Temperature indicators

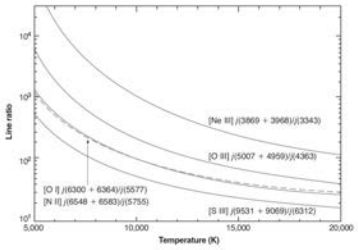
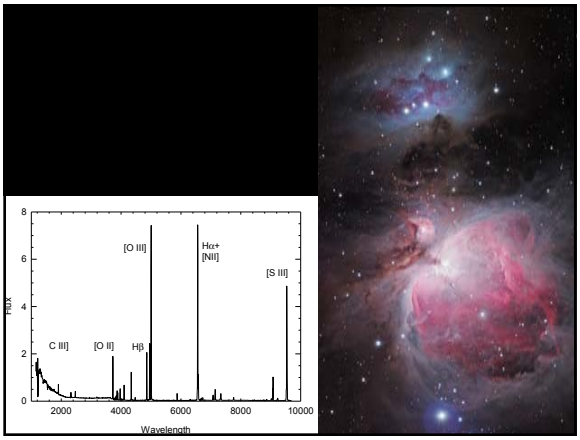


Figure 5.1
Four temperature sensitive forbidden line ratios are shown as a function of the electron temperature. The [O I] (solid line) and [N II] (dashed) ratios are nearly coincident, partially because of their similar excitation potentials. The ratios are shown in the low density limit ($n_e = 1\ cm^{-3}$).

BPT Diagram & Strong-lined methods

- **What can we do if we cannot detect the faint lines needed to measure ratios described in AGN3 Chapter 4 & 5?**
- **Because object too faint, or**
- **Telescope not big enough?**



BPT

PUBLICATIONS OF THE
ASTRONOMICAL SOCIETY OF THE PACIFIC

Vol. 93 February 1981 No. 551

CLASSIFICATION PARAMETERS FOR THE EMISSION-LINE SPECTRA OF EXTRAGALACTIC OBJECTS

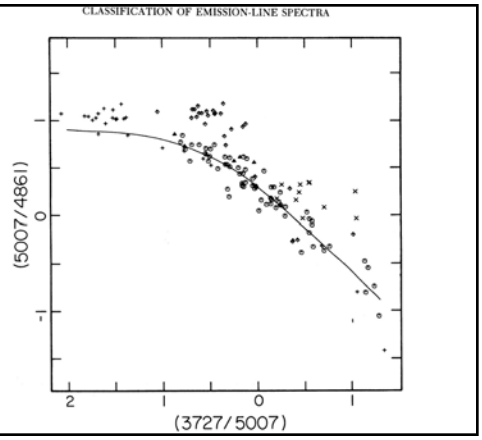
J. A. BALDWIN AND M. M. PHILLIPS
Cerro Tololo Inter-American Observatory,* Casilla 603, La Serena, Chile
AND
ROBERTO TERLEVICH

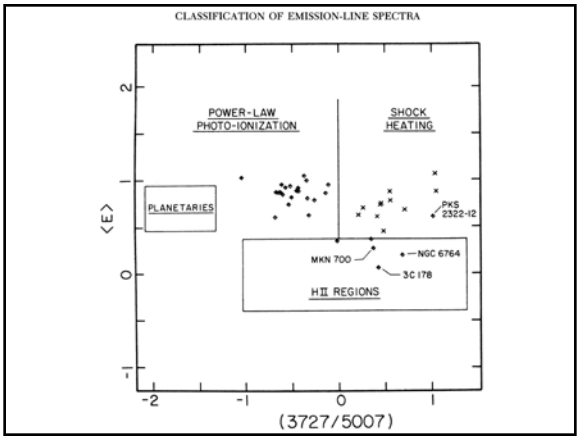
- http://adsabs.harvard.edu/abs/1981PASP...93....5B

BPT paper on ADS

- References in the article
- Citations to the Article (2928) (Citation History)
- Refereed Citations to the Article
- SIMBAD Objects (47)
- NED Objects (46)
- Also-Read Articles (Reads History)
- Translate This Page

Title: Classification parameters for the emission-line spectra of extragalactic objects
Authors: Baldwin, J. A.; Phillips, M. M.; Terlevich, R.





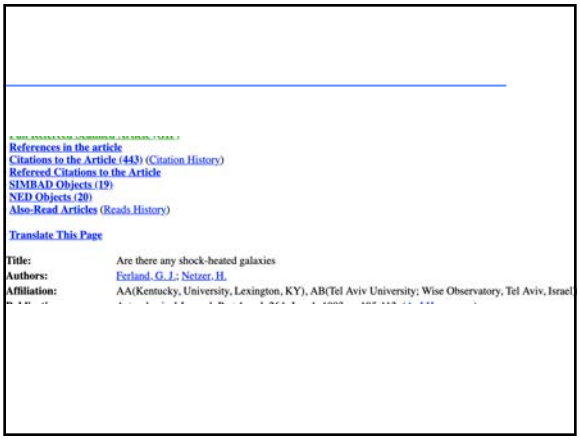
Other possibilities …

THE ASTROPHYSICAL JOURNAL, 264:105–113, 1983 January 1

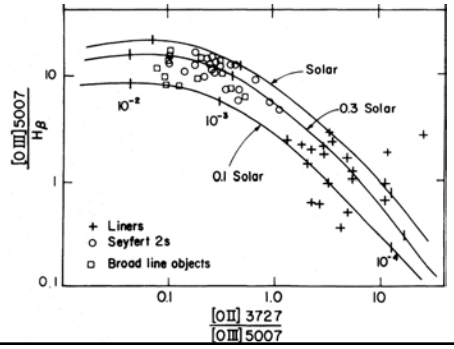
ARE THERE ANY SHOCK-HEATED GALAXIES?

GARY J. FERLAND
Department of Physics and Astronomy, University of Kentucky
AND
HAGAI NETZER
Department of Physics and Astronomy and The Wise Observatory, Tel Aviv University
Received 1982 May 3; accepted 1982 June 25

- http://cdsads.u-strasbg.fr/abs/1983ApJ...264..105F



BPT due to range of U, Z?



Veilleux & Osterbrock 1987

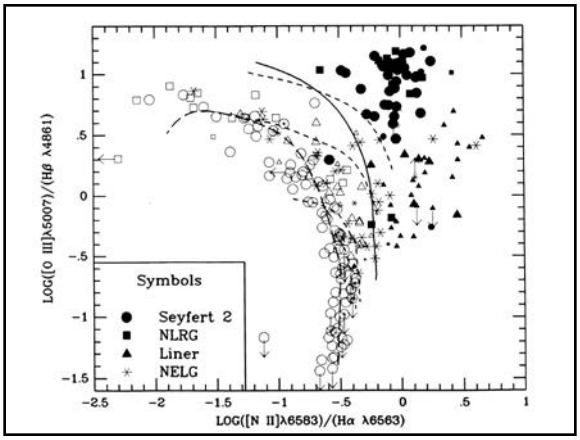
THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 63:295–310, 1987 February

SPECTRAL CLASSIFICATION OF EMISSION-LINE GALAXIES[1]

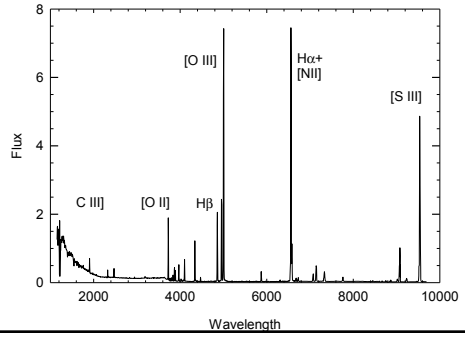
SYLVAIN VEILLEUX AND DONALD E. OSTERBROCK
Lick Observatory and Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz
Received 1986 June 4; accepted 1986 August 12

- http://adsabs.harvard.edu/abs/1987ApJS...63..295V

Don's version of BPT



Strong lines, close together



Purpose of BPT diagram

- BPT and VO use ratios of strong lines to classify the emission-line region
  - HII region, PN, AGN, shock,
  - Quasar, Starburst galaxy, NLRG, Seyfert
- Others try to measure chemical composition, metallicity, or ionization parameter

The grid command – Hazy1 Chap 18

- Computes a grid of models in parallel on multi-core machines
- Include "vary" keyword on commands with variable parameters (Chapter 17.4)
- "grid" command specifies lower, upper bounds, and step size
  - Radius 13 vary
  - grid 13 23 2

Special rules for temperature grids

18.3 Grid start point, end point, increment [linear]

Parameters for those commands with the **vary** keyword (see Table 17.1 on page 239) can be varied within a grid. Each command with a **vary** option must be followed by a **grid** command.

For nearly all commands, the quantity will be varied logarithmically (current exceptions are the **illuminate**, **ratio alphox**, **dlaw**, and **fudge** commands). If the quantity is varied logarithmically, the lower / upper limit and the step size also need to be given as logarithms, as shown above. If the keyword **linear** is included on the **grid** command, then these numbers will be interpreted as linear quantities. As an example, the following will produce a grid of models with a constant electron temperature of 5000, 10000, 15000, and 20000 K.

```
constant temperature 4 vary
grid range from 5000 to 20000 step 5000 linear
```

18.5 Beware the grid command treatment of temperatures!!

The following will crash with an fpe

```
constant temperature 4 vary
grid range from 5000 to 20000 step 5000  // wrong, this will crash!
```

This is because of the rule stated above that the **grid** command treats temperature ranges as logs unless the keyword **linear** occurs.

Save files with grids

- "Save grid" command saves step parameters
  - Summary of error conditions
  - Check for problems
- "no hash", "last", options on other save commands

16.69.7 Save line list [absolute]

This reads in a list of emission lines from a file and reports the predicted line intensities. It is designed as a way to obtain predictions for a subset of the lines that are predicted during a series of calculations. It is often used together with the **grid** command when doing grids of calculations or with the **time** command when following the evolution of a time-varying continuum source.

Filenames

These are tricky since two filenames appear in this command. All **save** commands have the name of an output file in double quotes. This is the first filename on the command line. The file containing the list of emission lines is within the second pair of quotes. In the following example

```
save line list "output.txt"  "LineListHII.dat"
```

the save output will go to `output.txt` and `LineListHII.dat` contains the set of emission lines. Predicted intensities for the list of lines contained in the second file will be output into the first file.

Units of lines in line list

Units of the line brightness

Intrinsic line intensities are given by default. The keyword **emergent** will give those instead. The lines will be relative to the reference line by default. If the keyword **absolute** appears then they will be given in absolute units, the same units as the third column in the main emission-line output. By default these are erg cm^{-2} s^{-1} for the intensity case and erg s^{-1} for the luminosity case. The **print line surface brightness** command, described on page 183, can change the absolute units for all the lines to surface brightness, either sr^{-1} or arcsec^{-2}.

Save line list ratio

The ratio option

If the keyword **ratio** appears then the ratio of adjacent lines will be output. There must be an even number of lines in the line-list file. The output will have the ratio of the intensity of the first divided by the second, the third divided by the fourth, etc. This provides a quick way to look at line ratios as a function of other parameters. The **grid** command can produce grids of calculations.

Suppose the file `linelist.dat` contains the following:

```
#
# the [O III] temperature indicator
o  3     5006.84
Blnd     4363
```

The command

```
save line list "o3.lin" ratios from "linelist.dat"
```

would report the ratio of the [O III] λ5006.84 to the λ4363 line.