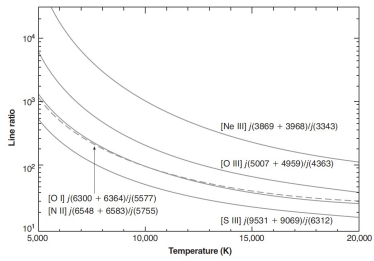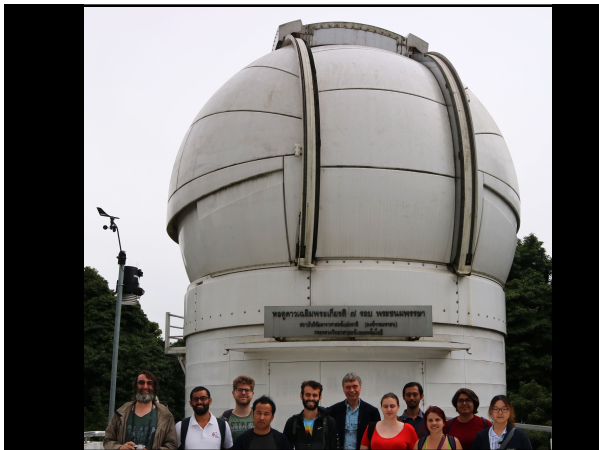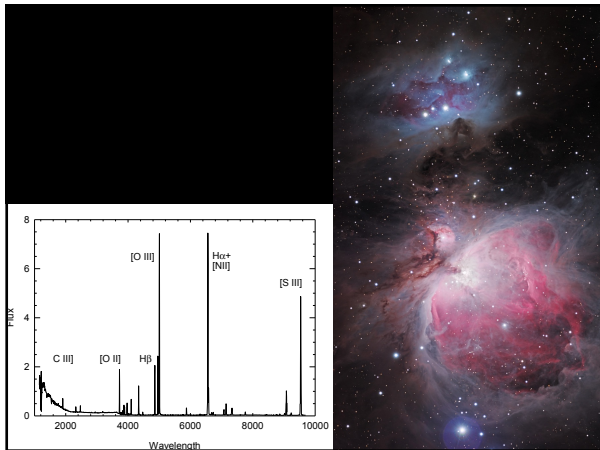## Temperature indicators

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

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

CLASSIFICATION OF EMISSION-LINE SPECTRA

CLASSIFICATION OF EMISSION-LINE SPECTRA

POWER-LAW
PHOTO-IONIZATION

SHOCK
HEATING

PLANETARIES

PKS
2322-12

MKN 700

NGC 6764

3C 178

H II REGIONS

⟨E⟩

(3727/5007)
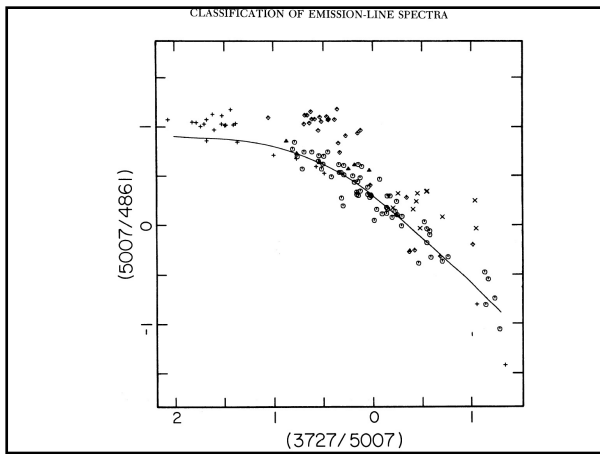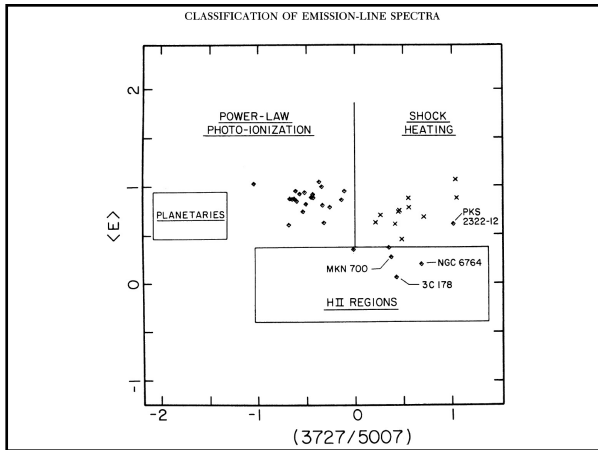
ARE THERE ANY SHOCK-HEATED GALAXIES?

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AND
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Department of Physics and Astronomy and The Wise Observatory, Tel Aviv University

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

BPT due to range of U, Z?

Solar

0.3 Solar

0.1 Solar

10^{-2}

10^{-3}

10^{-4}

+ Liners
○ Seyfert 2s
□ Broad line objects

$\frac{[OIII]5007}{H\beta}$

$\frac{[OII]\ 3727}{[OIII]\ 5007}$

Page 3
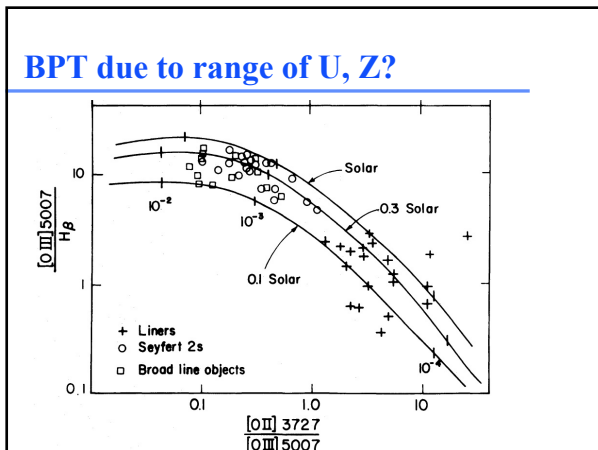
Veilleux & Osterbrock 1987

SPECTRAL CLASSIFICATION OF EMISSION-LINE GALAXIES[1]

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Received 1986 June 4; accepted 1986 August 12

- **http://adsabs.harvard.edu/abs/1987ApJS...63..295V**
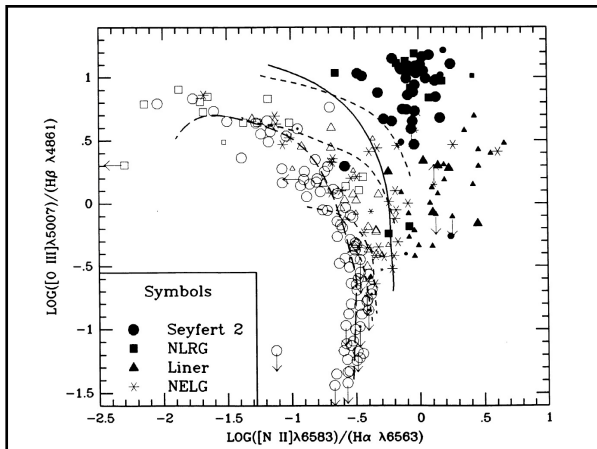
Purpose of BPT diagram

- **BPT and VO use ratios of strong lines to classify the emission line region**
  - HII region, PN, AGN, shock, etc

- **Others try to measure chemical composition, metallicity, or ionization parameter**