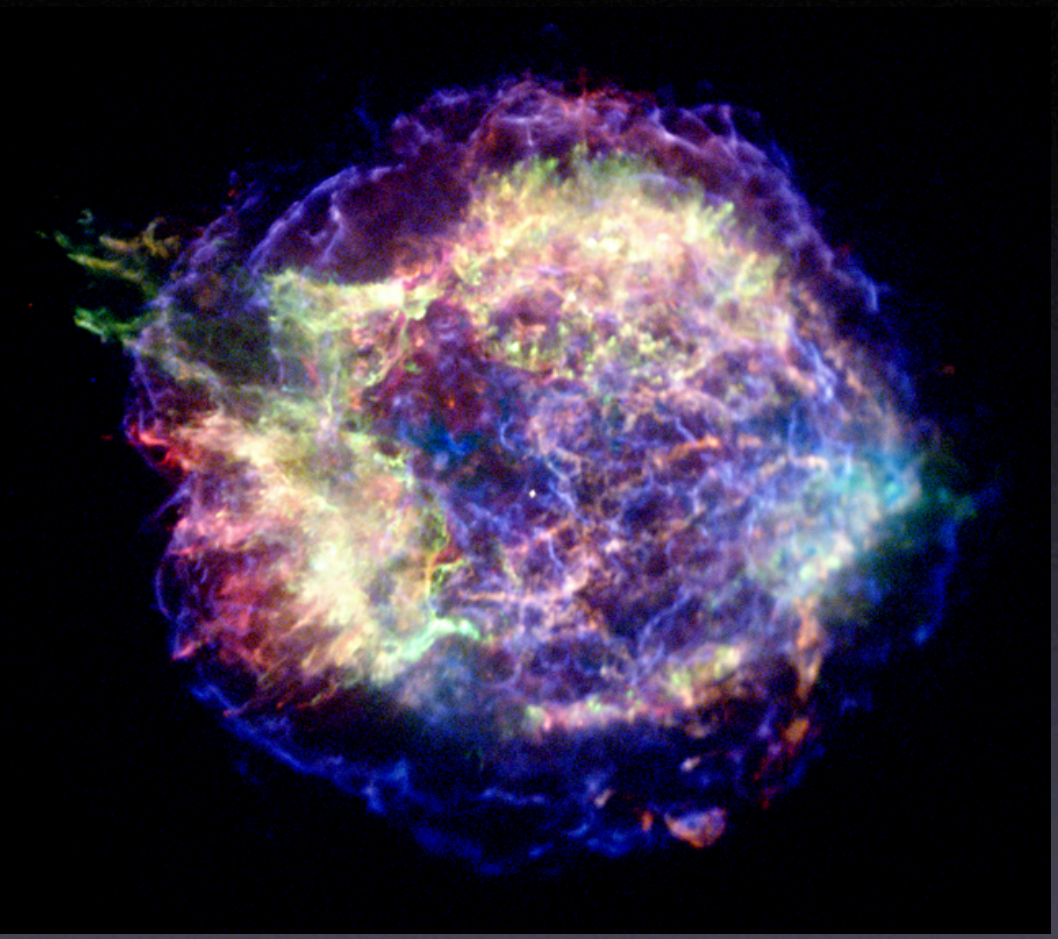
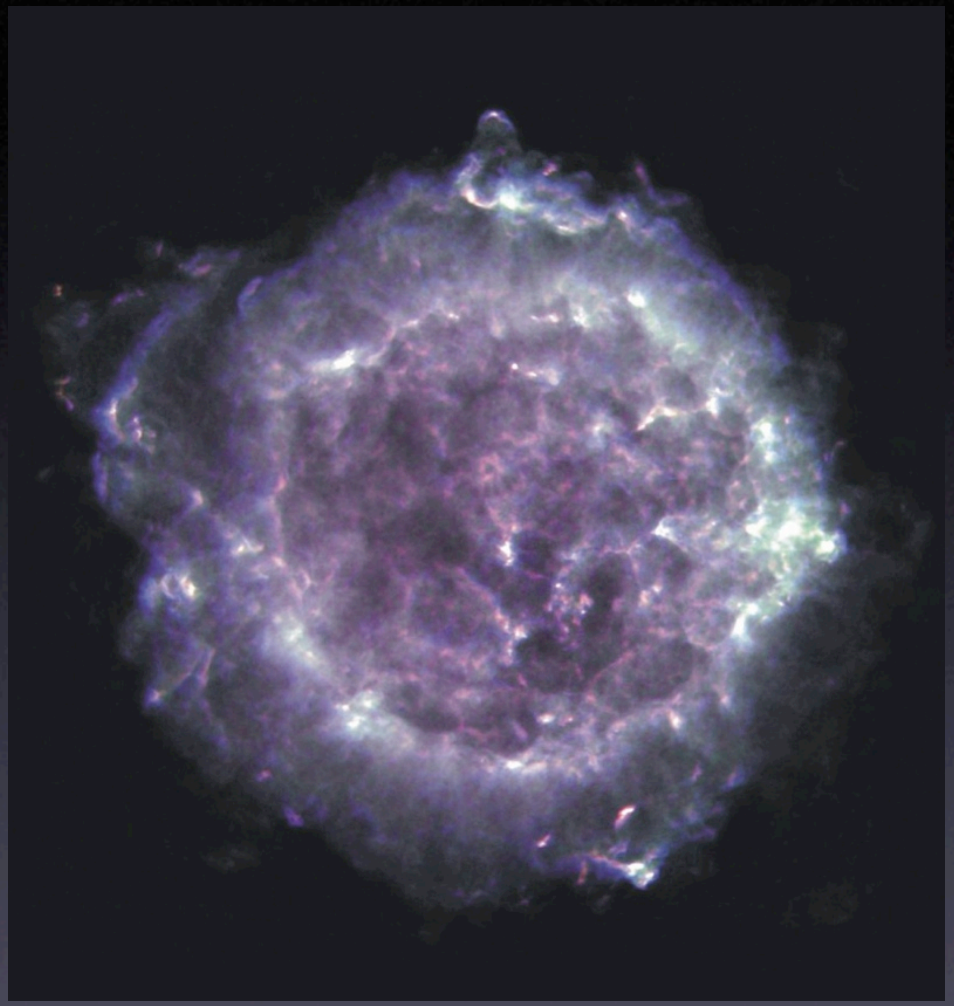
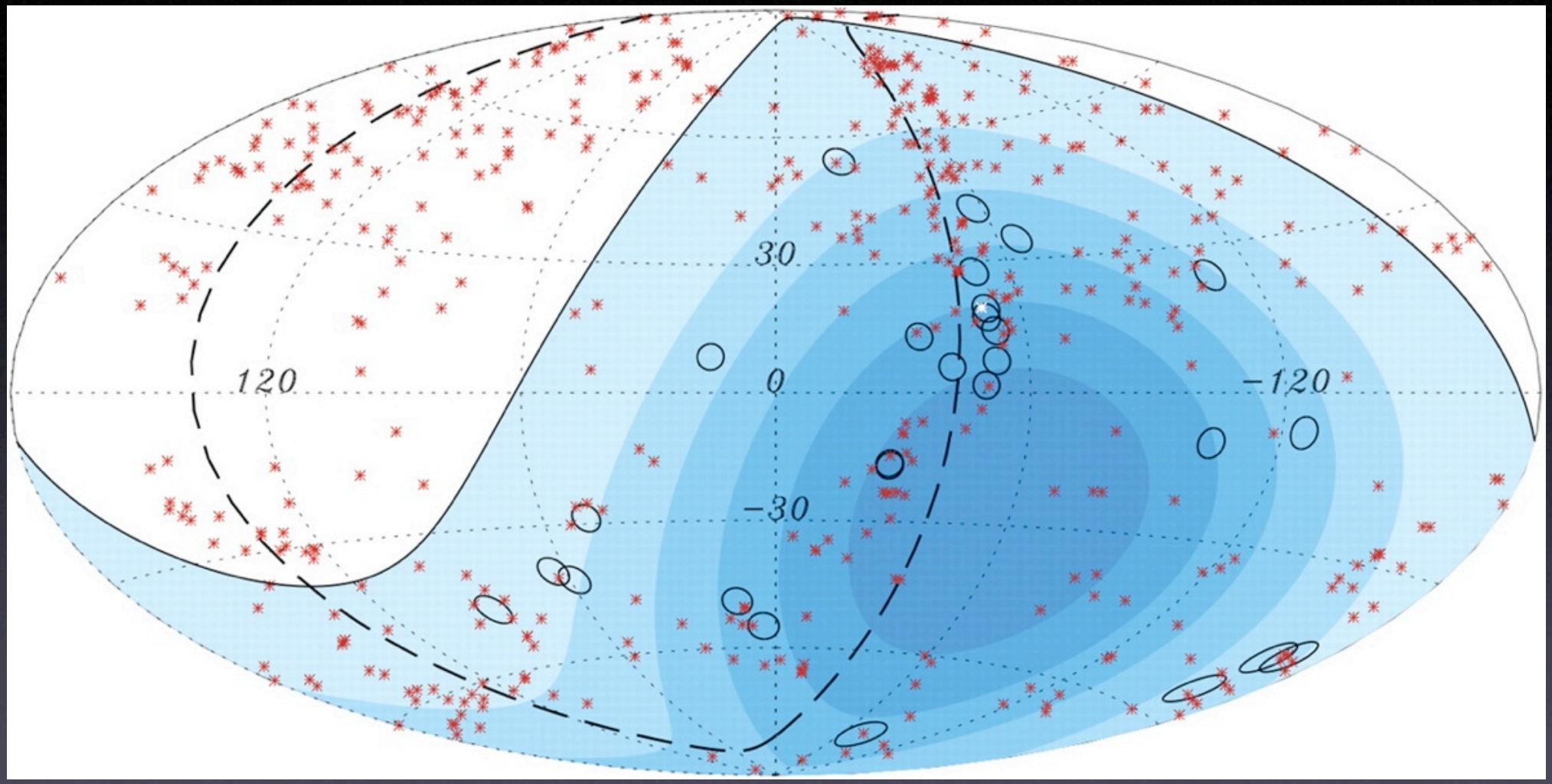
Radiative Processes

2010

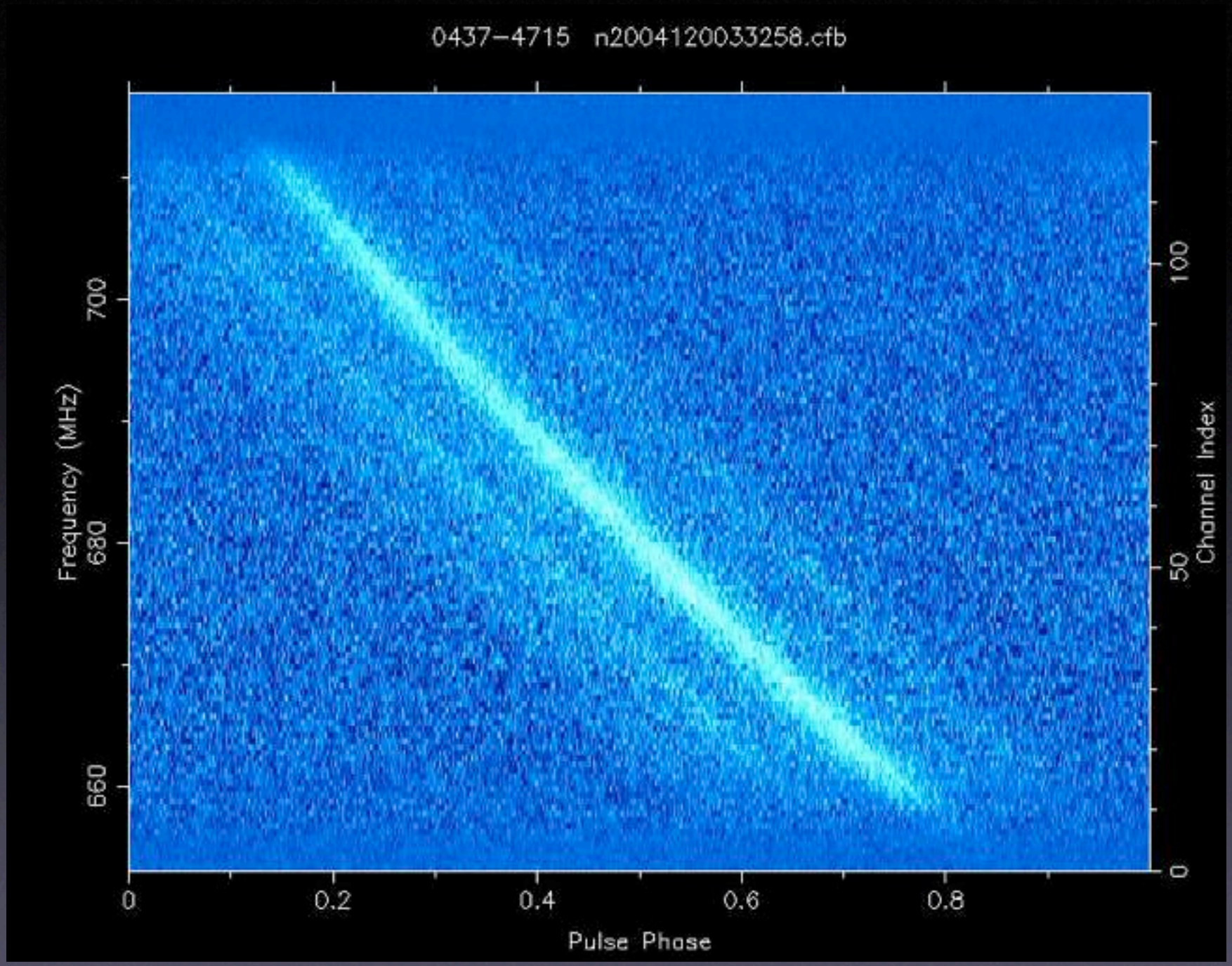




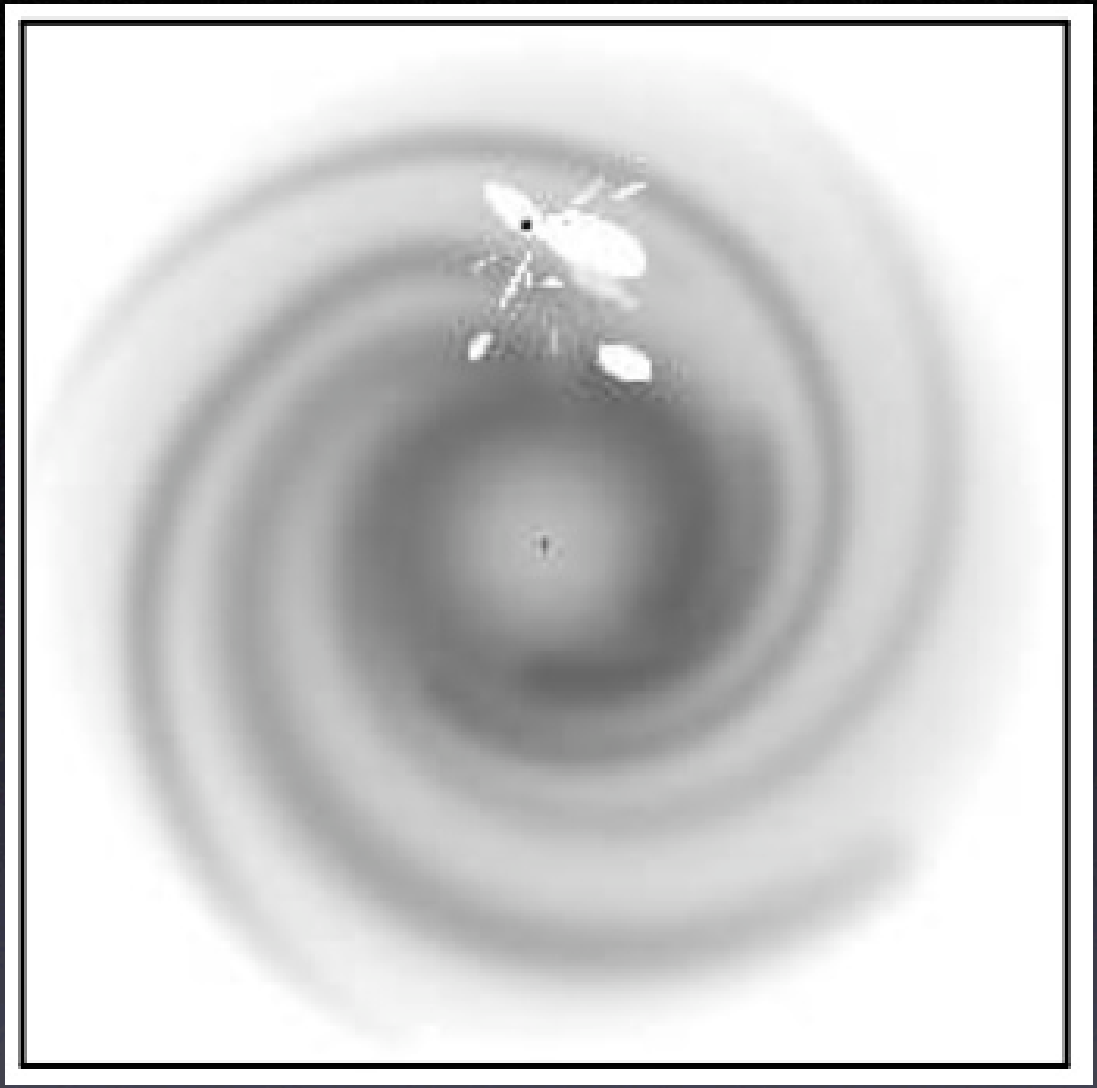
Supernova remnant Cassiopeia A,
in X-ray (left), radio (right)



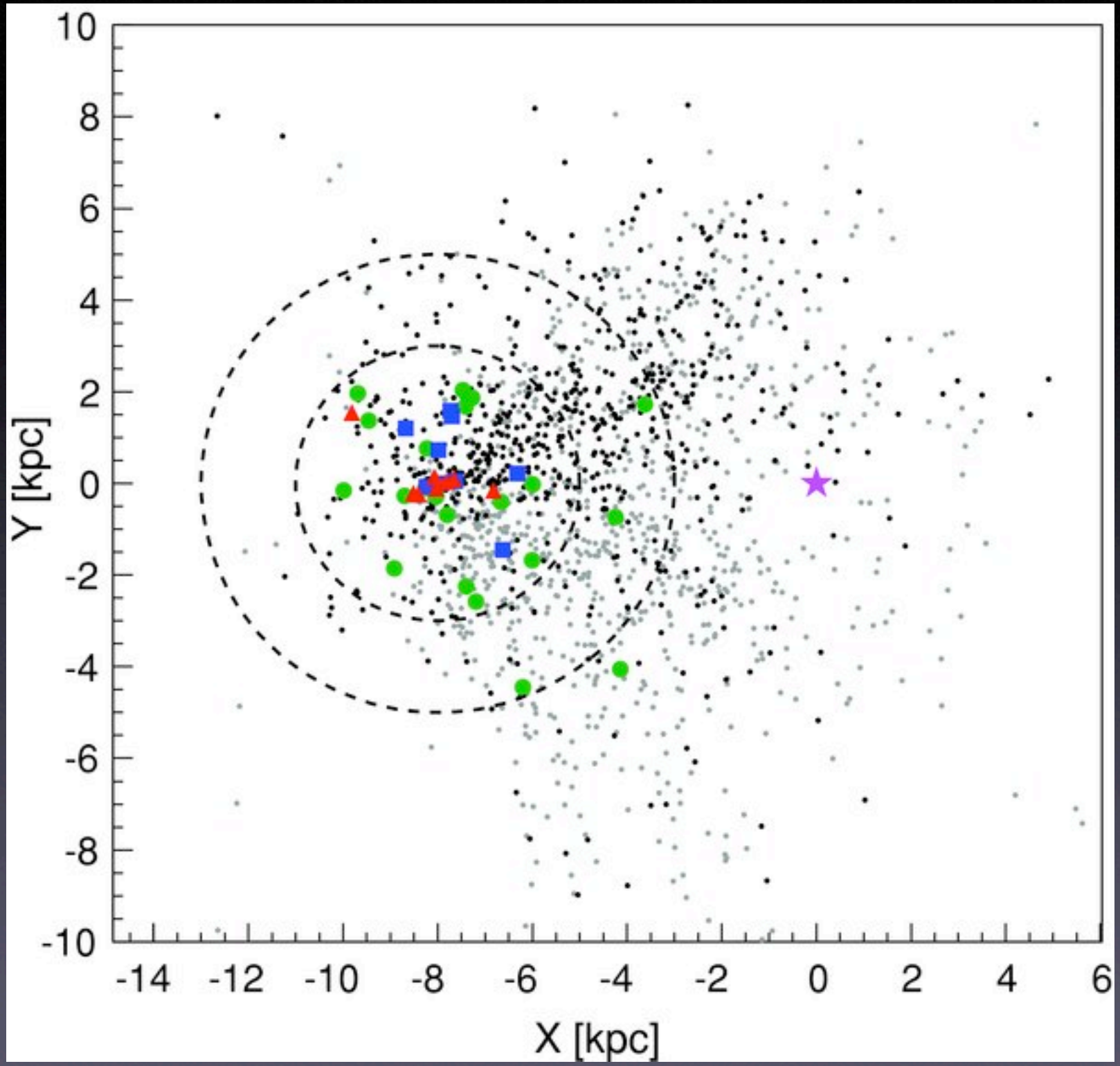
Auger cosmic-ray directions vs.
AGN locations



Pulsar dispersion



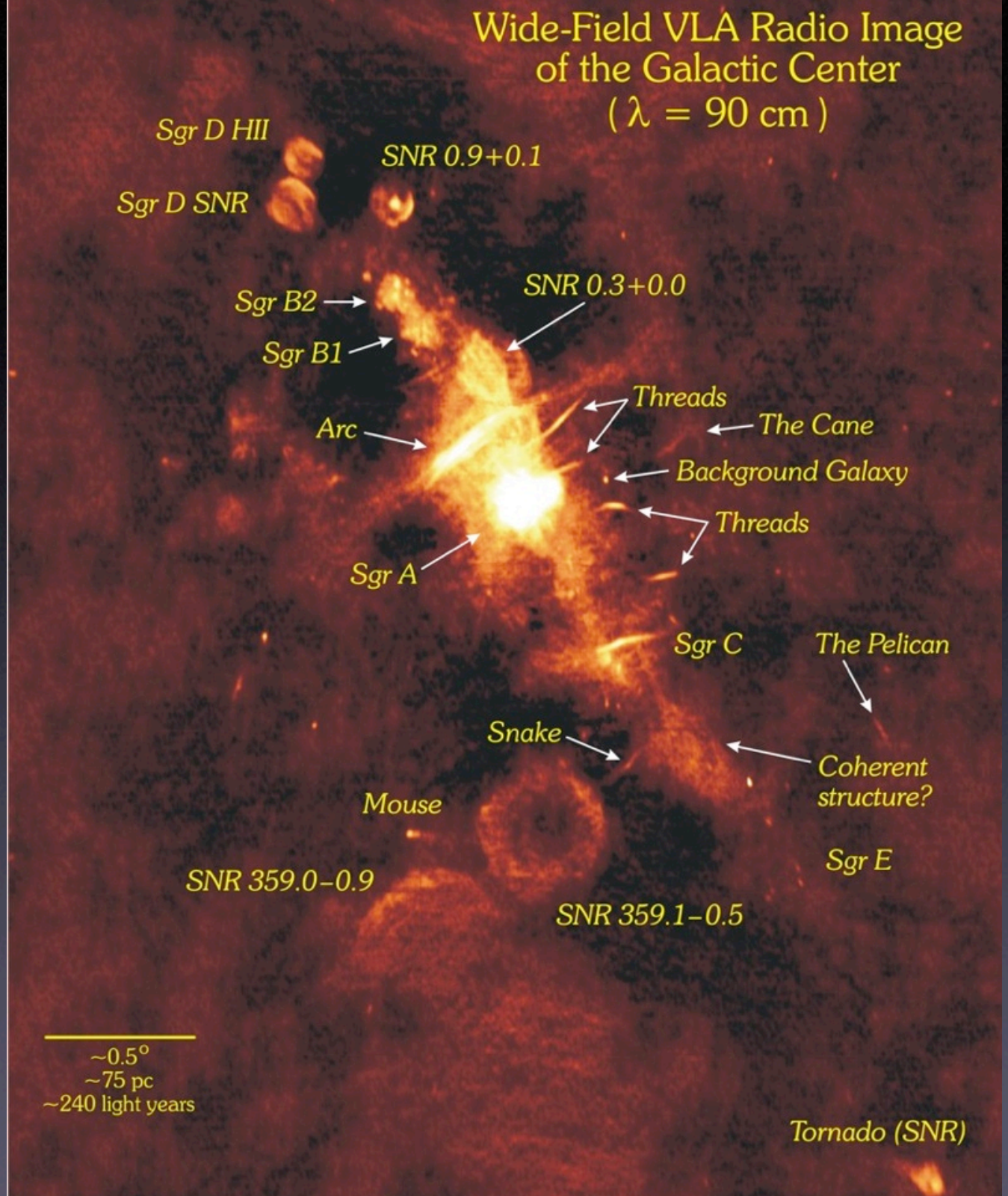
Free electron model of Galaxy,
Cordes & Lazio 2002

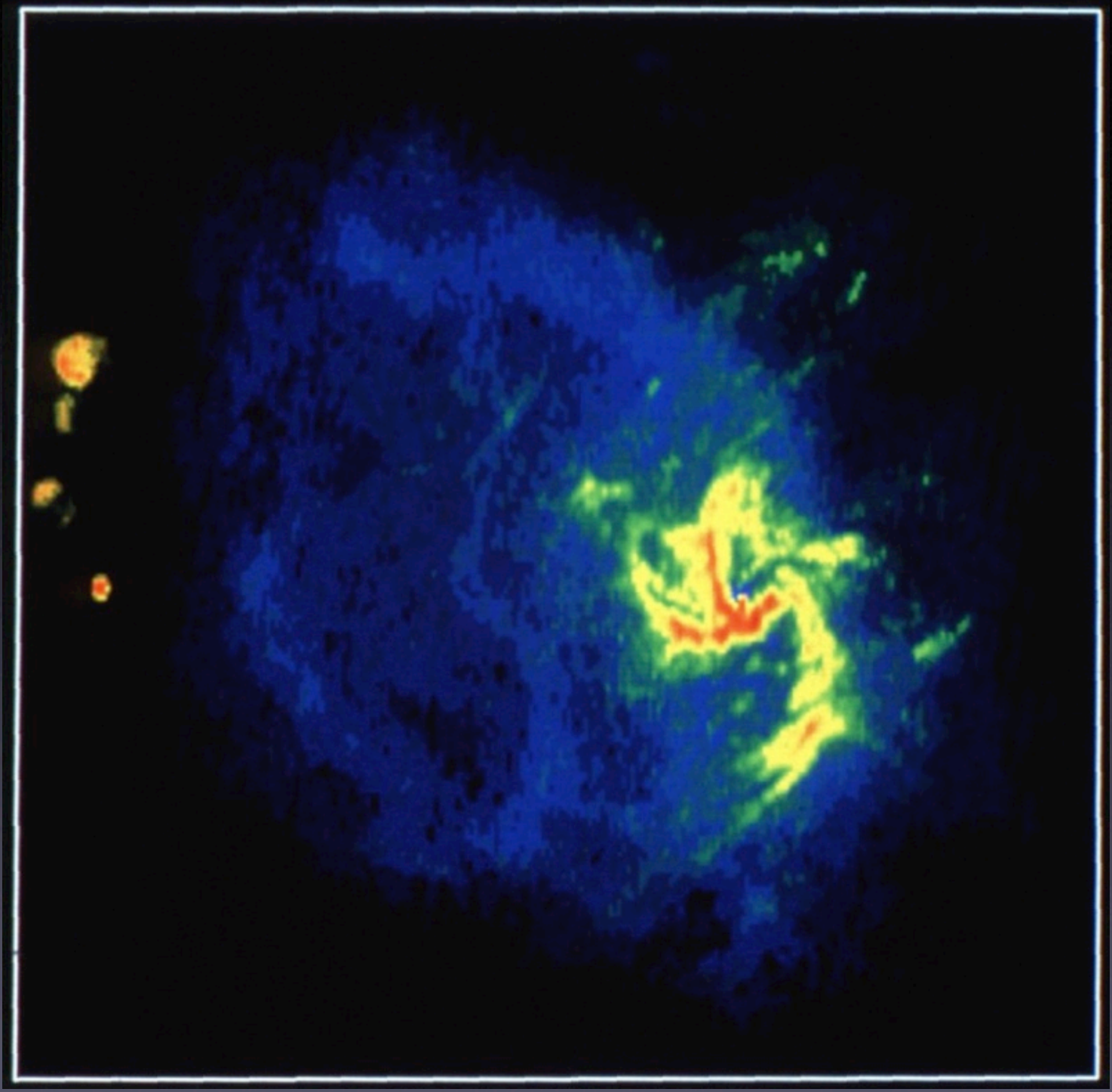


Pulsars in our Galaxy (Fermi)

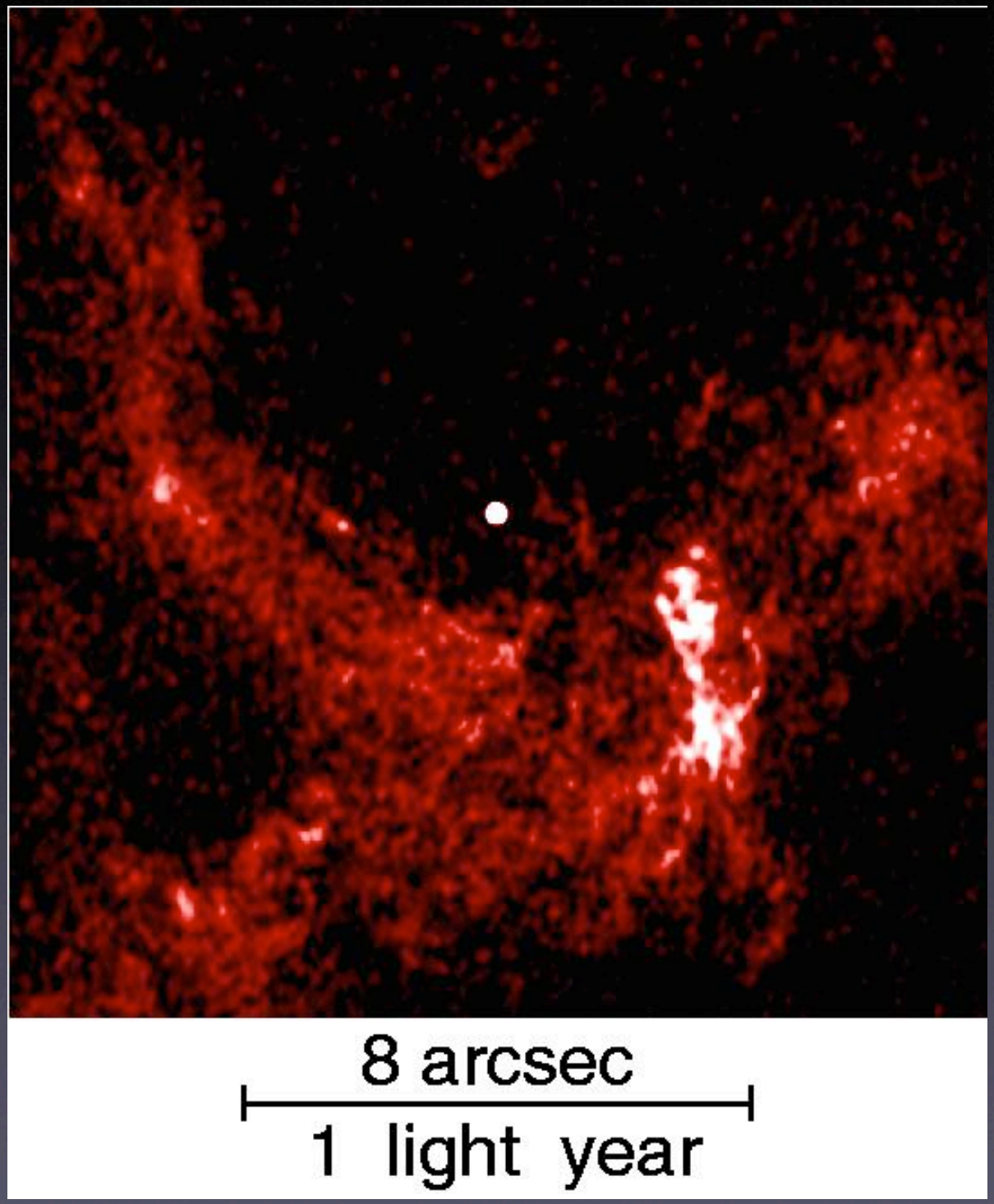
Magenta star: Galaxy center

Other colors: γ-ray pulsars


Wide-Field VLA Radio Image
of the Galactic Center
(λ = 90 cm)
Sgr D HII
SNR 0.9+0.1
Sgr D SNR
SNR 0.3+0.0
Sgr B2
Sgr B1
Threads
The Cane
Arc
Background Galaxy
Threads
Sgr A
Sgr C
The Pelican
Snake
Coherent
structure?
Mouse
Sgr E
SNR 359.0−0.9
SNR 359.1−0.5
~0.5°
~75 pc
~240 light years
Tornado (SNR)



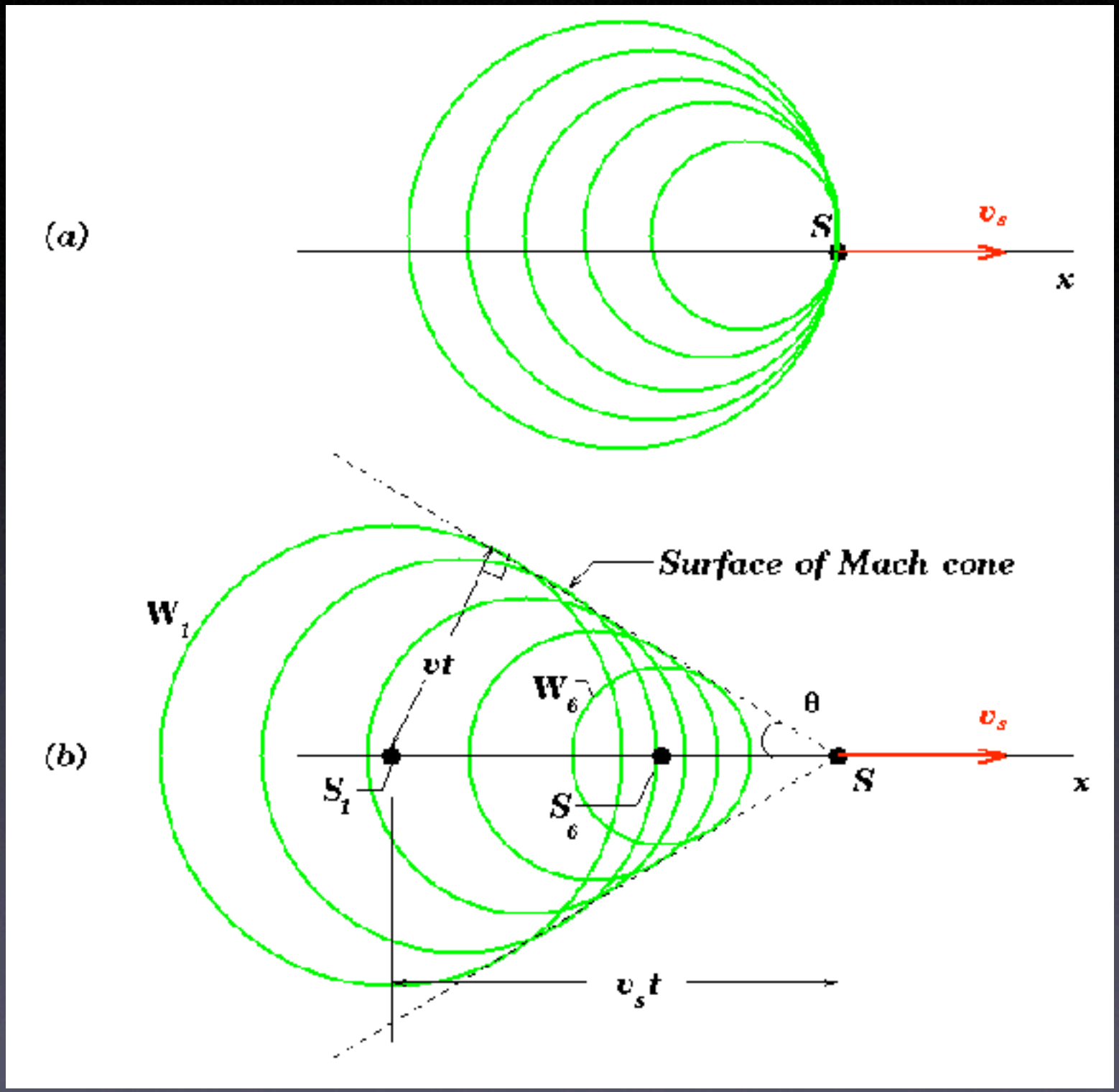
Sgr A,
VLA, Goss

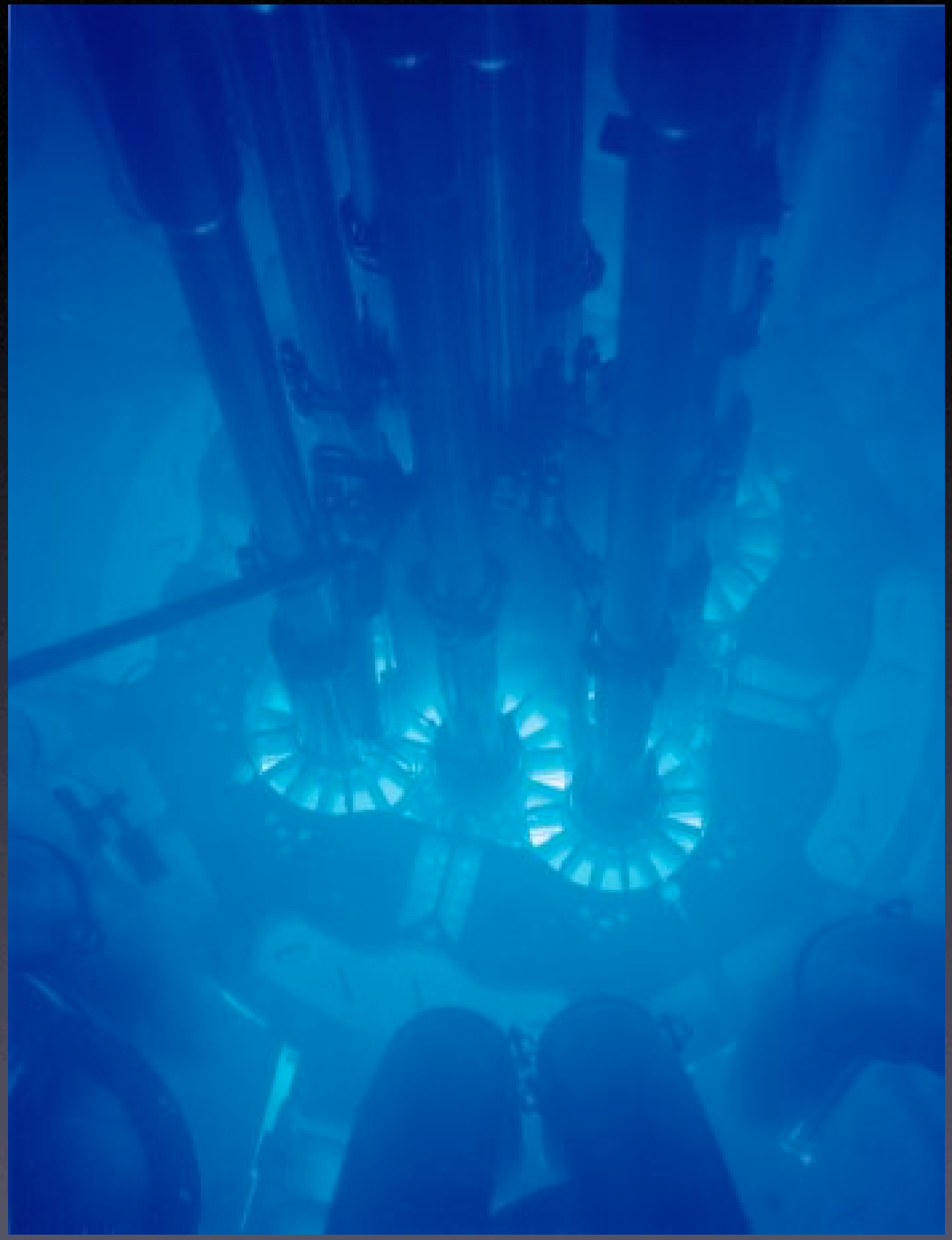


Sgr A*
Zhao & Goss,
VLA

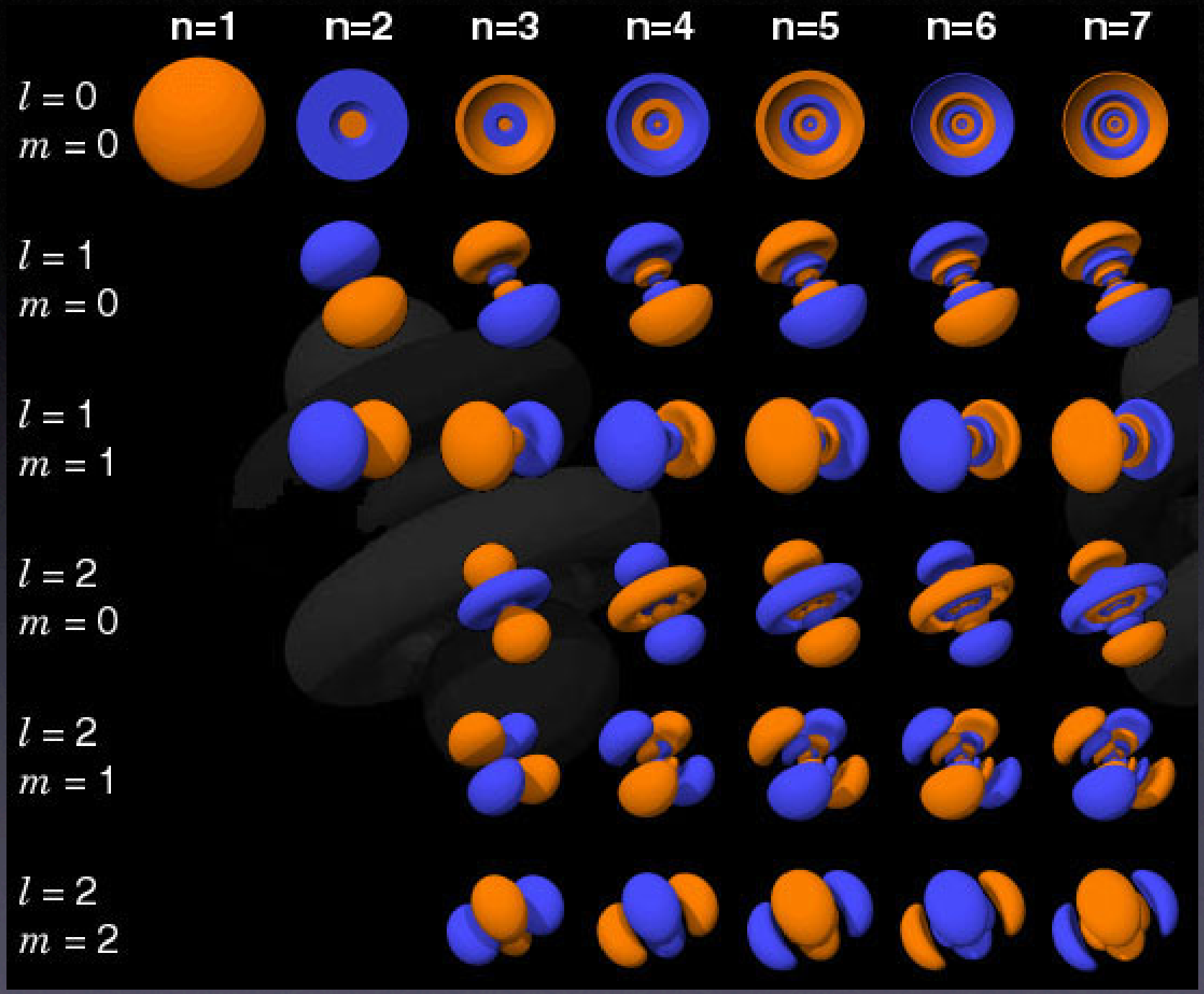
Wave fronts from particle at c

Wave fronts from particle faster than local speed of light

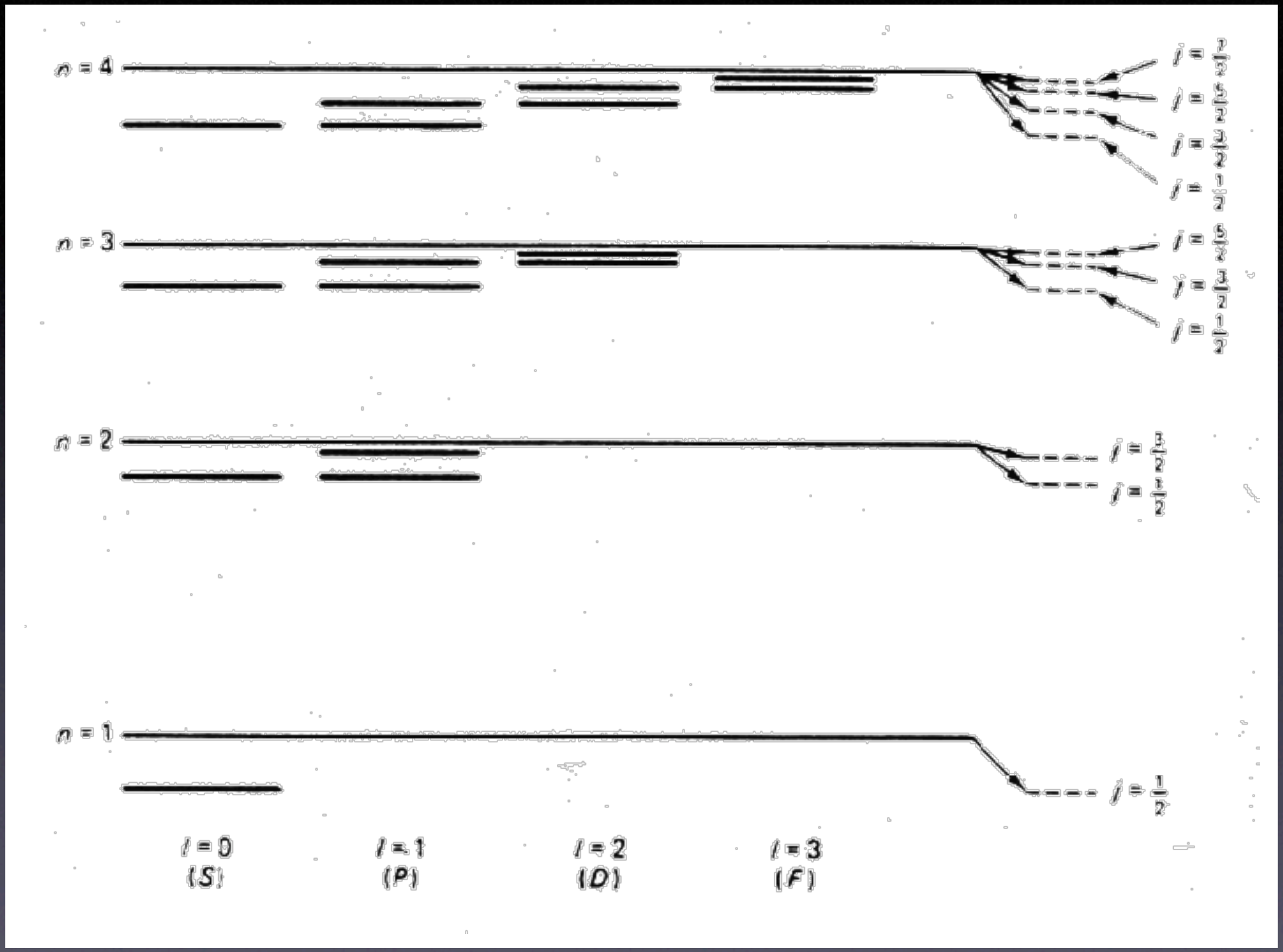




Advanced Test Reactor, Idaho National Lab

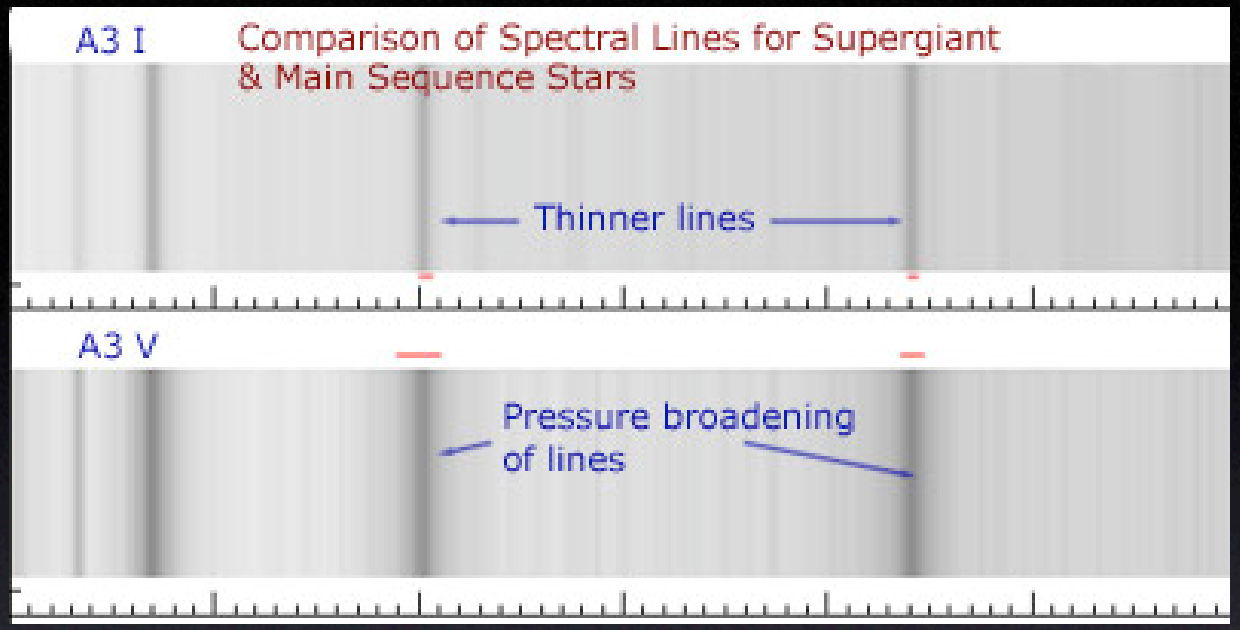


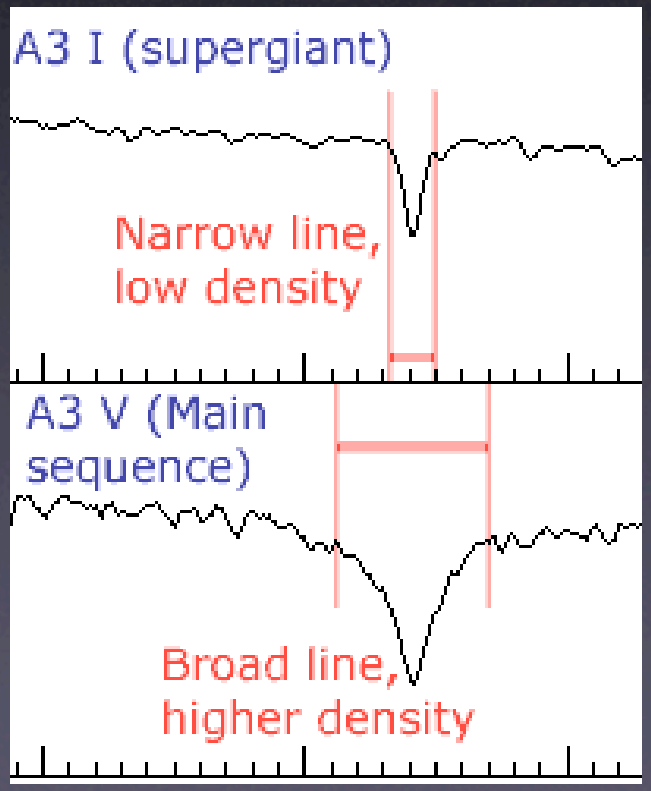
Electron orbitals (Beloit Chemistry)



Hydrogen fine structure (Griffiths)

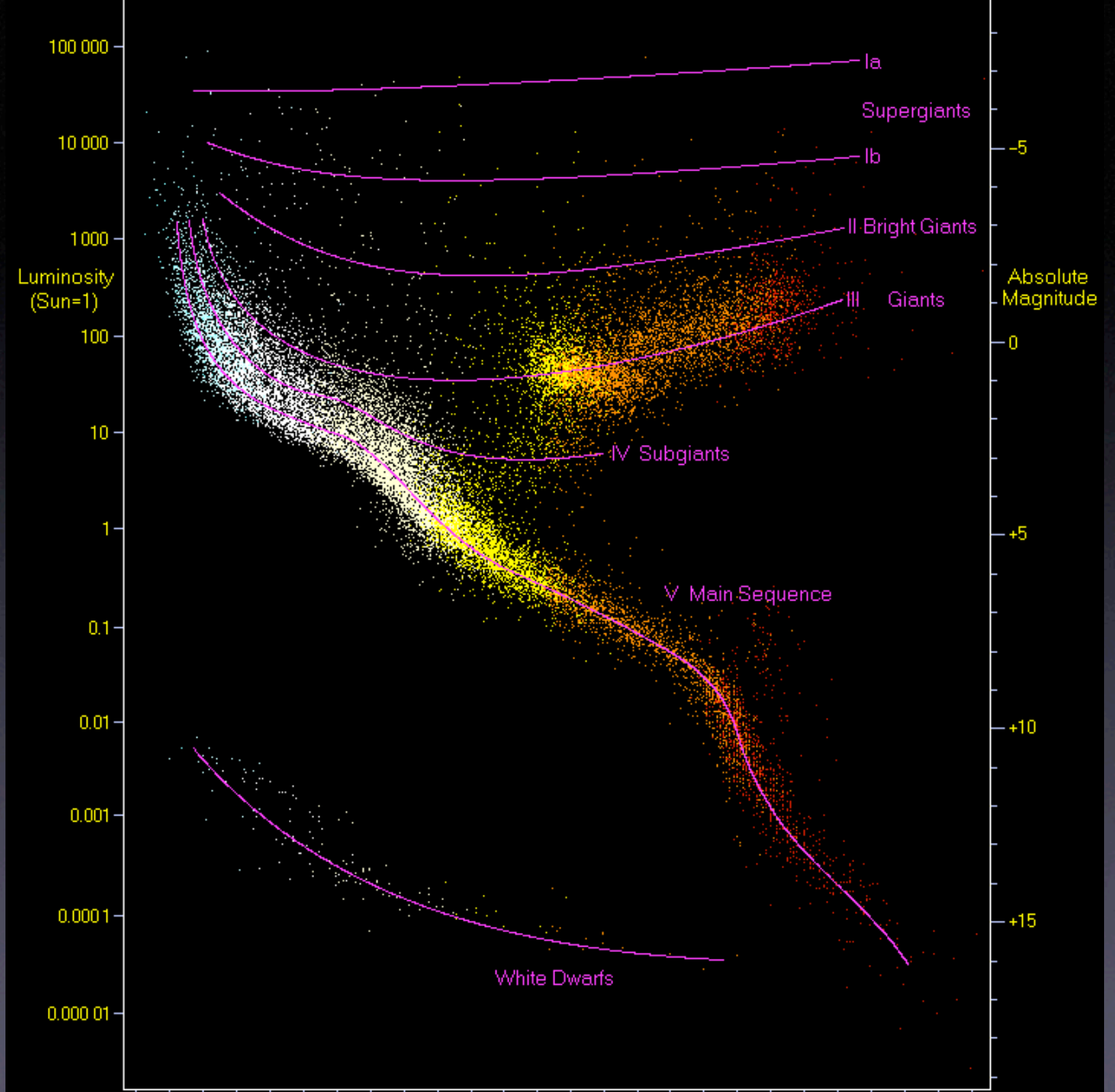
Effect of pressure broadening (ATNF spectra)

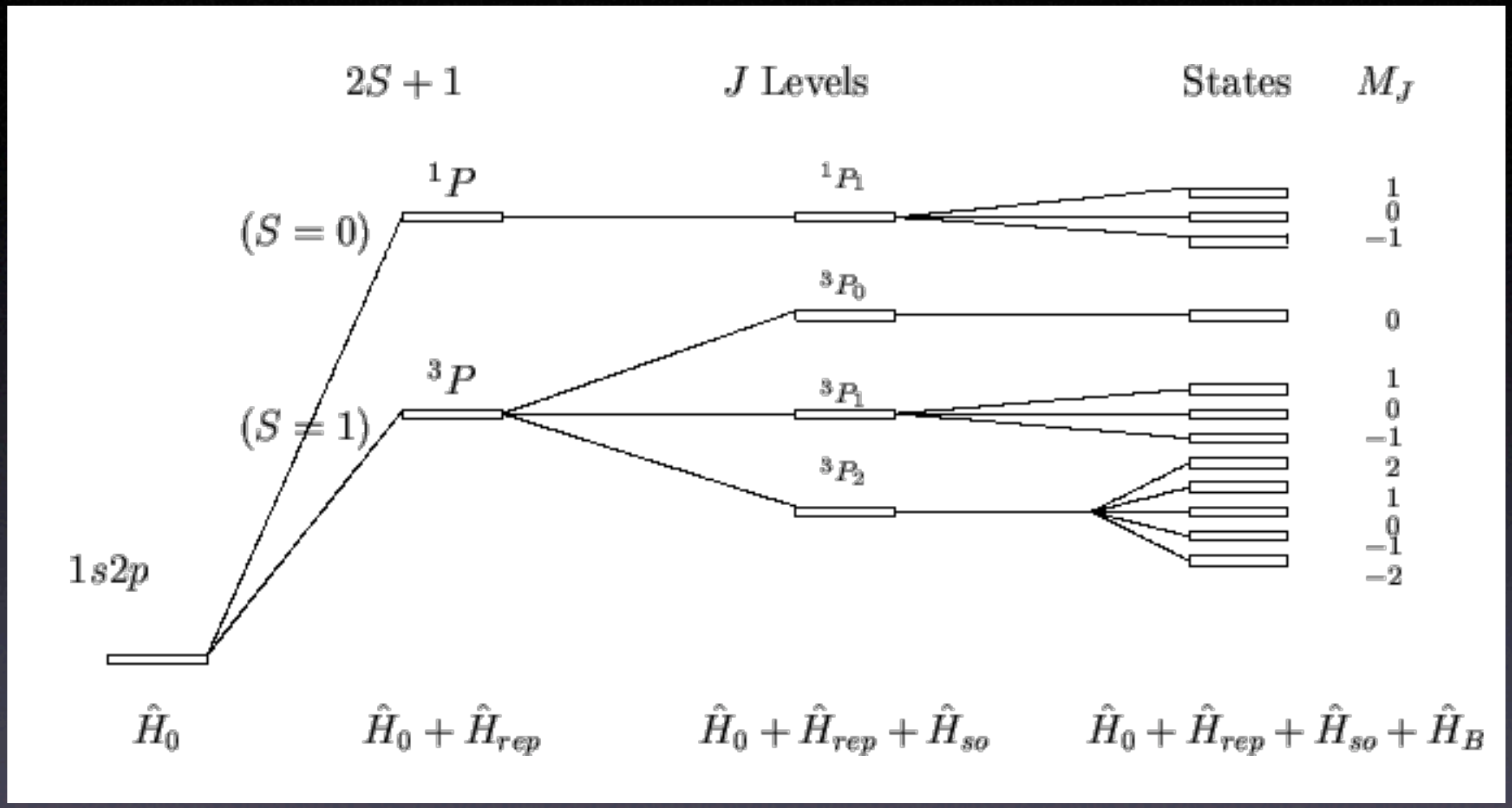




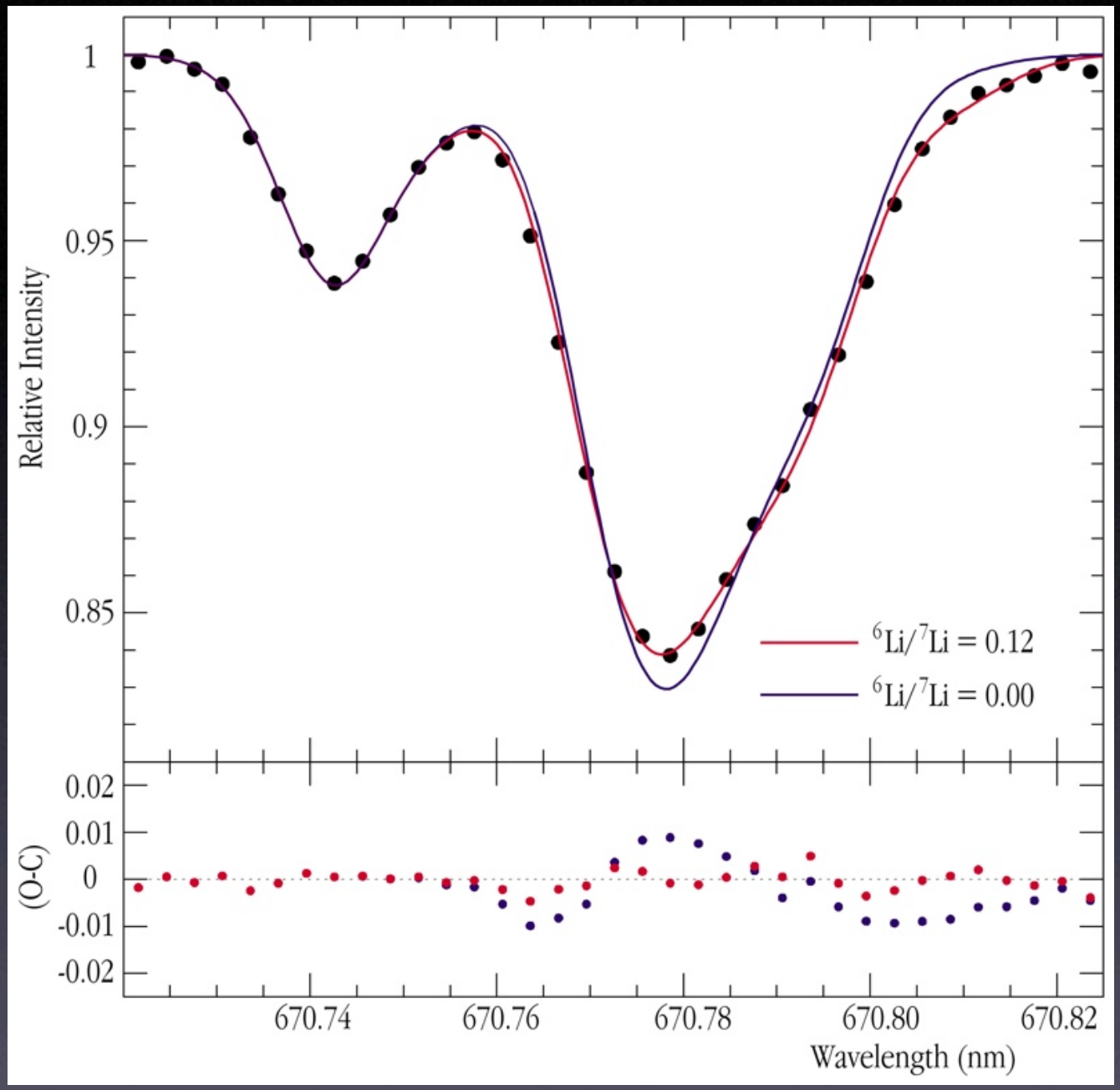
Pressure broadening, due to Stark effect

Hertzsprung-Russell color-magnitude diagram, with luminosity classes

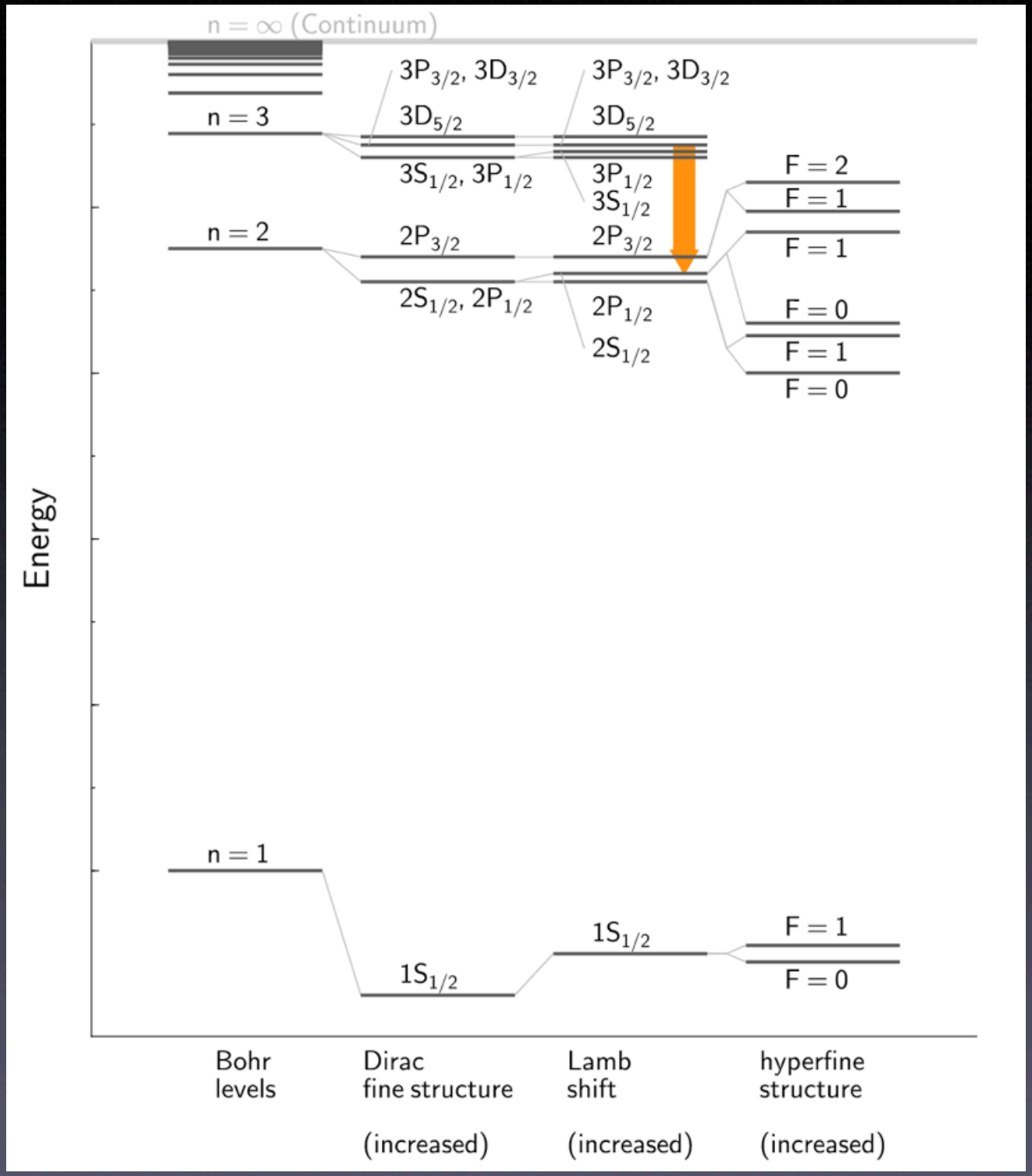




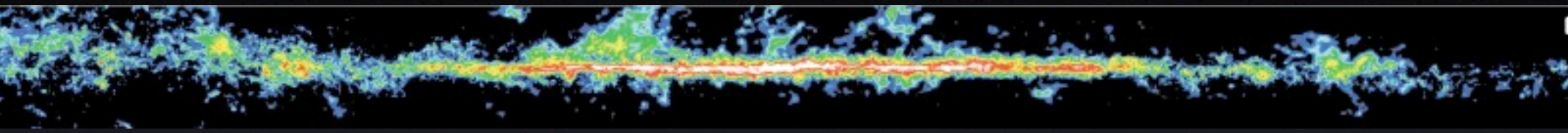
Energy levels of multi-electron atom, including spin-orbit & Zeeman effects



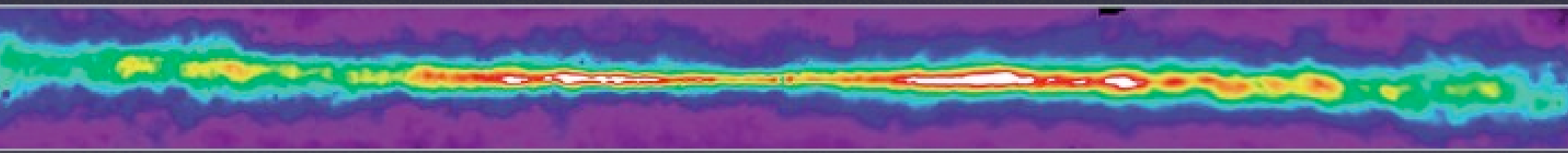
^{6}Li vs. ^{7}Li in HD 82943,
ESO VLT, Israelian+02



Full hydrogen level scheme (BackReaction Blog)



CO (molecular cloud) map of Milky Way



21-cm atomic H map of Milky Way

NGC 7331, optical, Mortfield & Kupke

Contours of gas velocity

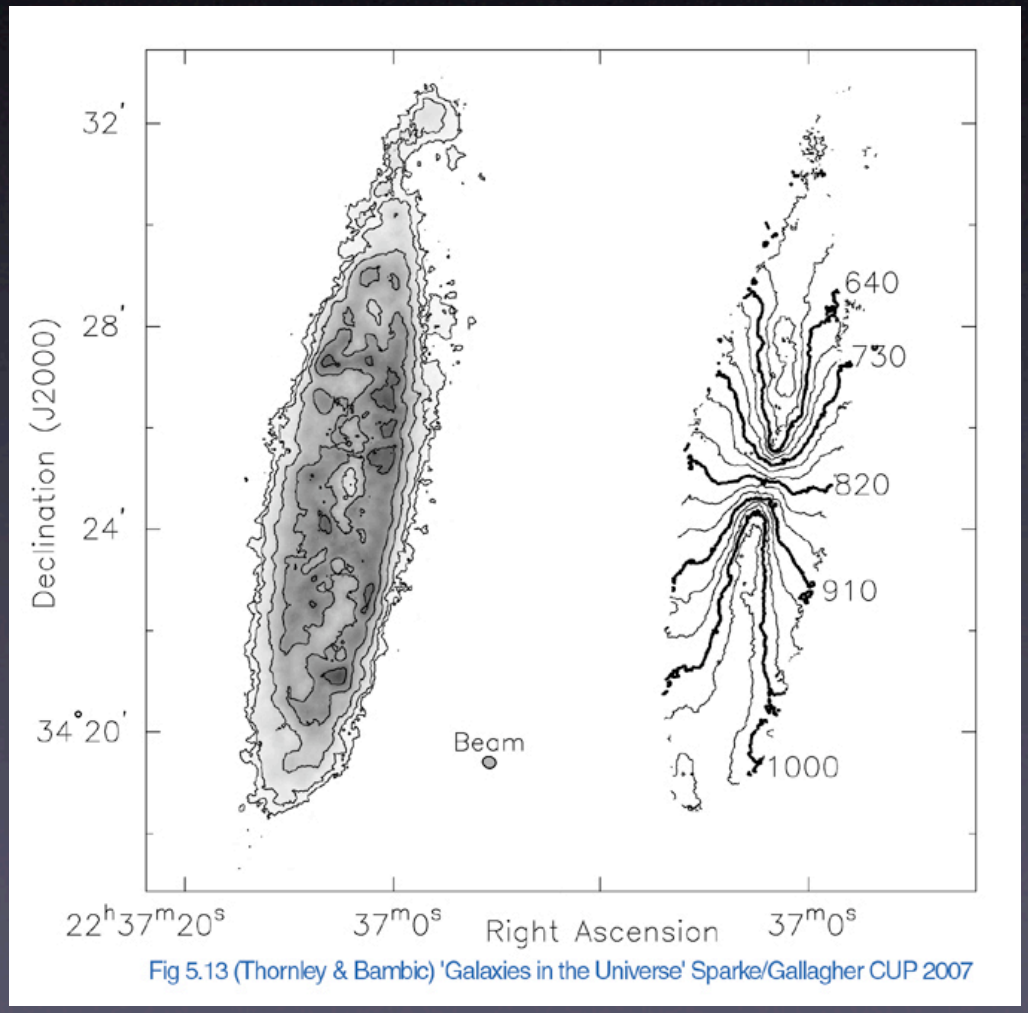


Fig 5.13 (Thornley & Bambic) 'Galaxies in the Universe' Sparke/Gallagher CUP 2007

Atomic H (21-cm) map, NGC 7331

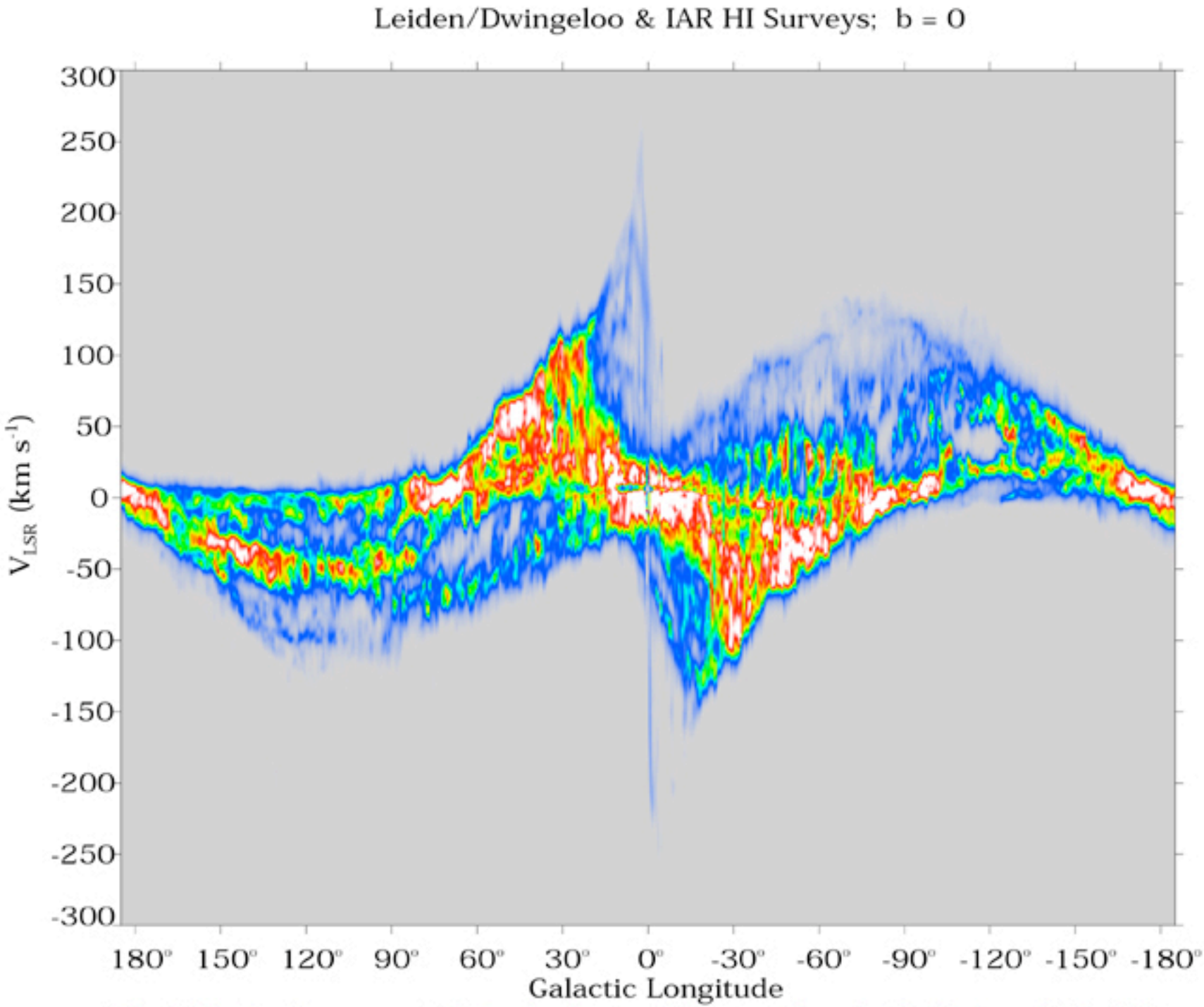
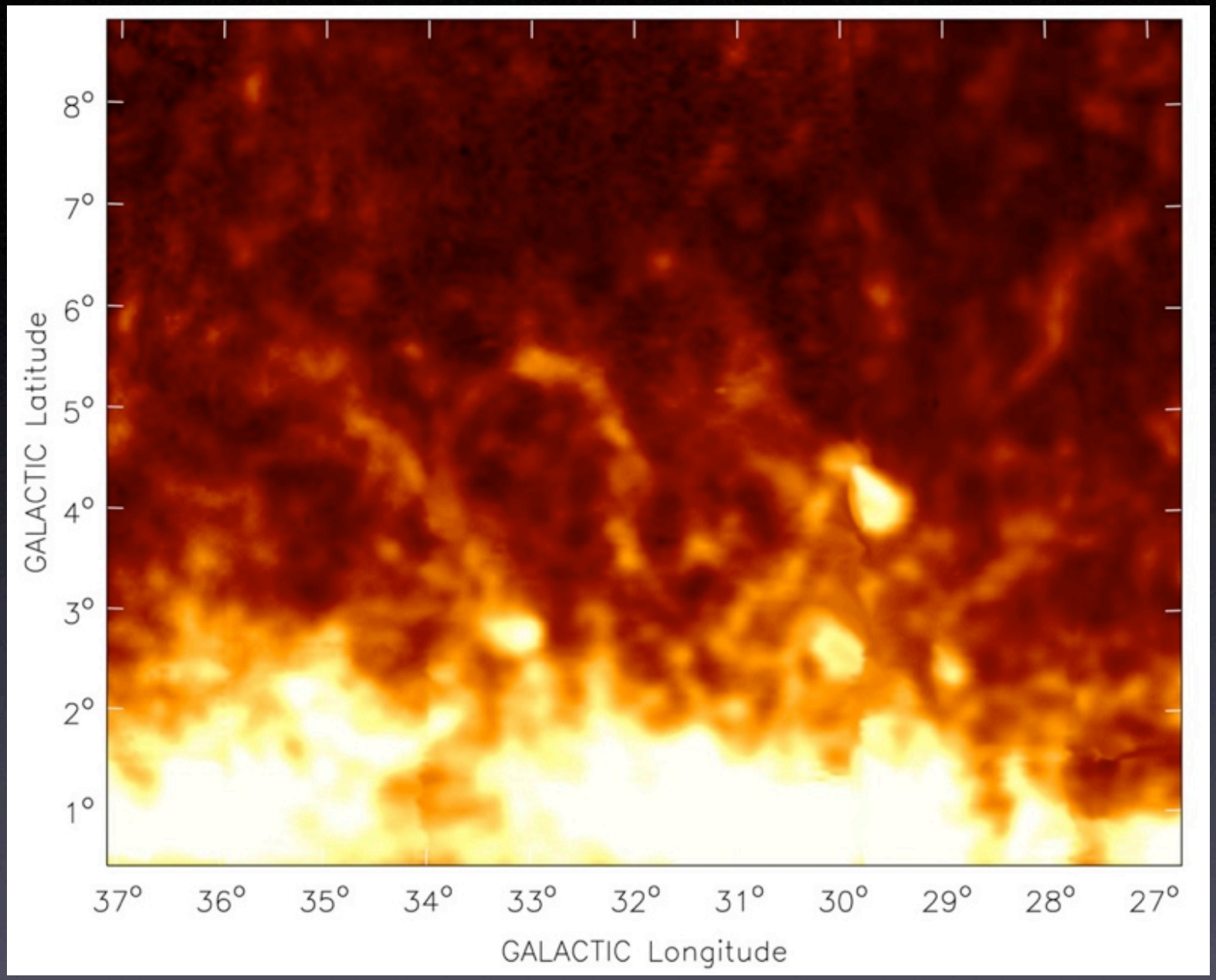
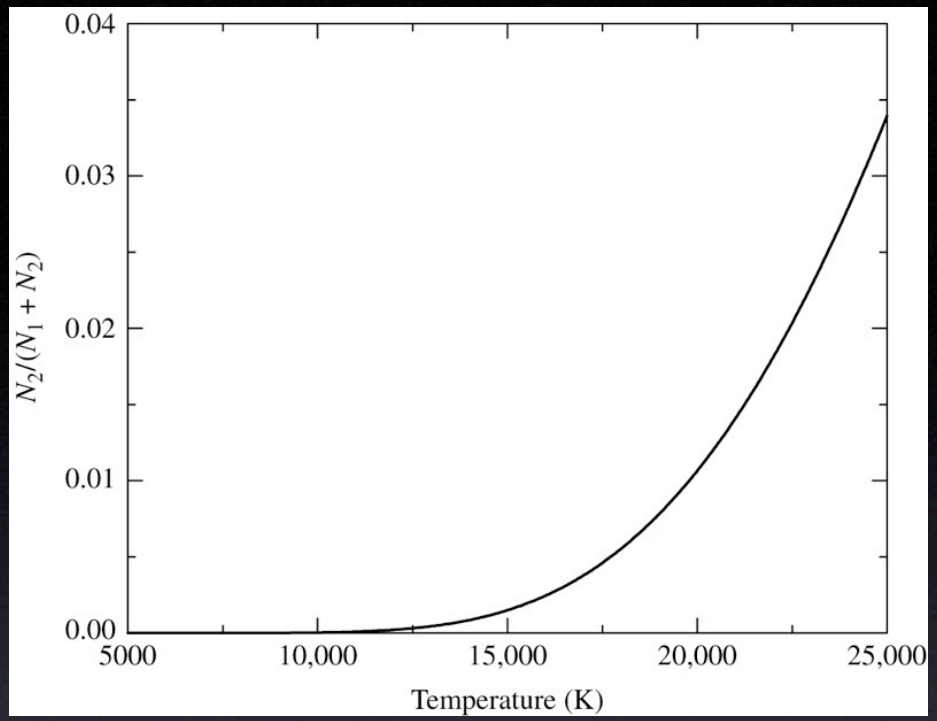


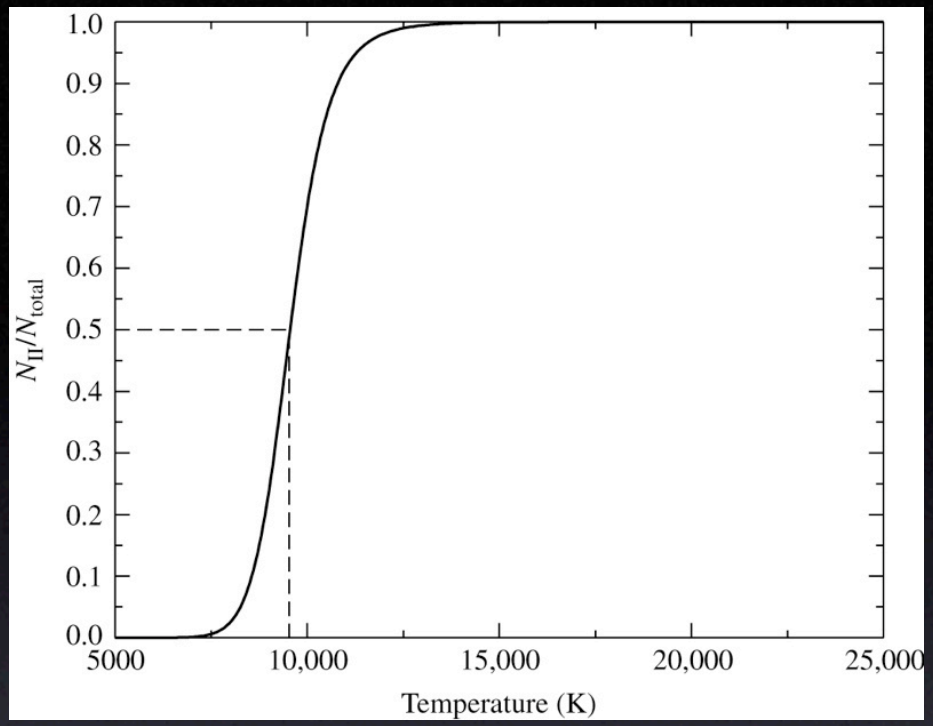
Fig 2.20 (D. Hartmann) 'Galaxies in the Universe' Sparke/Gallagher CUP 2007



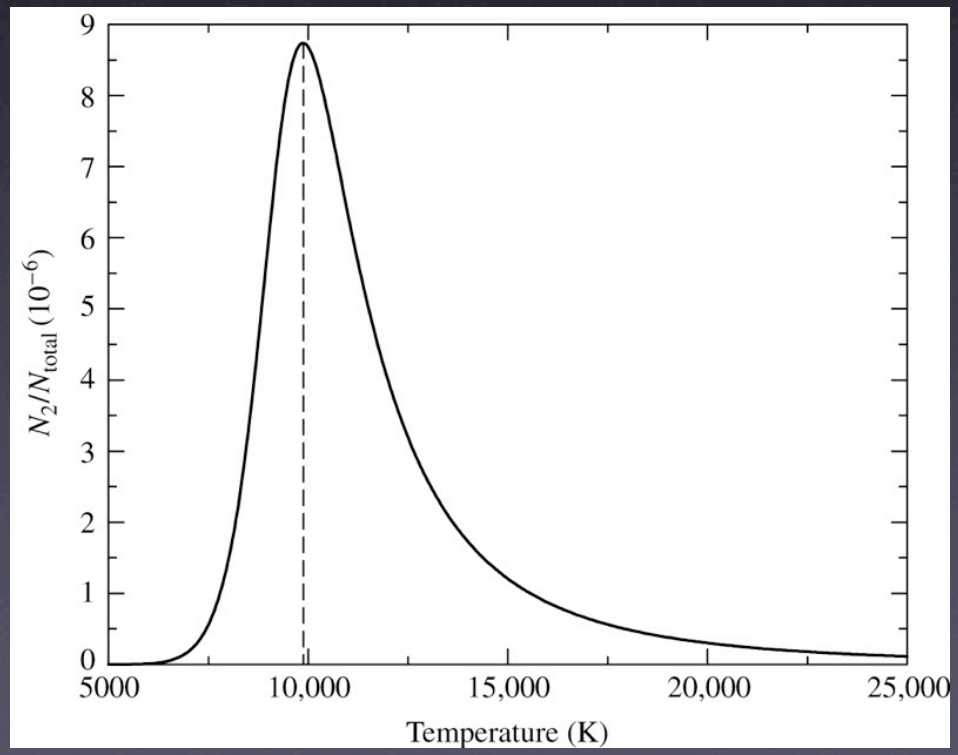
HI slice of Galactic plane



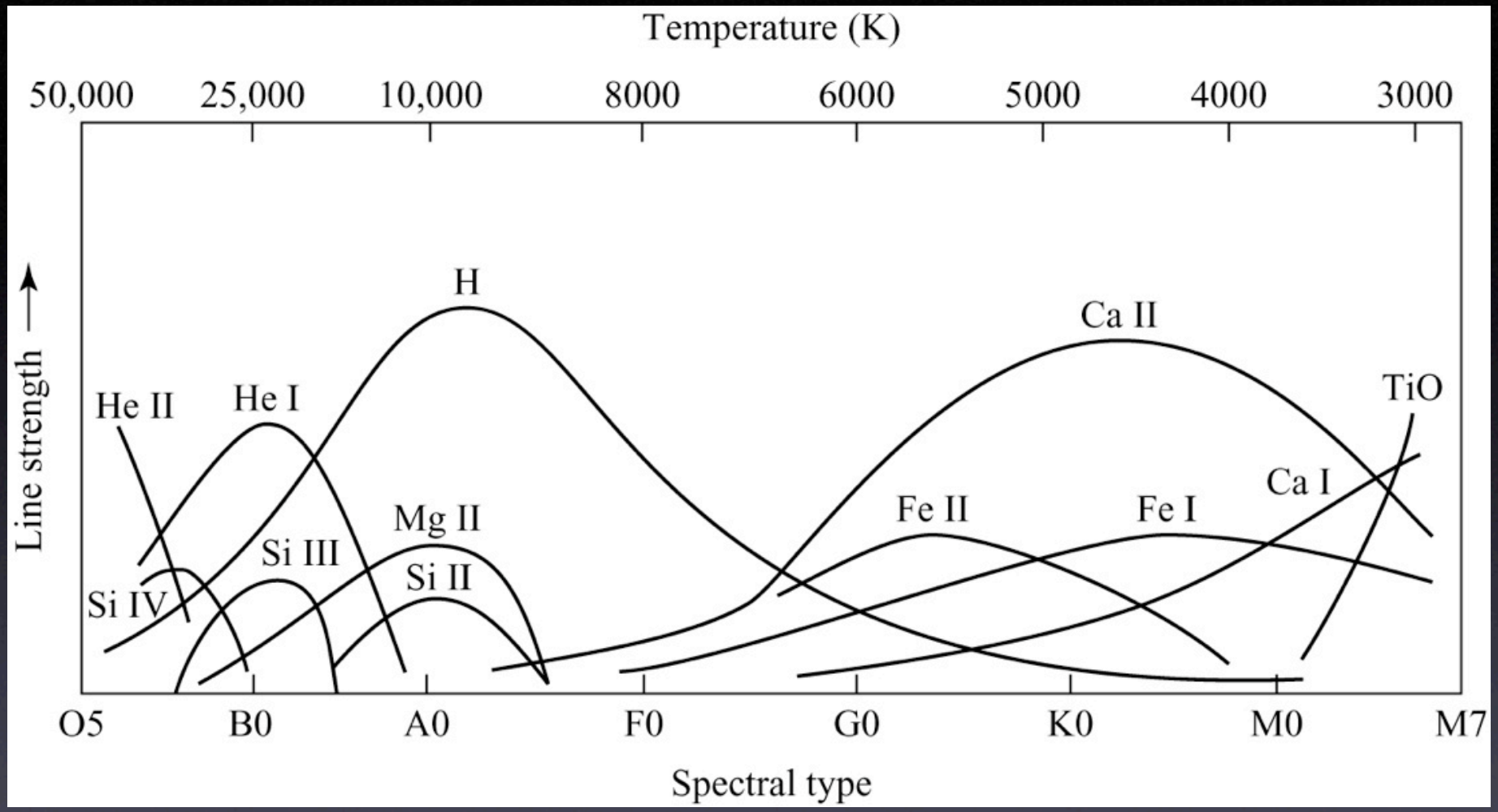
Boltzmann



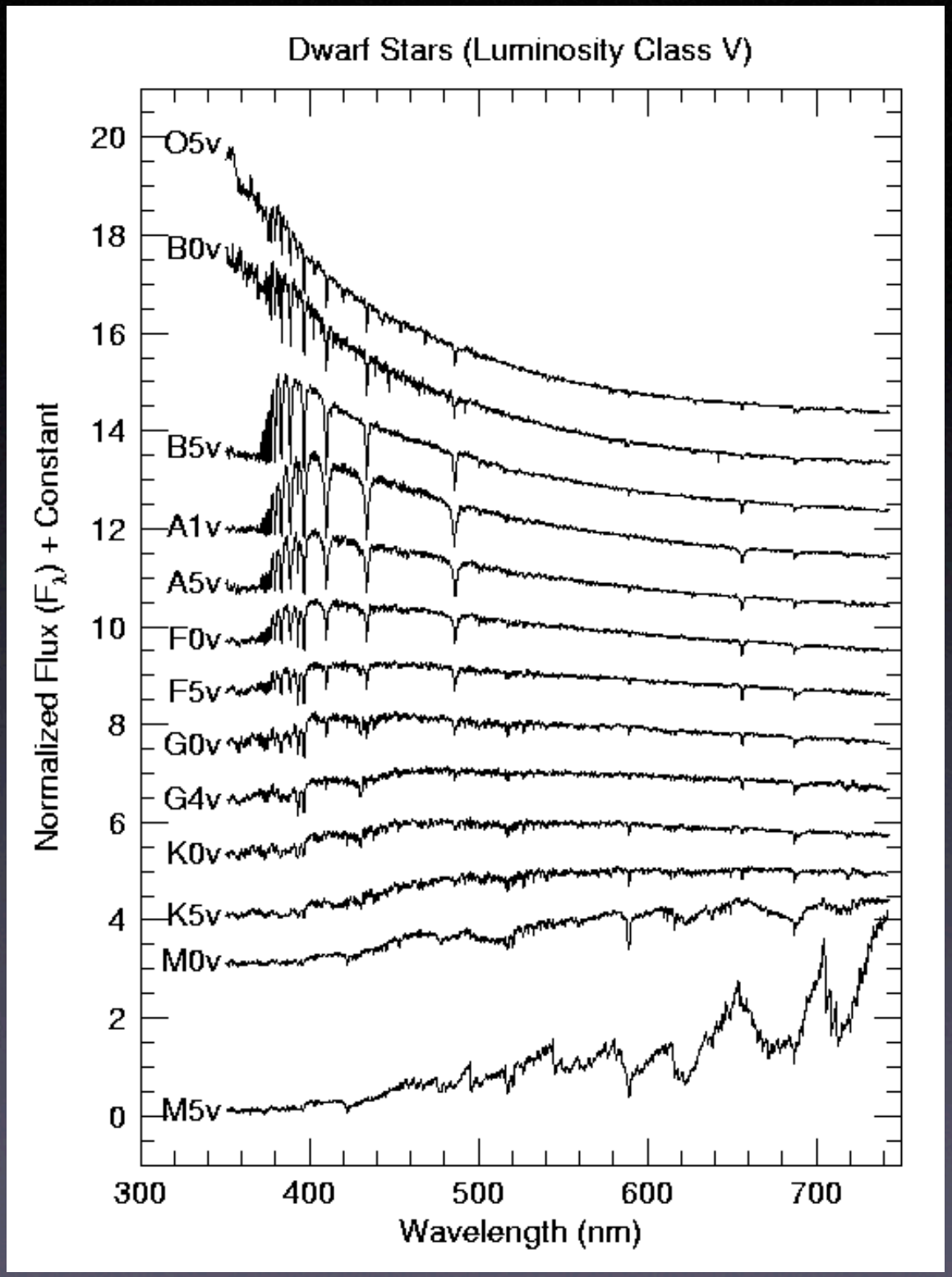
Saha



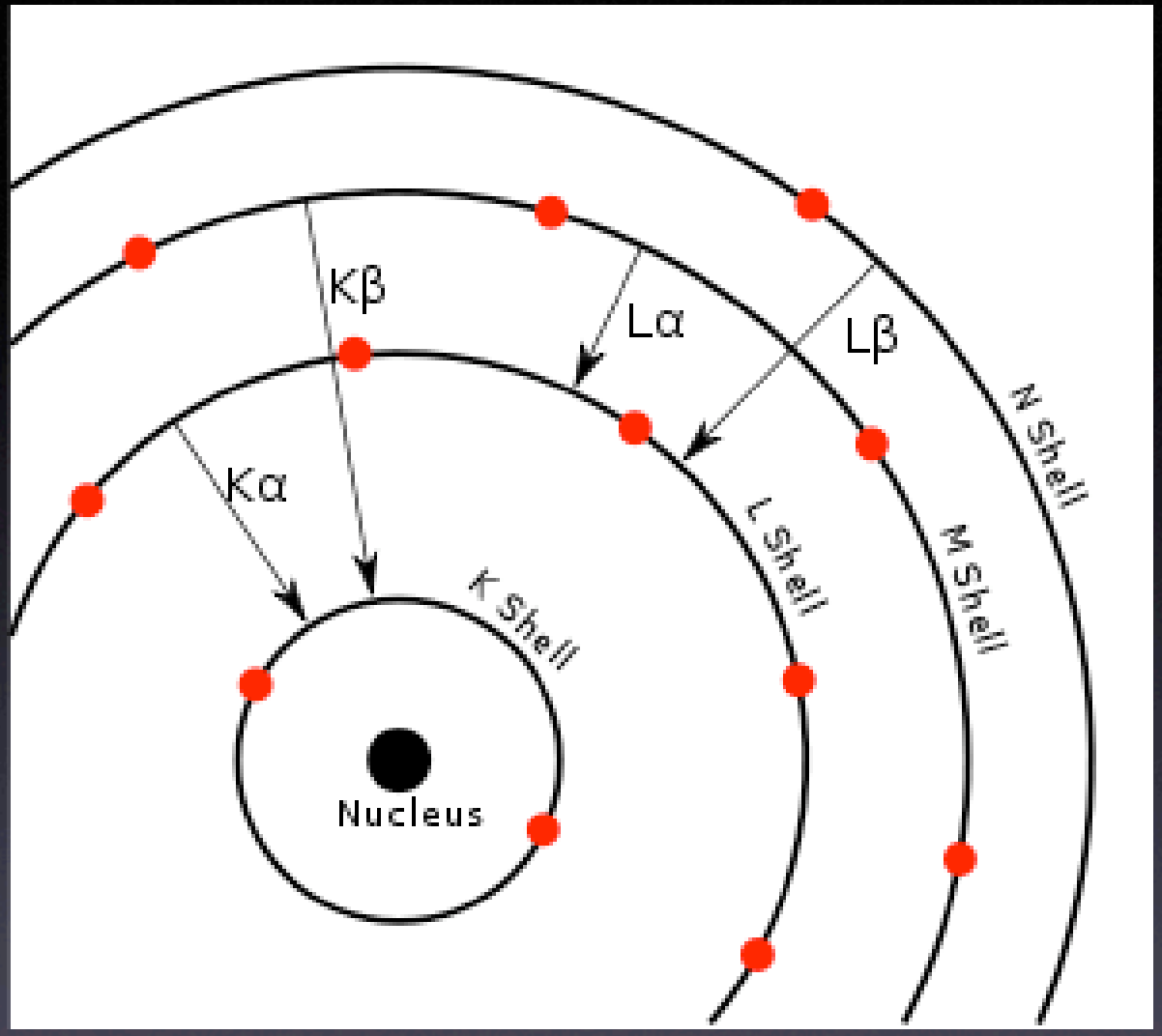
Combined



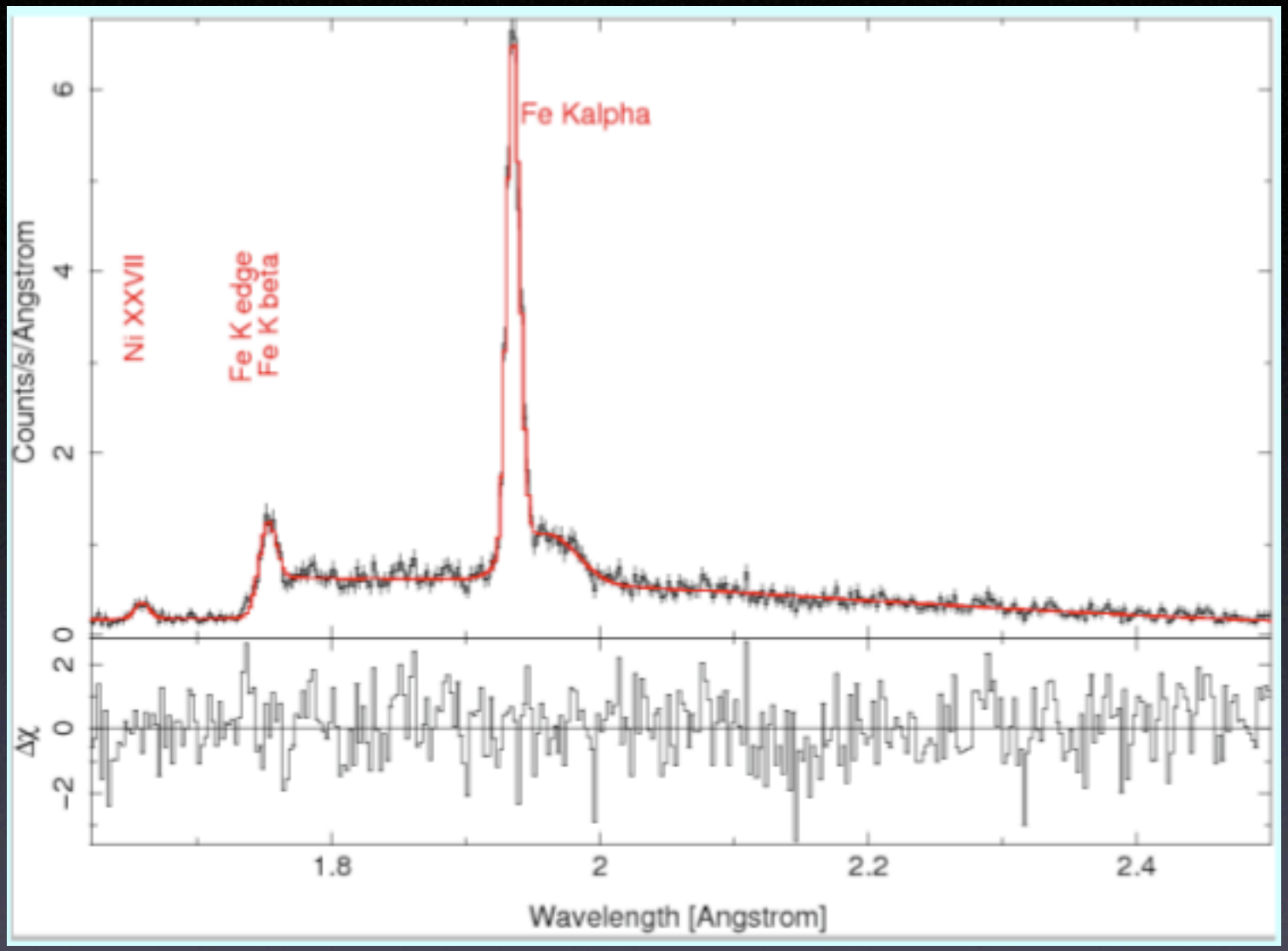
Carroll & Ostlie



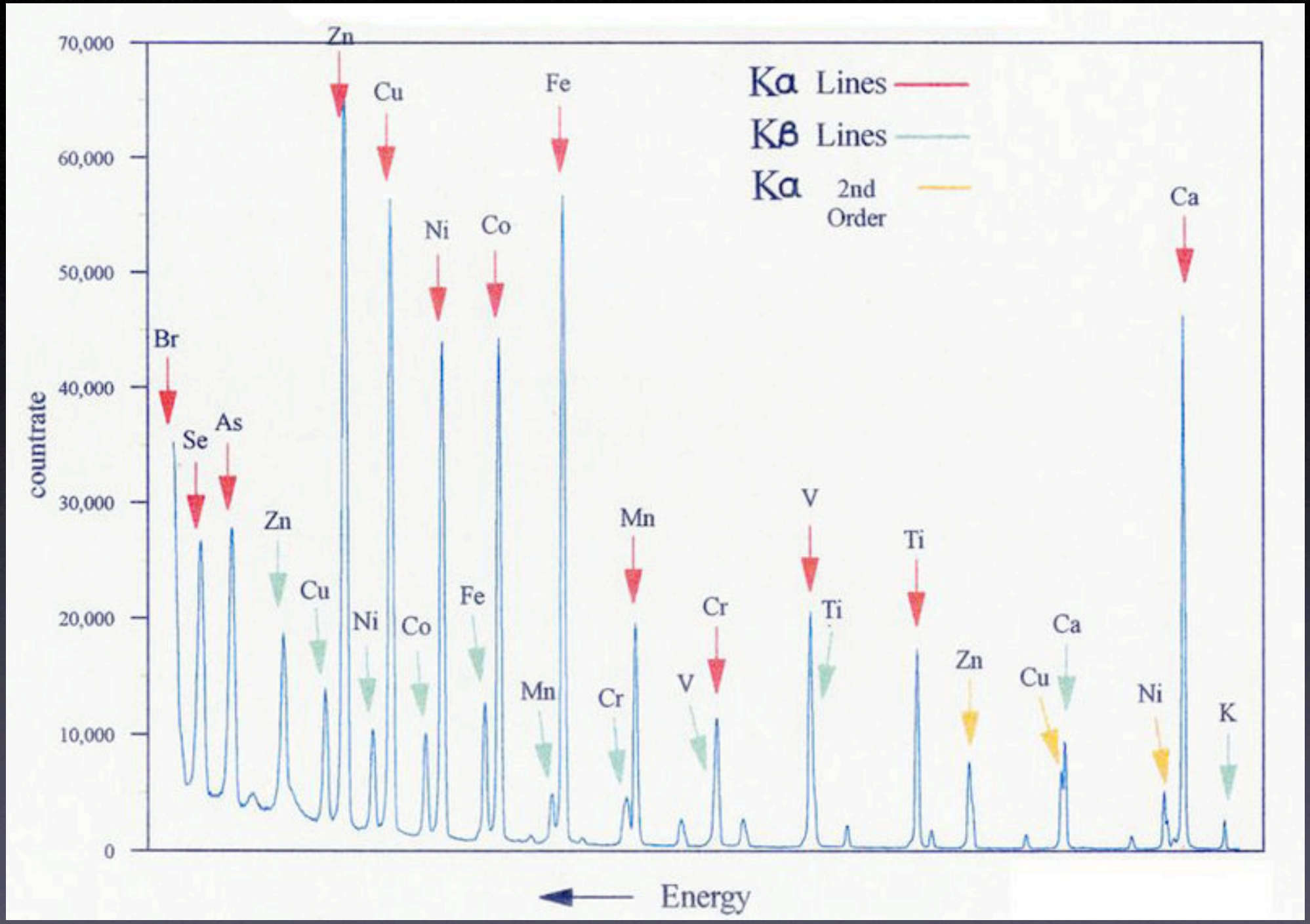
Range of stellar spectra



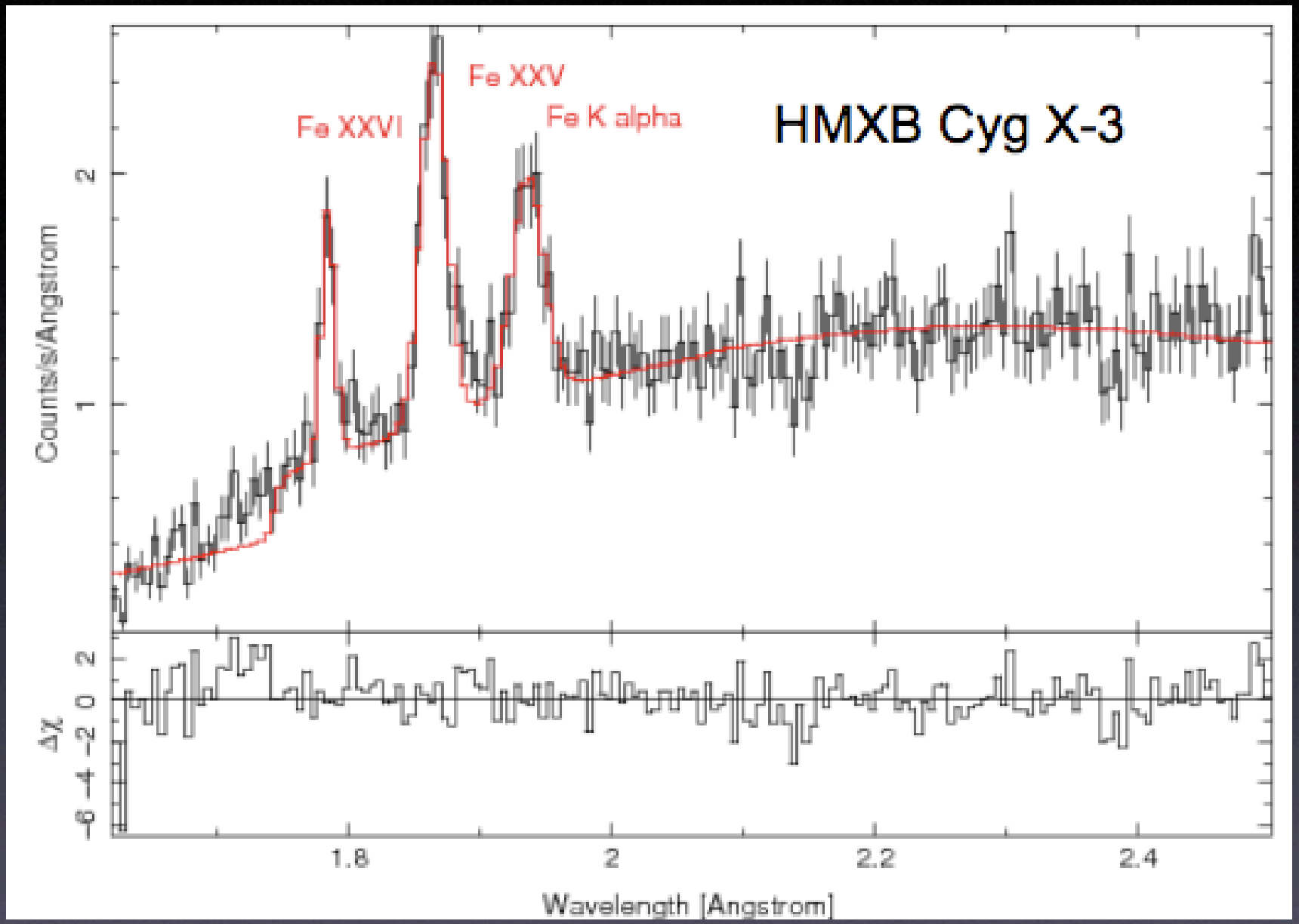
X-ray fluorescence



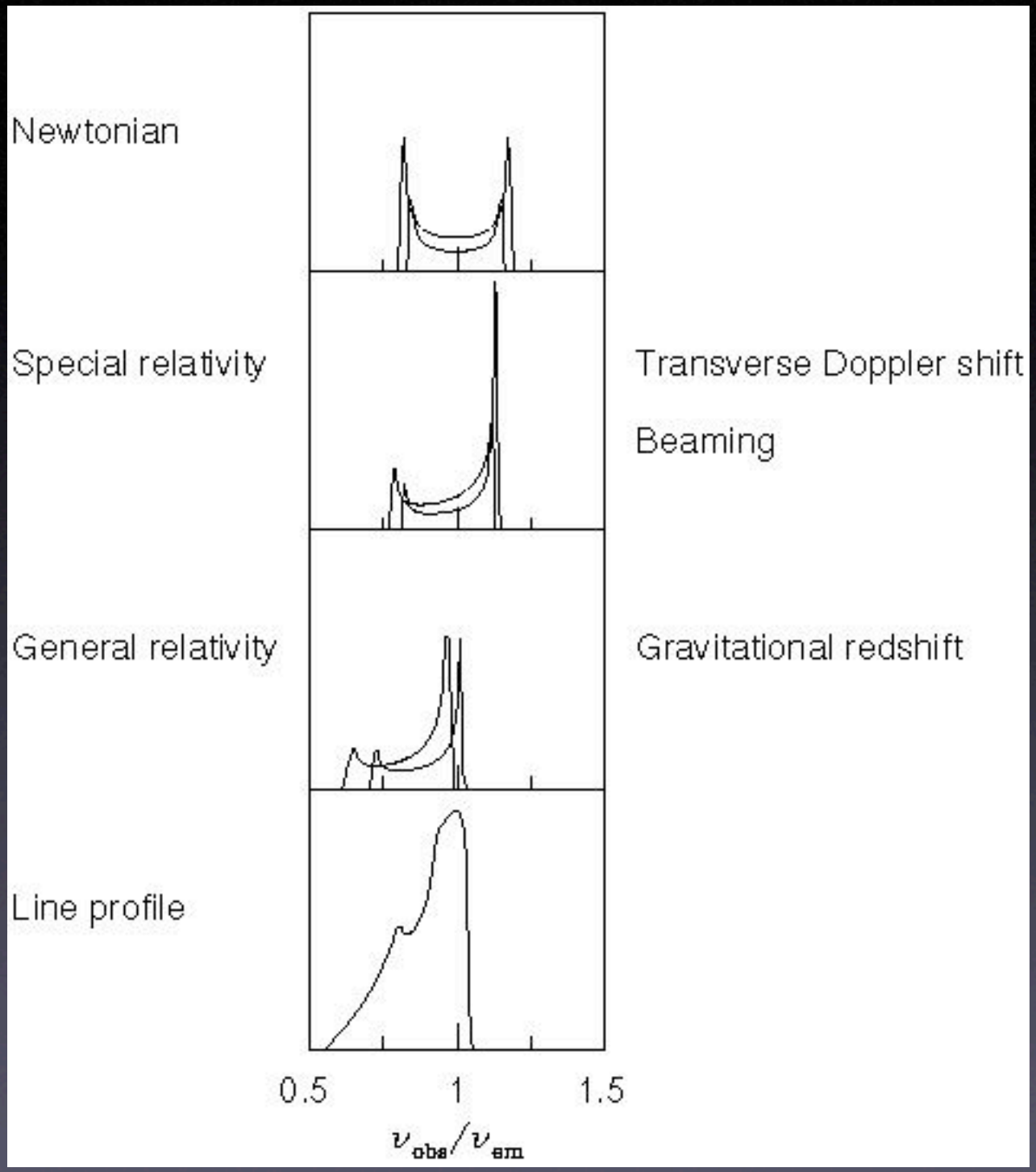
X-ray fluorescence spectrum,
neutral Fe (Torrejon)



X-ray fluorescence, multiple elements

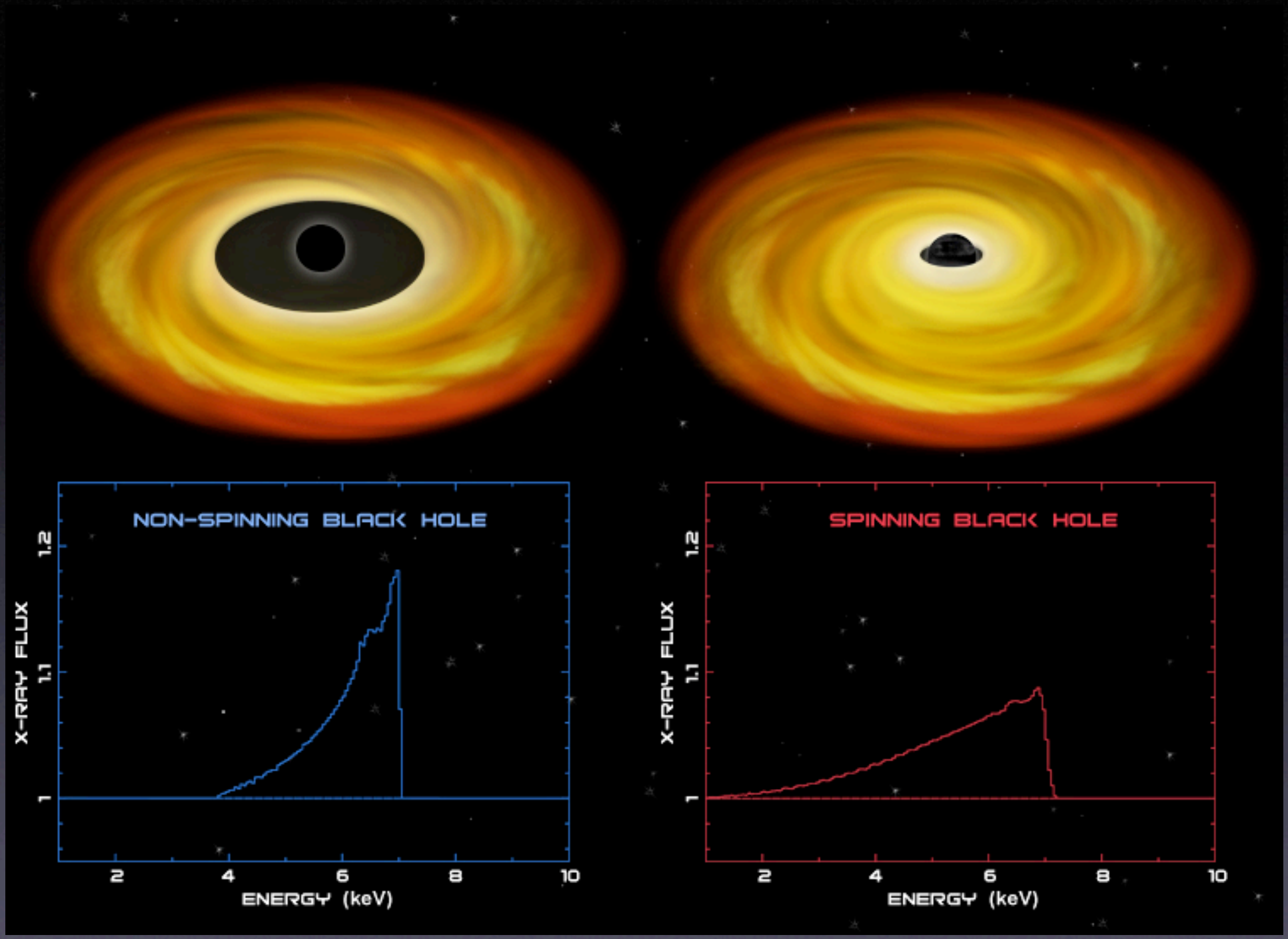


Neutral, 24-ionized, 25-ionized Fe
Kα lines; range of ions in stellar wind



Neutral Fe Kα line profiles, for disk spectra

A. Fabian



NASA; redshifted Fe Kα line for BHs

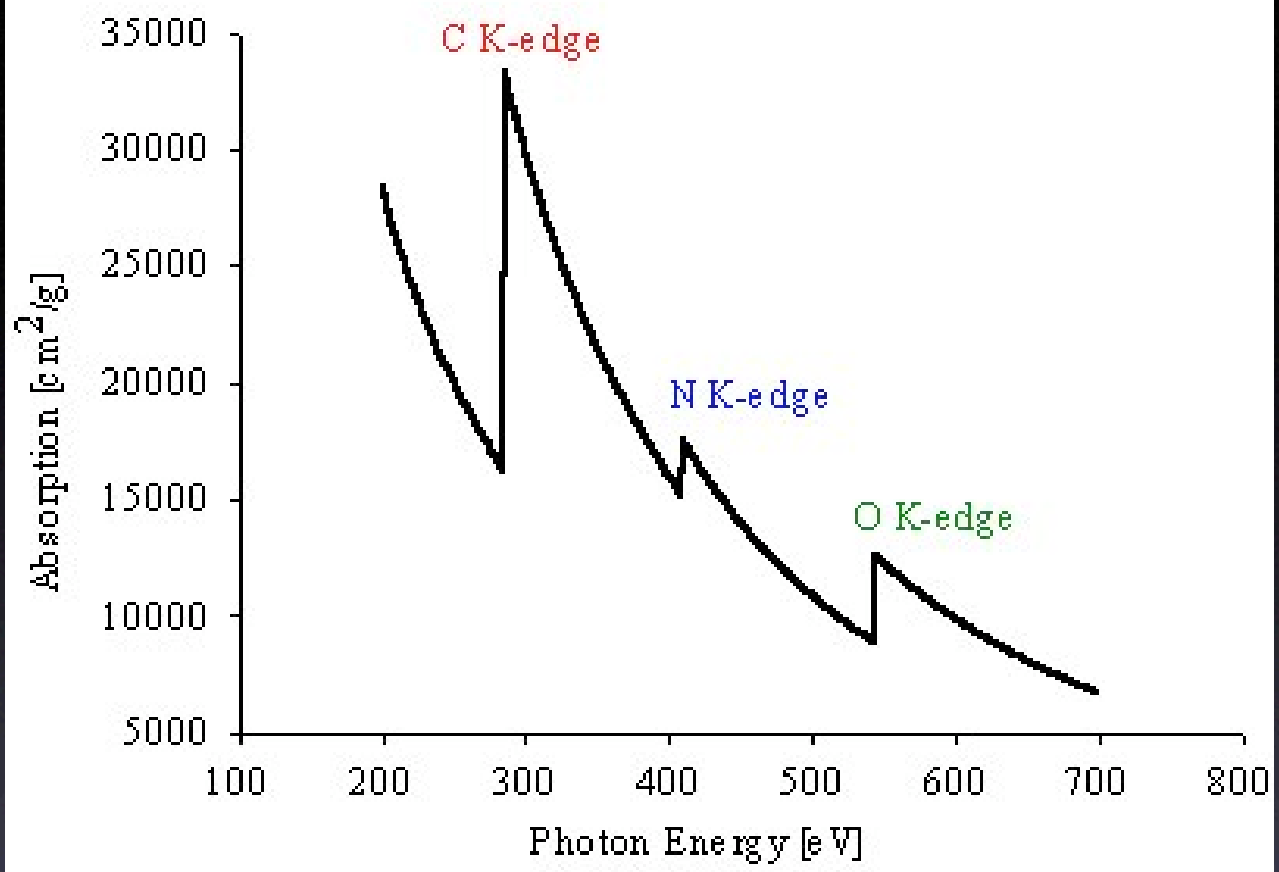
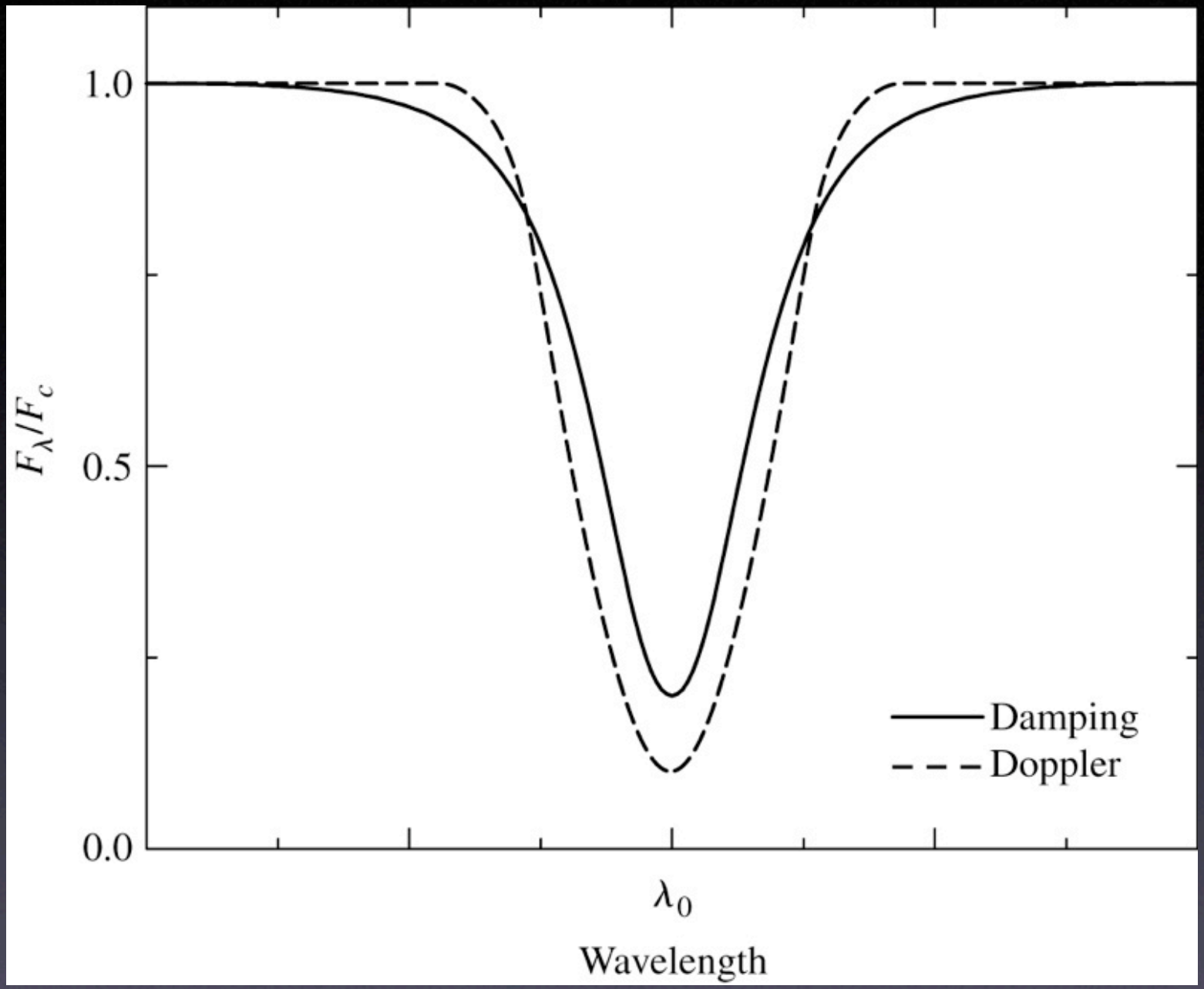
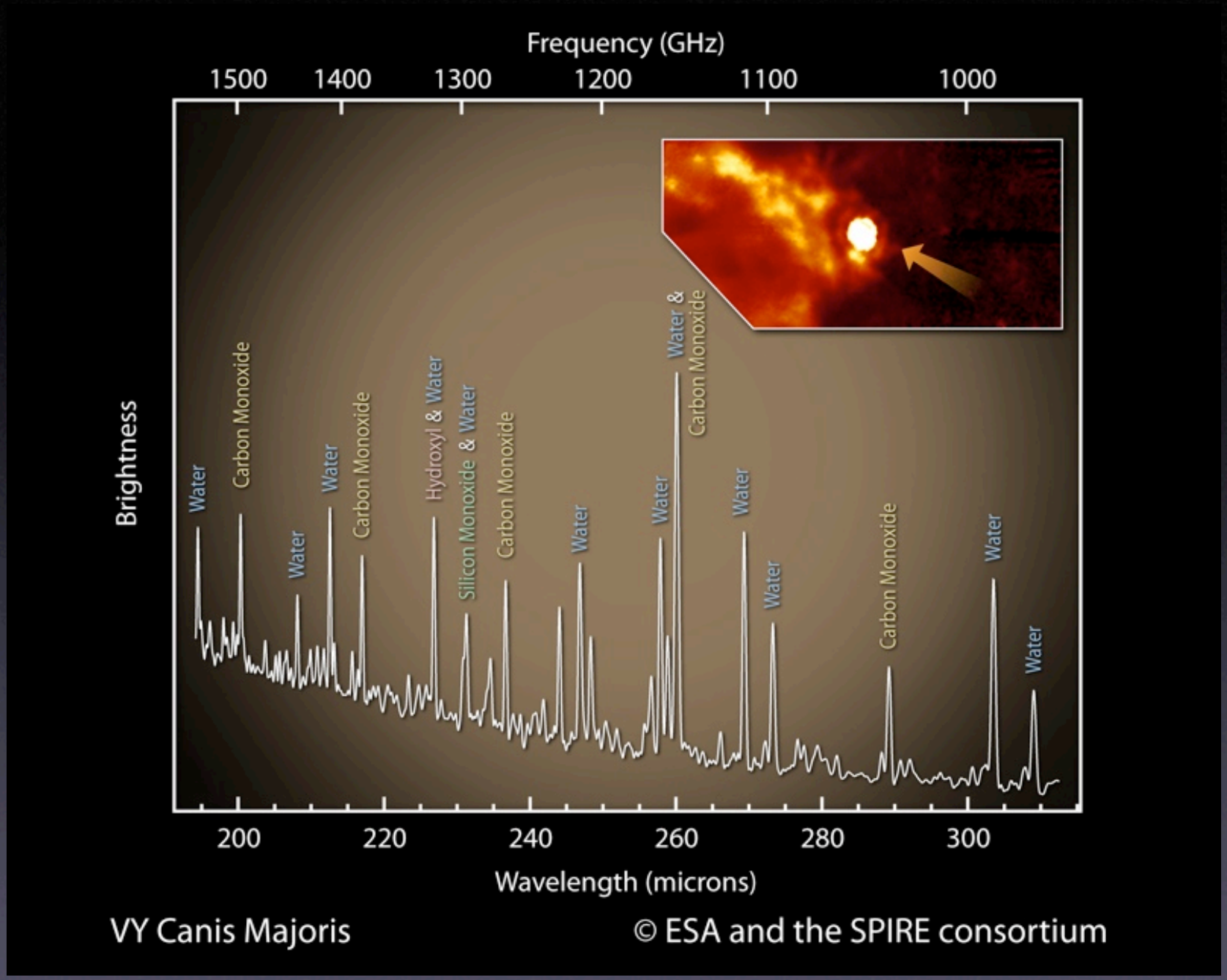


Fig. 1 X-ray absorption edges of carbon, nitrogen and oxygen of a composition typical of a polymer. A rapid increase of the absorption occurs at the threshold of energy required to excite electrons from these inner shells.

Koprinarov



Damping (pressure broadening) vs. Doppler profiles
Carroll & Ostlie



Herschel image, spectrum of red supergiant

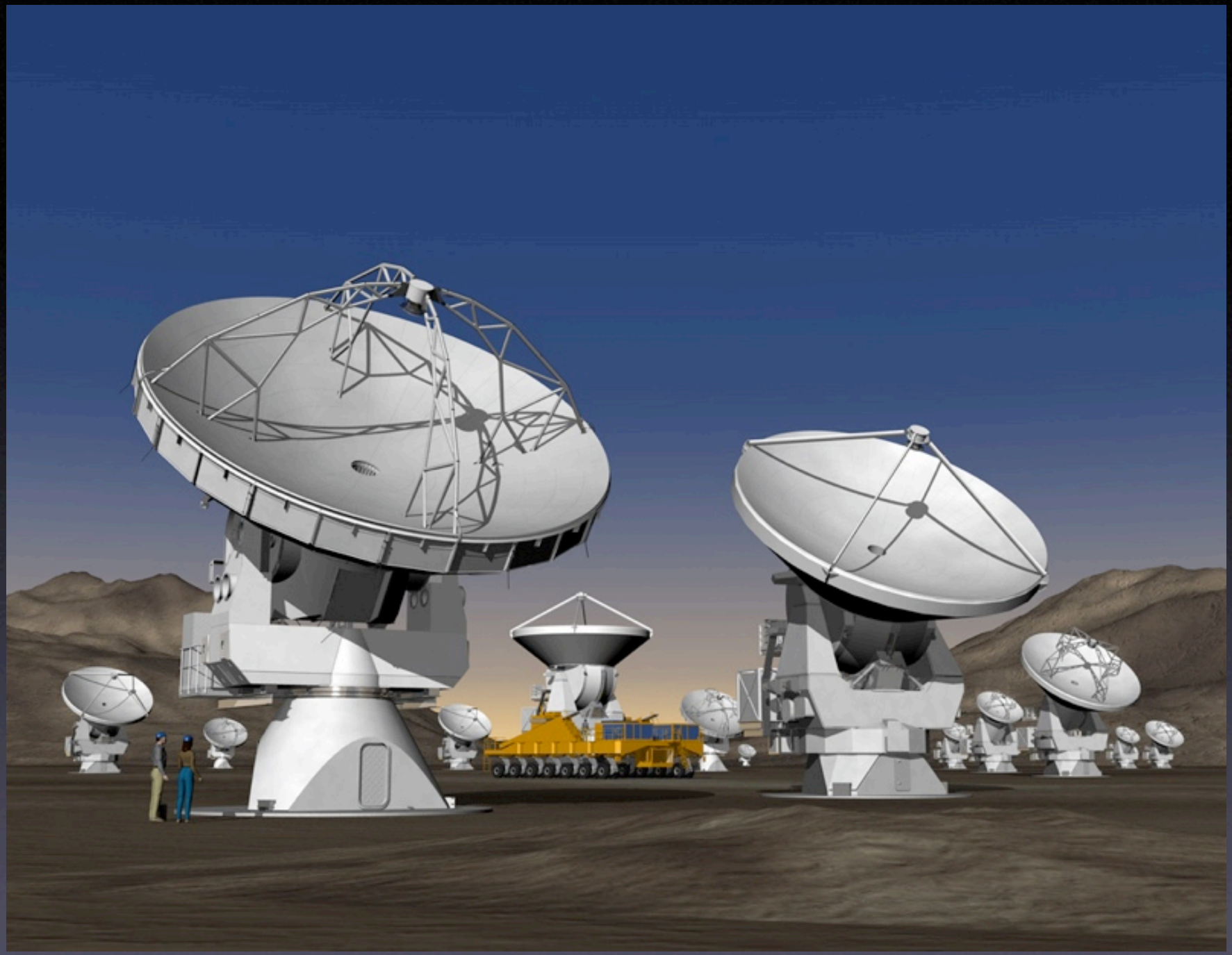


Illustration of ALMA radio telescope (Chile)