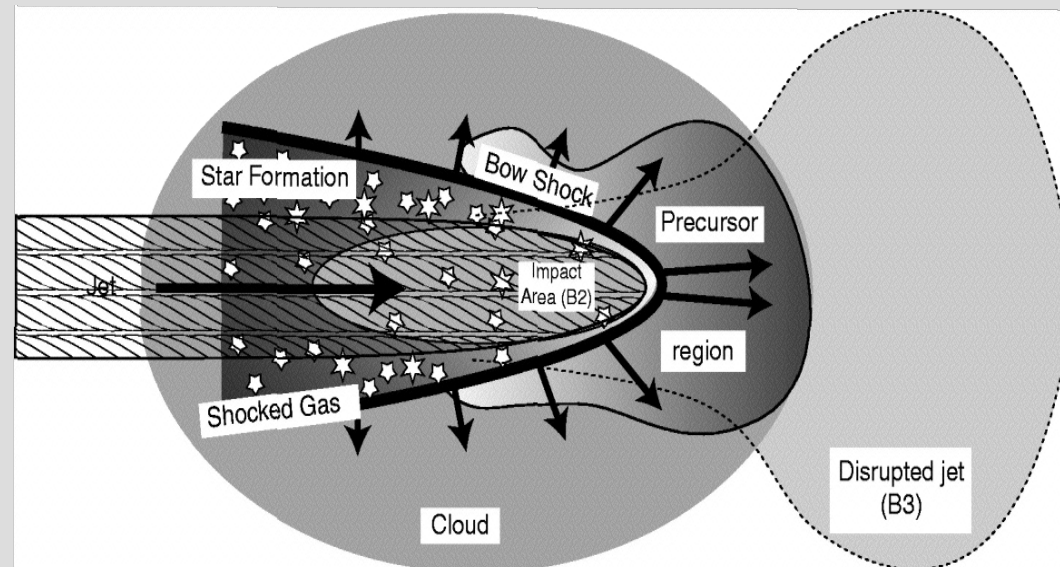


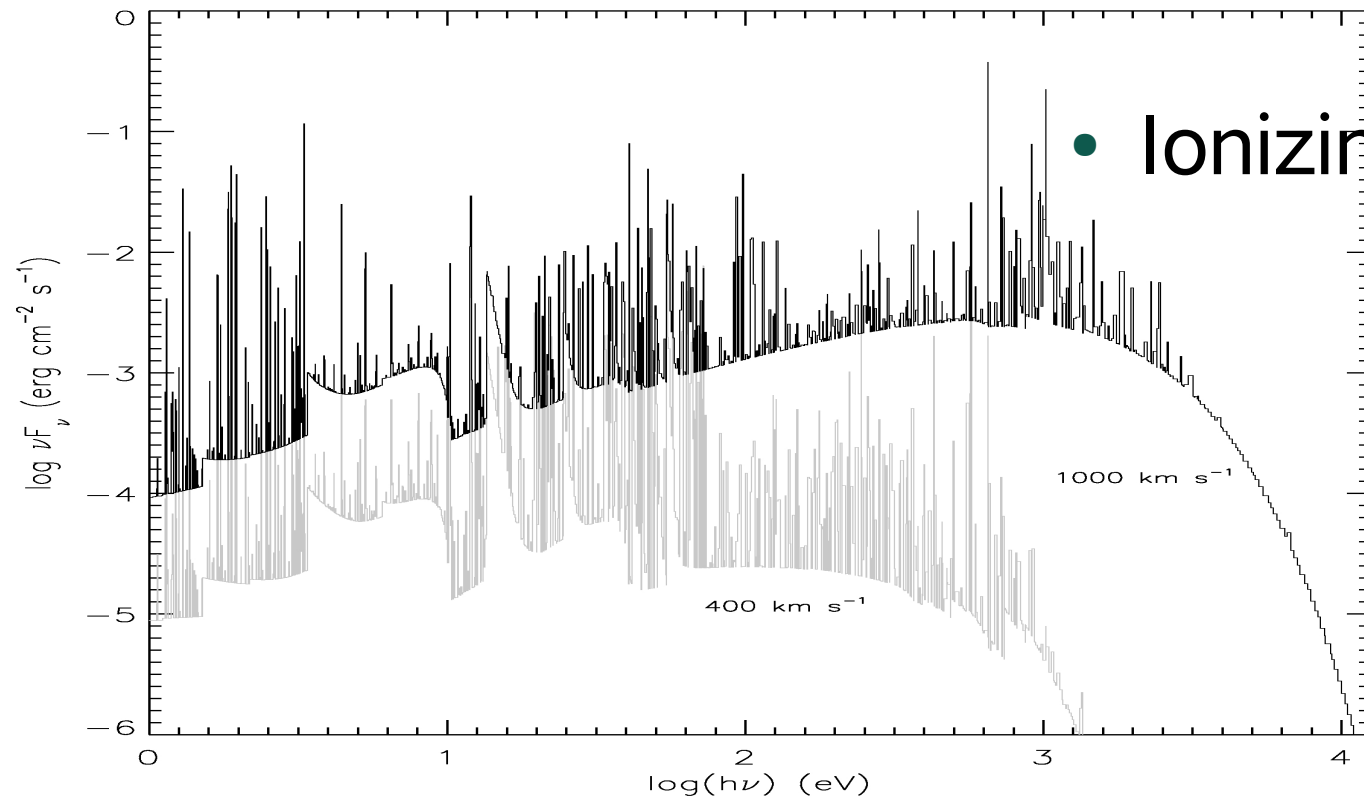
Shocks in the NLR of AGN

M. Allen, M. Dopita, R. Sutherland, B.
Groves, L. Kewley

Shocks in NLRs of AGN

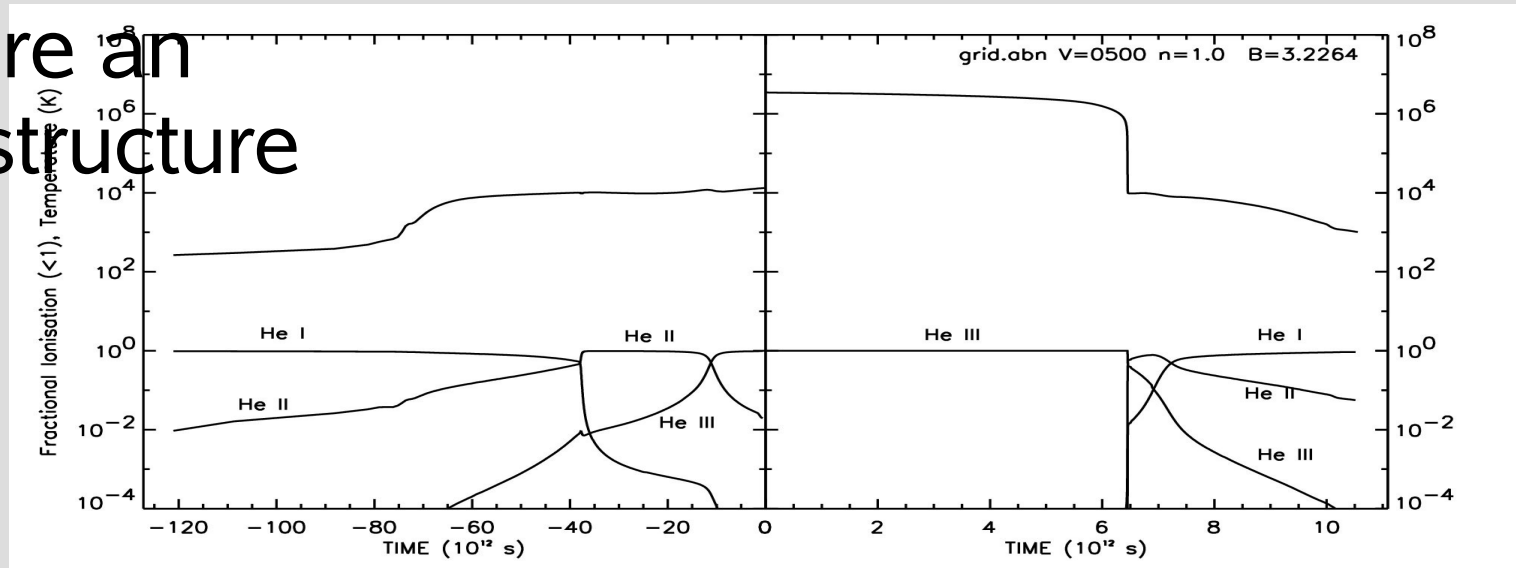
- Driven by jets and outflows
- $V_{\text{shock}} > 170 \text{ km/s} \rightarrow \text{Radiative}$
- Important for understanding emission line spectra and overall energetics



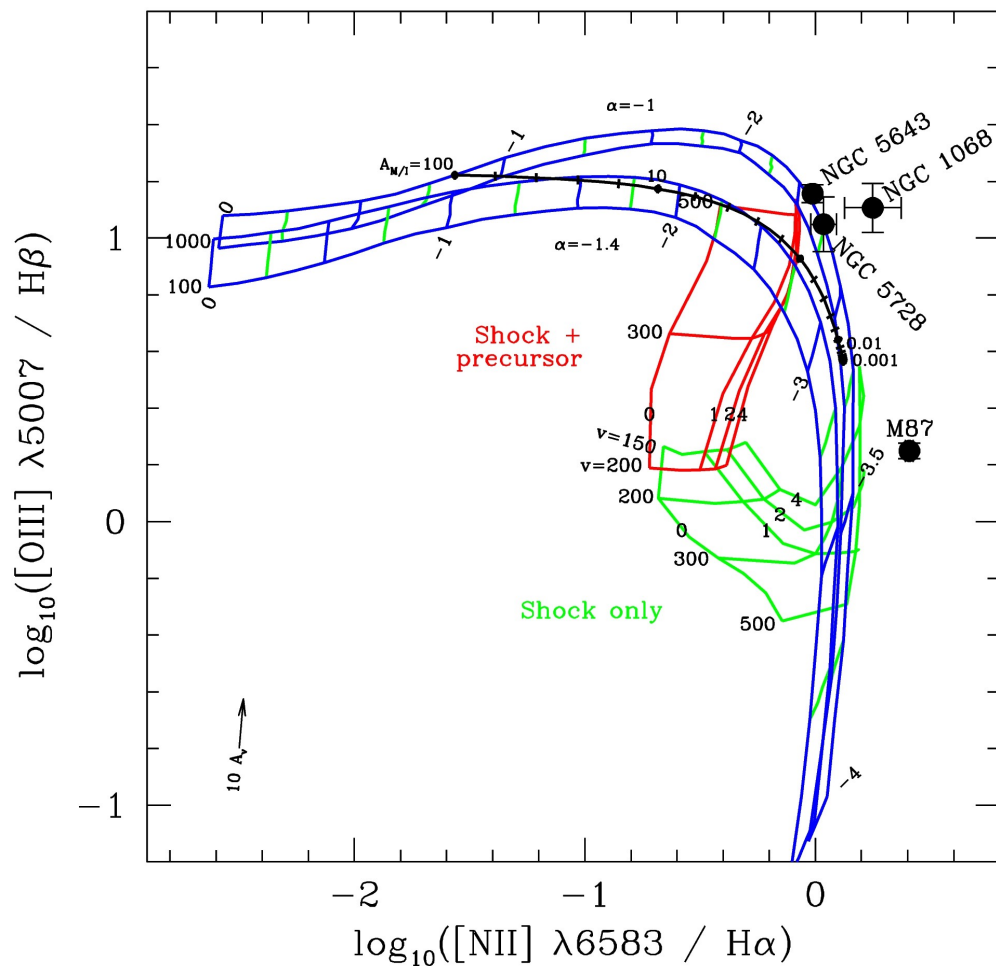


- Ionizing spectra

- Temperature and ionization structure



Line Ratio Diagnostics

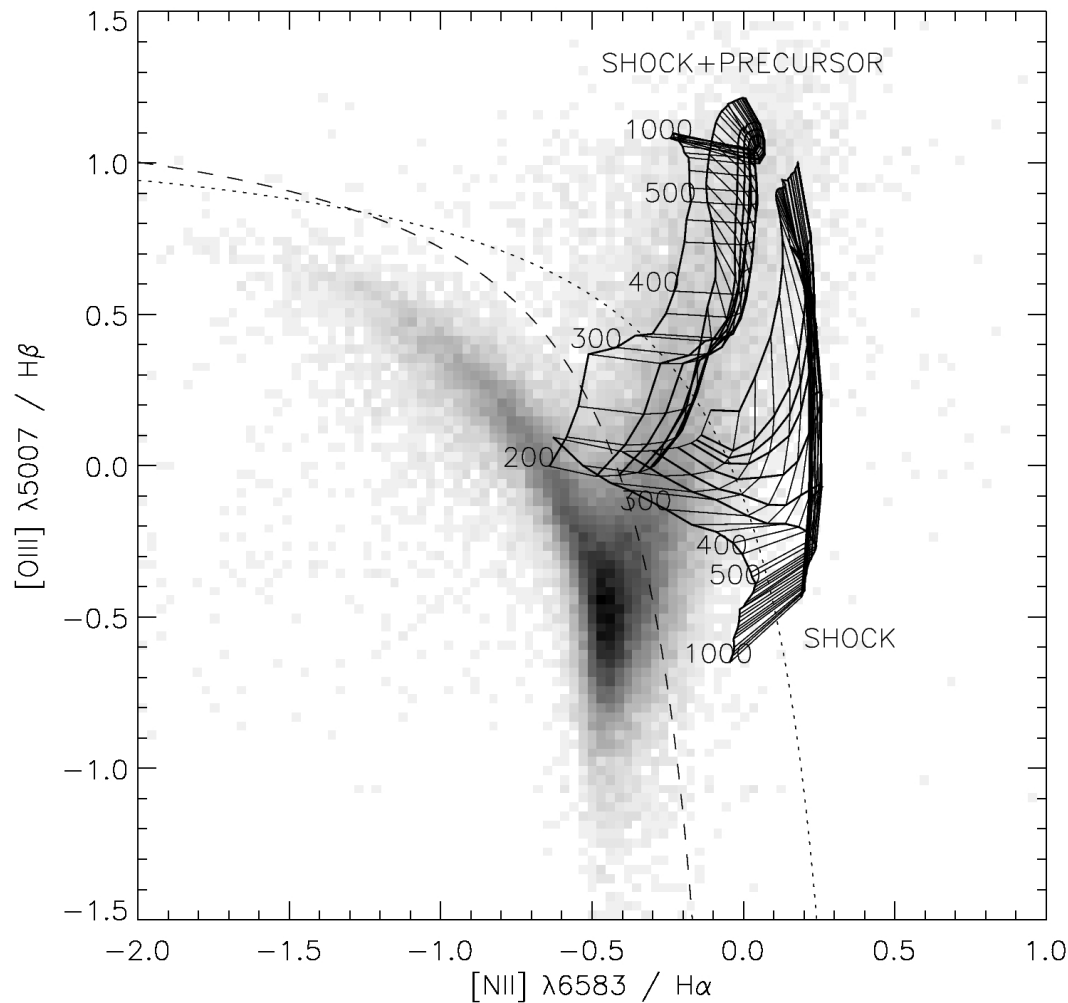


- Many observations near the the high V end of Dopita & Sutherland grid

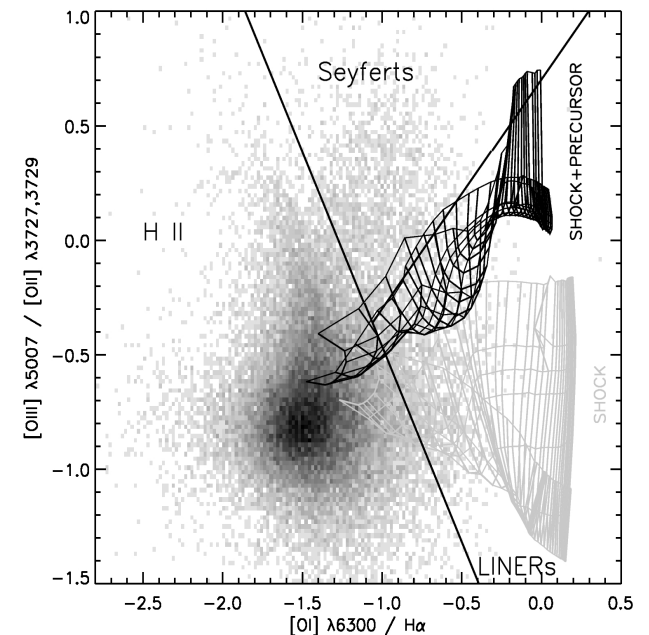
New MAPPINGS III models

- Updated from Dopita & Sutherland 96
- Wide parameter space grid:
 - Velocities: 100 – 1000 km/s
 - Magnetic parameters $B/n^{1/2}$ 0-10
 - Densities 0.001 – 1000 cm^{-3}
 - Abundances: 5 different sets
- Updated atomic data, better convergence, full line list, DS96 quirks fixed

Line Ratio Diagnostics



- beyond the DS96 500 km/s limit important for many observed objects



cdsweb.u-strasbg.fr/~allen

[Mark Allen Homepage](#)

[Mappings Output Files](#)

[Emission Line Ratio Files](#)

[Column Density Files](#)

[IDL Plotting Widget](#)

Mappings III Shock Model Library

This is a library of radiative shock models calculated with the Mappings-III shock and photoionization code.

shock velocities: 100-1000 km/s

magnetic parameters: 0.0001 - 10

densities: 0.01, 0.1, 1.0, 10, 100, 1000

abundances: Solar, 2xSolar, SMC, LMC, +

The library consists of:

The original Mappings III output files

Tables of emission line ratios for each velocity sequence

Tables of column densities for shock and precursor components

IDL plotting widgets for 2-d line ratio diagrams, and for plotting shock and precursor ionization structures

Any model any set of line ratios

MAPPINGS Shock Model Line Ratio Diagram Tool version 0.1

Y1

Ca V 2280,5700
Fe XIII 2288,1600
S X 2303,8600
He II 2306,2700
O III 2320,9200
C II 2325,1600
O III 2331,3700
Si II 2335,1100
Fe XI 2341,0500
Si VII 2350,5400

Y2

Si III 1886,5000
Si IX 1888,9700
Si VII 1894,7700
Si III 1895,8400
S I 1907,3500
C III 1909,0700
C III 1911,1500
Si IX 1984,6700
S IX 1987,3700
C III 1999,2000

X1

N IV 1485,9800
S XI 1489,0800
Fe VII 1490,3400
S XI 1519,1800
Si II 1531,0000
C IV 1548,2000
C IV 1550,8000
S IX 1553,1800
C I 1561,0000
Ne V 1574,7500

X2

Si III 1886,5000
Si IX 1888,9700
Si VII 1894,7700
Si III 1895,8400
S I 1907,3500
C III 1909,0700
C III 1911,1500
Si IX 1984,6700
S IX 1987,3700
C III 1999,2000

CII/CIII vs. CIV/CIII

1277

C II 2325,1600,

Clear Y1

1247 1248

C III 1909,0700, C III 1911,1500,

Clear Y2

1209 1210

C IV 1548,2000, C IV 1550,8000,

Clear X1

1247 1248

C III 1909,0700, C III 1911,1500,

Clear X2

SHOCK MODELS

```
n=1 abn=dopita2005 Precursor
n=1 abn=dopita2005 Shock
n=1 abn=dopita2005 Shock+Precurs
n=100 abn=Sol Precursor
n=100 abn=Sol Shock
n=100 abn=Sol Shock+Precursor
n=1 abn=Sol Precursor
n=1 abn=Sol Shock
n=1 abn=Sol Shock+Precursor
n=1 abn=SMC Precursor
n=1 abn=SMC Shock
n=1 abn=SMC Shock+Precursor
n=1 abn=LMC Precursor
n=1 abn=LMC Shock
n=1 abn=LMC Shock+Precursor
n=1 abn=2Sol Precursor
n=1 abn=2Sol Shock
n=1 abn=2Sol Shock+Precursor
n=1000 abn=Sol Precursor
n=1000 abn=Sol Shock
```

RESET SHOCK MODEL

Velocity labels [1-10]00

Magnetic Field labels Off

OVER-PLOT PHOTOIONIZATION MODELS

```
md_Z0_25A_si1_2
md_Z0_25A_si1_4
md_Z0_25A_si1_7
md_Z0_25A_si2_0
md_Z0_5A_si1_2
md_Z0_5A_si1_4
md_Z0_5A_si1_7
md_Z0_5A_si2_0
md_Z1A_si1_2
md_Z1A_si1_4
```

RESET PHOTOIONIZATION MODEL

PLOT RANGES

Default Limits

Postscript (tmp.ps)

EXIT

X MIN -0.712000 X MAX 1.21600

Y MIN -0.519200 Y MAX 1.12240

- Comparison with Dopita & Sutherland 1996

