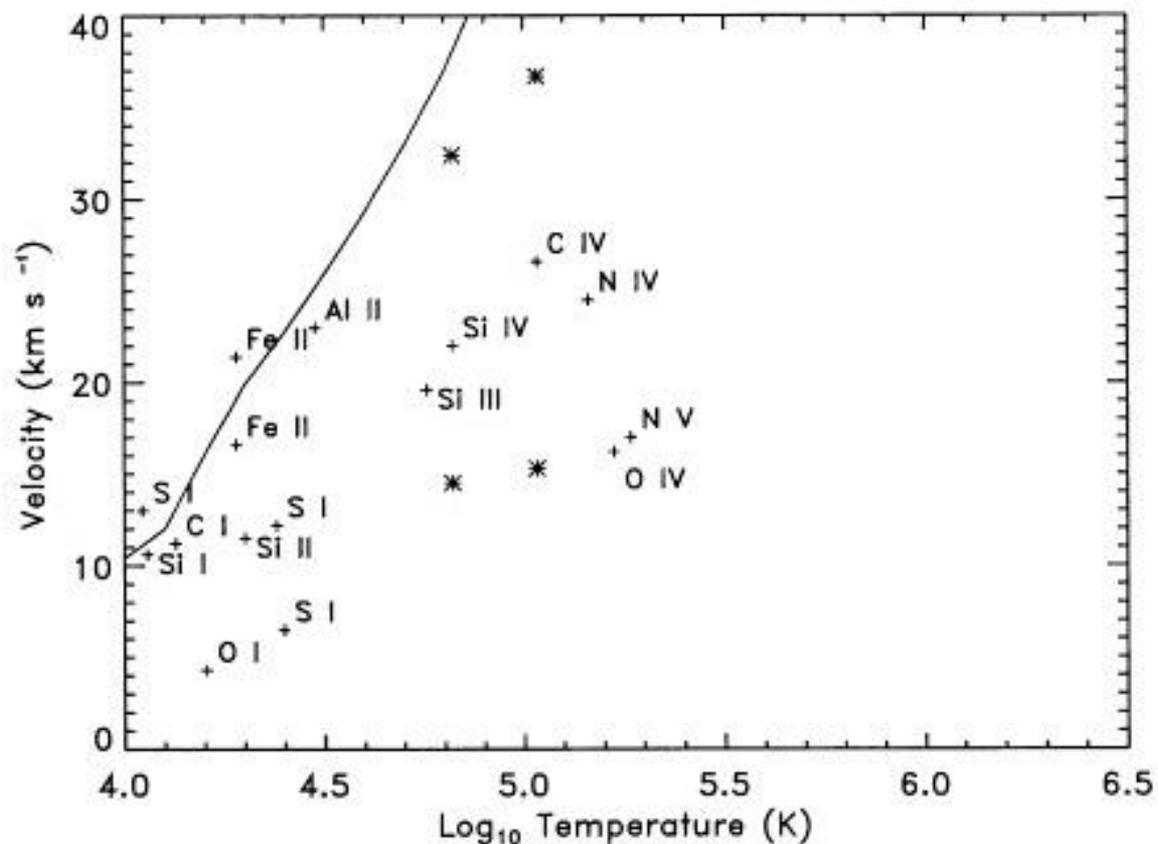


Fig. 3. Nonthermal velocities in the quiet Sun derived from HRTS spectra. Solid line indicates sound speed; * indicates two-component gaussian values.

Atomic data for coronal and TR ions

**Anand Bhatia
(Goddard Space Flight Center)**

We calculated new atomic data for many ions using UCL atomic codes, with many diagnostic results published.



Worked with many other atomic physicists – QUACS consortium led by Peter McWhirter, RAL.

Jacques Dubau and colleagues at MEUDON

An atomic database for astrophysics



***Tuscany – Arcetri Observatory
Helen, Giulio, Enrico, Ken, Massimo and Peter***

- **UK, USA, Italy**
- **First database to make atomic data freely available for astrophysics**
- **First released in 1996**
- **UK APAP network**
- **Over 5,000 citations**

Founder members of the CHIANTI team:

Ken Dere, Helen Mason and Brunella Monsignori-Fossi

NASA AWARD 2024 "for outstanding contributions to the scientific productivity of NASA missions and the creation of a uniquely valuable tool for spectroscopic scientists worldwide"

esa SP-348
November 1992

Coronal Streamers, Coronal Loops, and Coronal and Solar Wind Composition



Proceedings of the First SOHO Workshop
Annapolis, Maryland, USA
25 – 28 August 1992



First SoHO Workshop

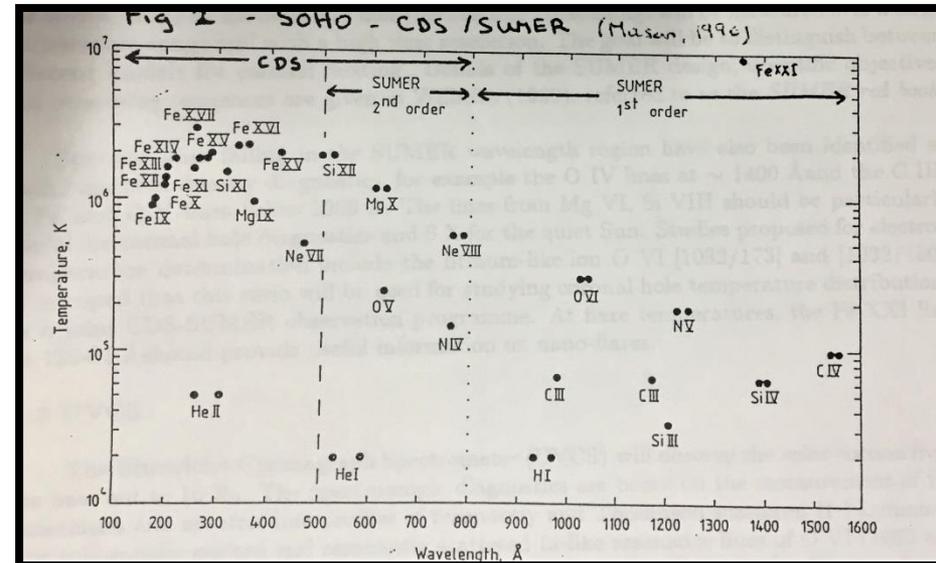
1992, Annapolis

We worked together long before SoHO was launched.

SoHO marked a new era in collaboration and co-ordination of science plans, observations and data reduction.

CDS/SUMER had regular joint team meetings.

Working together was a lot of fun!!

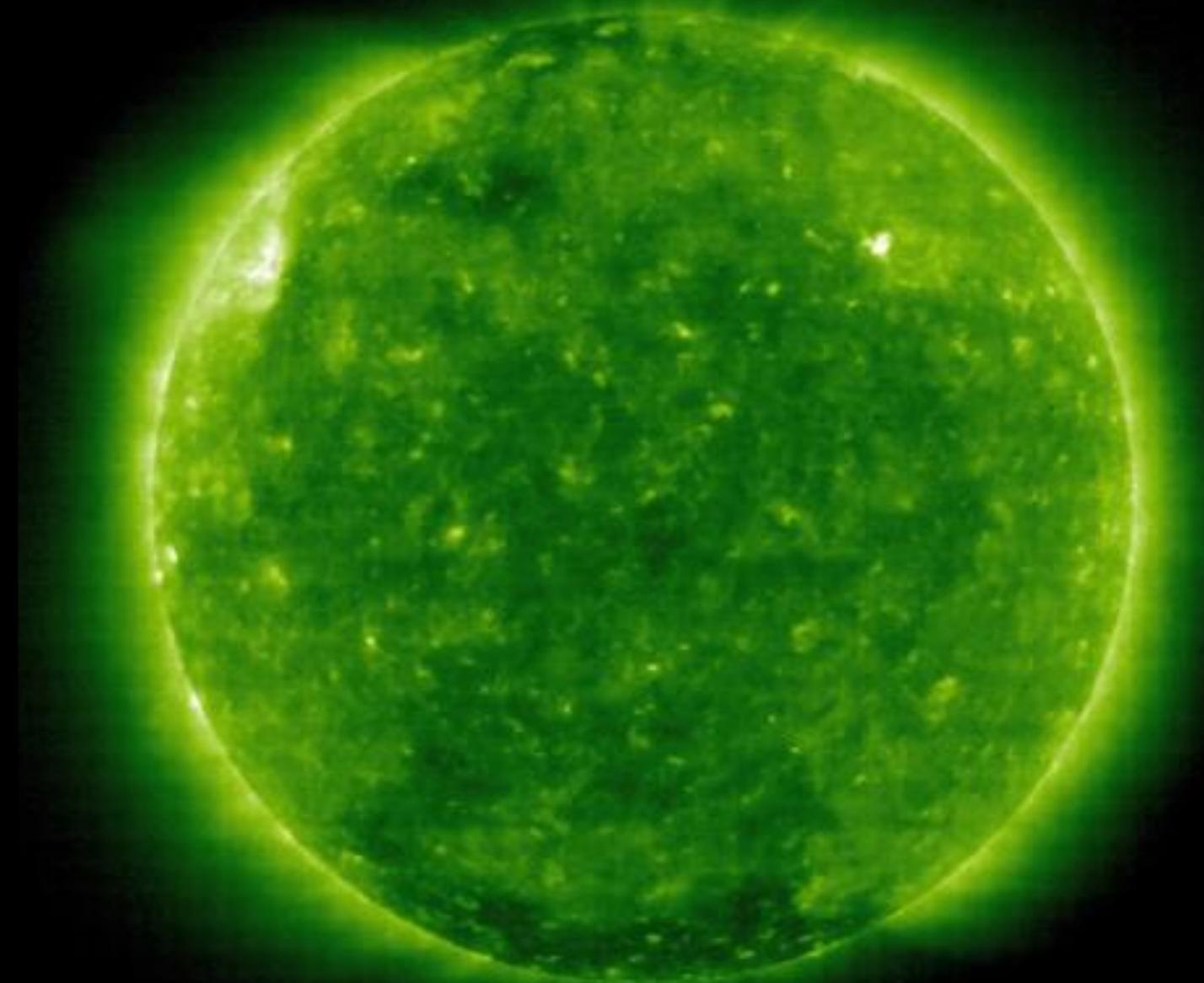


SOHO

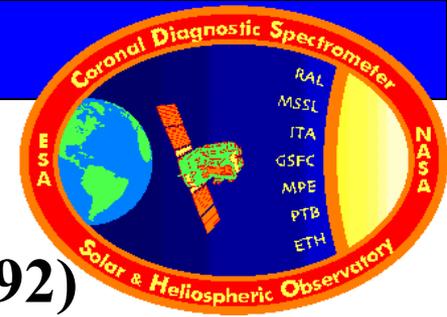
New Views of the Sun



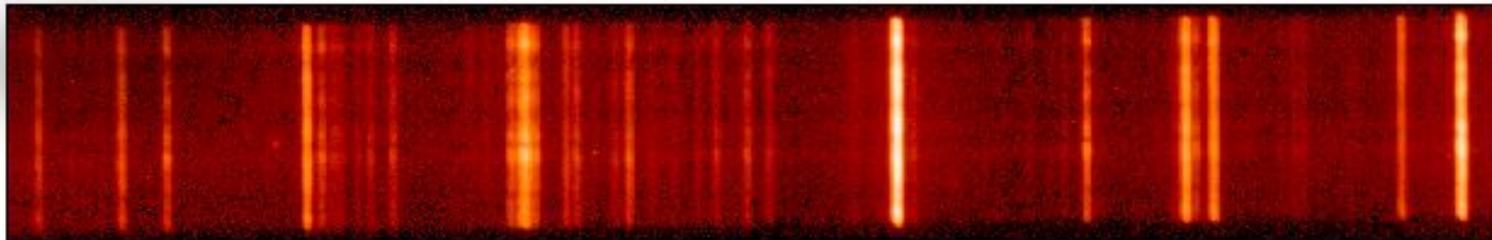
SoHO – EUV Imaging Telescope – 195A



Coronal Diagnostic Spectrometer



PI - Prof Richard Harrison, RAL
Previously - Bruce Patchett (died 1992)
Spectra at each wavelength and spatial position. Took a long time to build up a raster
NIS: 307-397A, 513-633A
GIS: 151-785A



520

540

560

580

600

620

He I 584.33 Å

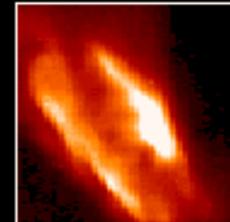
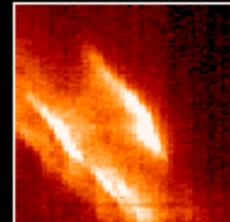
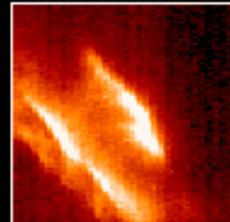
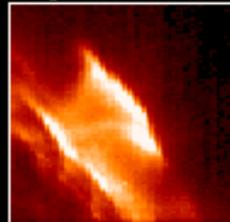
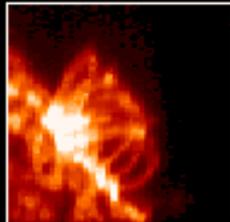
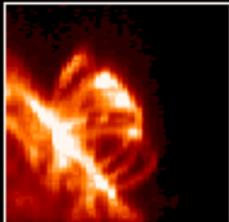
O V 629.73 Å

Mg IX 368.06 Å

Si X 356.04 Å

Si X 347.40 Å

Fe XVI 360.76 Å



25-Jul-1999 17:13:51

CHIANTI and CDS Spectrum

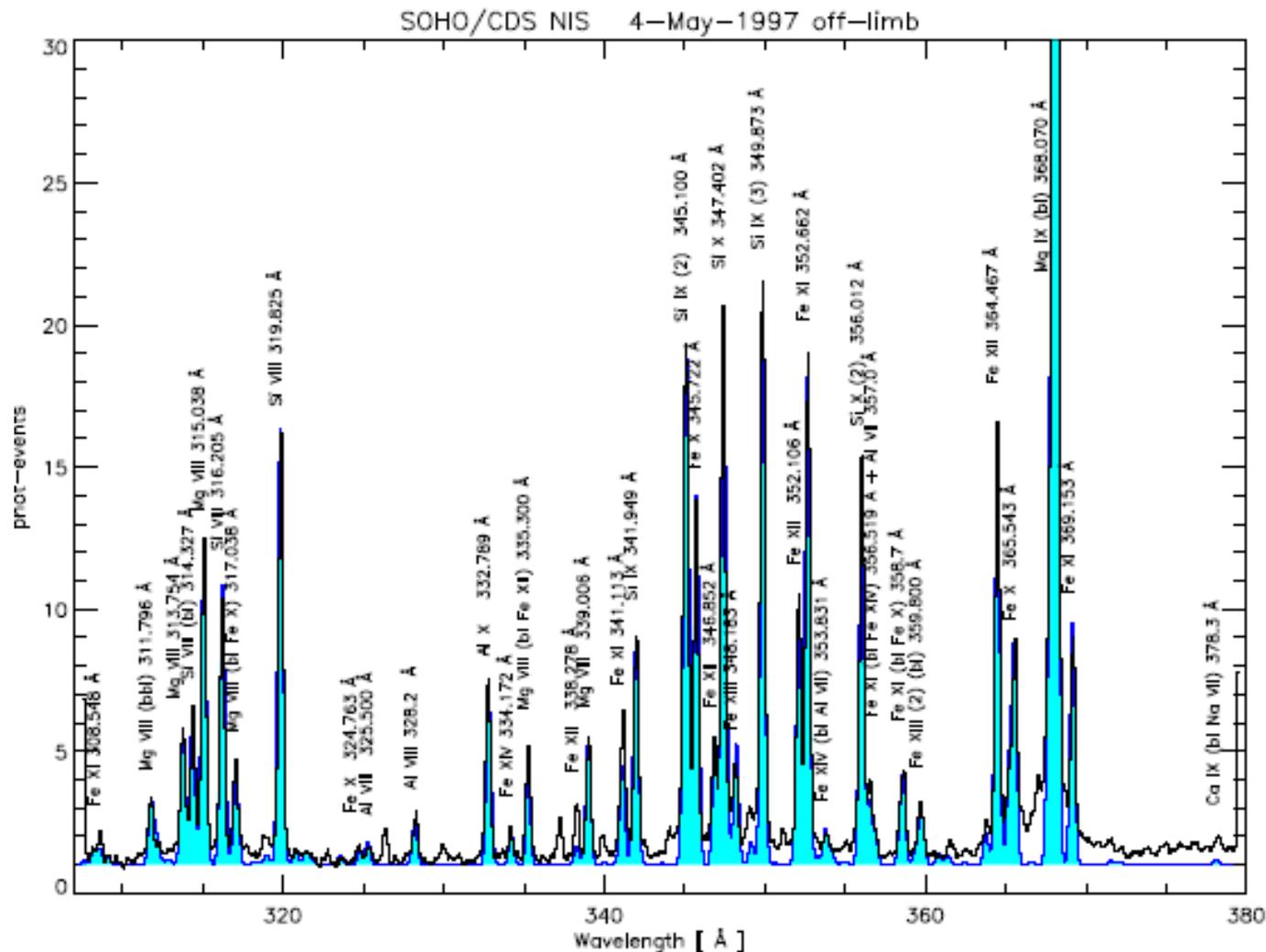


Figure 4: SoHO CDS NIS averaged spectra of the quiet Sun, with the simulated spectra obtained with CHIANTI v.1 shown with shaded blue areas and the second-order contributions in red (Del Zanna, 1999).

Some of the CDS Team at RAL



sun | trek

Sun | trek is an educational website created by UK solar researchers & teachers, led by Helen Mason and Dave Pike.



SunSpaceArt.org

2025 European Solar Physics Division (ESPD) Kees Zwaan Inspirational Community Prize

'Today I loved this lesson because the science and art inspired me'