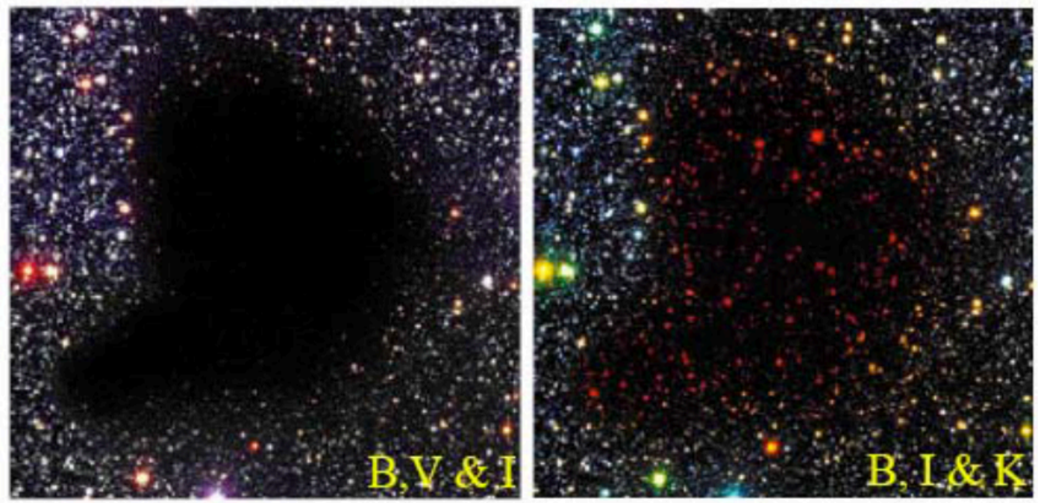
Interstellar extinction

Examples of the Effects of Dust

B68 dark cloud
extincted stars
appear red



Pleiades starlight
scattered by dust

- Extinction is not "grey"
- Presence of extinction modifies the apparent color of a star

Band (nm)	A/A_V
U (360)	1.531
B (450)	1.324
V (550)	1
R (660)	0.748
I (800)	0.482
J (1250)	0.282
H (1650)	0.175
K (2200)	0.112
L (3500)	0.058
M (4800)	0.023

The ("general") extinction A_λ can also be written as terms of the brightness in magnitudes of a source, but this requires knowing its distance and luminosity

$$m_\lambda = M_\lambda + 5 \log d - 5 + A_\lambda.$$

Instead we use the distance-independent ***"selective extinction"*** , which is the additional *color excess* due to extinction

$$E(B-V) = A(B)-A(V) = (B-V) - (B-V)_0$$

The ***"normalized selective extinction"*** at any wavelength is also a common measure of extinction:

$$E(\lambda, V)/ E(B-V)$$

The ***"normalized extinction"*** : $1/R_V$, measures the steepness of the extinction curve

$$R_V = A(V) / [A(B)-A(V)] = A(V) / E(B-V)$$

It is steep in the diffuse ISM: $R_V = 3.1 \pm 0.2$, shallower in dark clouds: $R_V \approx 5$

- Suppose we know the true color of a star

$$(B_0 - V_0)$$

- Observed color is

$$(B-V)$$

- What is the extinction to the star?

$$(B-V) = (B_0 + A_B) - (V_0 + A_V)$$

$$= (B_0 - V_0) + (A_B - A_V)$$

Color excess [reddening]

If $A_{\lambda 2} = 0$, e.g., a nearby star with negligible extinction

$$E_{\lambda 1-\lambda 2} = (m_{\lambda 1} - m_{\lambda 2}) - (m_{\lambda 1} - m_{\lambda 2})_0$$

E.g., λ1=4350 Å (B band) , λ2=5550 Å (V band)

$E_{B\text{-}V}$ [color excess] = [measured color] – [observed color]

Always shorter minus longer, e.g., E(B-V), E(I-K), E(U-B)

$$E_{B\text{-}V} = (B\text{-}V) - (B\text{-}V)_0 = A_B - A_V$$

IS reddening

Observed SED

Intrinsic SED

Total Extinction Quantified by A_V (at 5550 Å)

Ratio of total-to-selective extinction

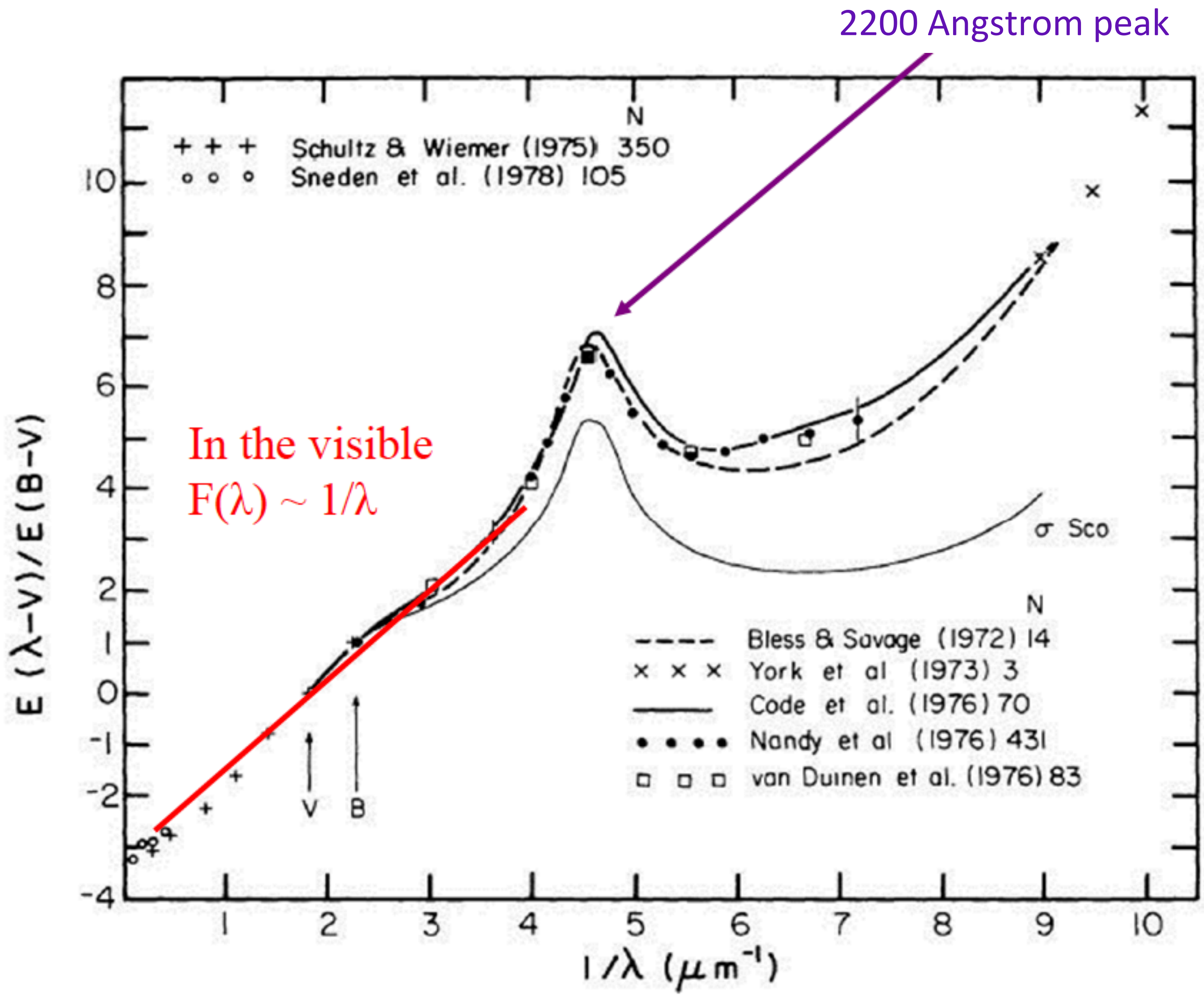
$$R = \frac{A_V}{E_{B-V}}$$

A generally accepted value **<R> ~ 3.1 +/– 0.1**,
i.e., $A_V = 3.1\ E(B-V)$

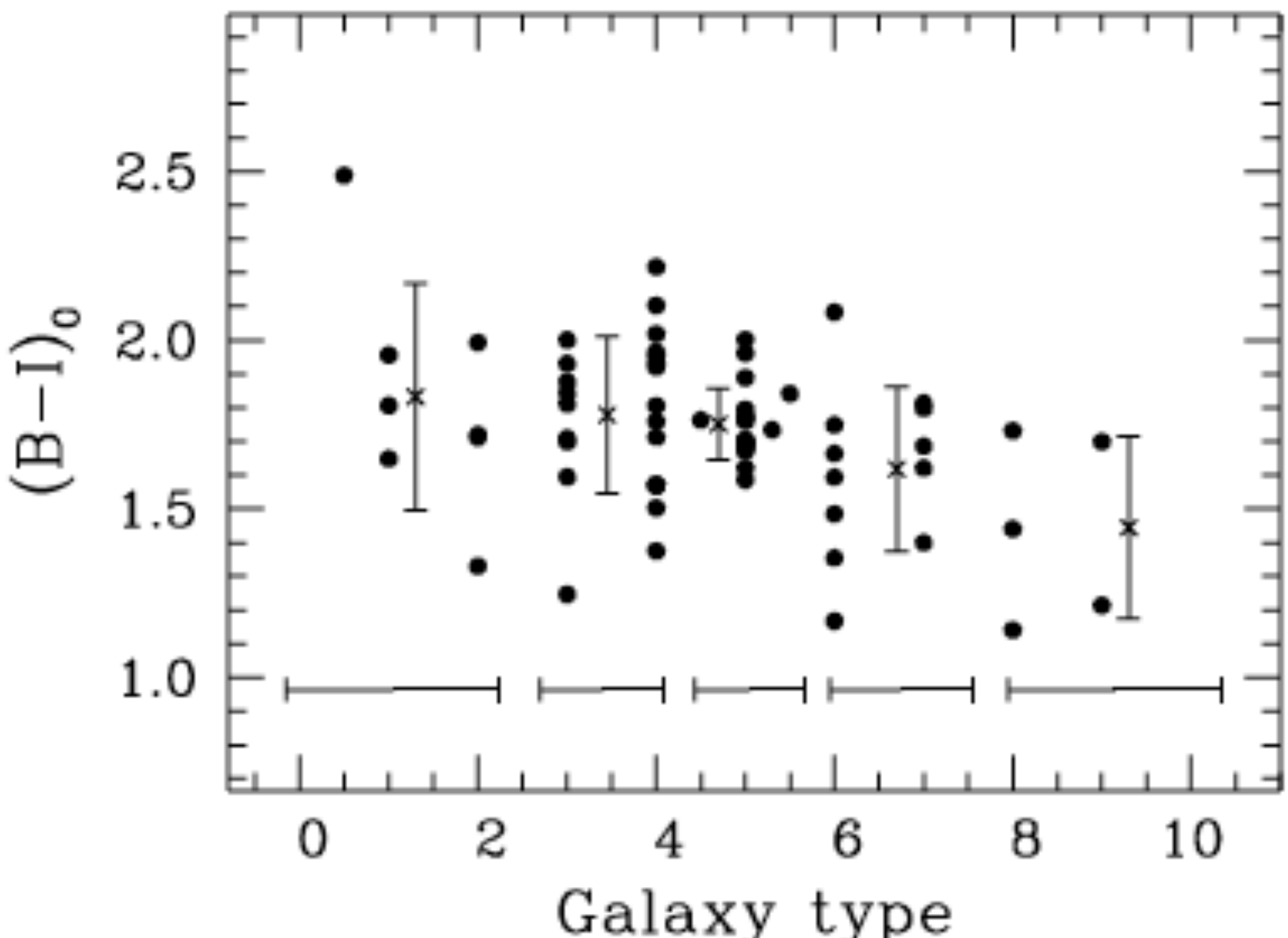
$$N_H/E(B-V) = 5.8 \times 10^{21}\ \text{H atoms cm}^{-2}\ \text{mag}^{-1}$$

A_V can be estimated by observing stars

The estimate is not reliable toward any particular direction or object, because of clouds are patchy.


2200 Angstrom peak
In the visible
F(λ) ~ 1/λ
N
+ + + Schultz & Wiemer (1975) 350
o o o Sneden et al. (1978) 105
σ Sco
N
Bless & Savage (1972) 14
× × × York et al (1973) 3
Code et al. (1976) 70
• • • Nandy et al (1976) 431
□ □ □ van Duinen et al. (1976) 83
V
B
E (λ−V)/E(B−V)
1/λ (μm⁻¹)

Un-reddened galaxy B-I colors



Galaxy Profiles [PDF]

Ionized Gas [PDF]

Extinction Chart [PDF]

Spiral Galaxy Color Gradients [PDF]

Spiral Galaxy Color Gradients 2 [PDF]

H-α survey [PDF]

H-α observation [PDF]

Star Formation in Galaxies [PDF]

M51 Star Formation [PDF]

interstellar extinction [PDF]

M51 bulge extinction [PDF]

M51 Spectra 2 [PNG]

5-22-2012 data [95 MB ZIP]

5-24-2012 data [55 MB ZIP]

5-29-2012 data [84 MB ZIP]

5-31-2012 data [113 MB ZIP]

Landolt star number 544 in SA 107