

1 SKG 5.7

P. 190,  $M(\text{HI})$  FOR NGC 7331:  $1.1 \times 10^{10} M_{\odot}$ P. 180, PROB 5.3:  $L_V \approx 3.3 \times 10^{10} L_{V,\odot}$ 

$$(B-V)_{7331} = -2.5 \log \frac{L_B}{L_V} + \text{const}$$

$$(B-V)_{\odot} = -2.5 \log \frac{L_{B,\odot}}{L_{V,\odot}} + \text{const}$$

$$\text{THUS } \frac{L_{B,\odot}}{L_{V,\odot}} = \frac{L_B}{L_V}$$

$$\text{SO } L_B = 3.3 \times 10^{10} L_{B,\odot}$$

$$\frac{M(\text{HI})}{L_B} = \frac{1.1 \times 10^{10} M_{\odot}}{3.3 \times 10^{10} L_{B,\odot}} = \boxed{\frac{1}{3} \frac{M_{\odot}}{L_{B,\odot}}}$$

$$\text{M31: } \frac{M(\text{HI})}{L_B} = \frac{5700 \times 10^6 M_{\odot}}{2700 \times 10^7 L_{B,\odot}} = \boxed{0.2 \frac{M_{\odot}}{L_{B,\odot}}}$$

$$\text{LMC: } \frac{M(\text{HI})}{L_B} = \frac{700 \times 10^6 M_{\odot}}{170 \times 10^7 L_{B,\odot}} = \boxed{0.4 \frac{M_{\odot}}{L_{B,\odot}}}$$

$$\text{SMC: } \frac{M(\text{HI})}{L_B} = \frac{650 \times 10^6 M_{\odot}}{34 \times 10^7 L_{B,\odot}} = \boxed{1.9 \frac{M_{\odot}}{L_{B,\odot}}}$$

IF  $M/L \geq 2$ ,

$$\rightarrow M_{\text{tot}} = 2 L_B \text{ in } M_{\odot}$$

STARS  
GAS,  
IGNORING  
DARK  
MATTER  
(WHICH  
DOMINATES!)

$$\therefore \frac{M_H}{M_{\text{tot}}} = \left( \frac{1}{3} \frac{M_H}{L_{B,\odot}} \right) \left( \frac{2 L_{B,\odot}}{2 M_{\odot}} \right)$$

$$\frac{M_H}{M_{\text{tot}}} = \frac{1}{6}$$

MASS OF STARS IS  
5x MASS OF GAS

2

6-2, CENTRAL SURFACE BRIGHTNESS = 23.25  $\frac{\text{MAG}}{\text{arcsec}^2}$

SKY BRIGHTNESS (IN V) = 21.8

$\frac{F_{\text{GAL}}}{F_{\text{SKY}}} = 10^{(M_{\text{SKY}} - M_{\text{GAL}})/2.5}$  - IS WHAT WE'RE AFTER  
 (GAL IN ONE " →)

$$M_{\text{SKY}} - M_{\text{GAL}} = -2.5 \log \frac{F_{\text{SKY}}}{F_{\text{GAL}}}$$

$$\frac{F_{\text{SKY}}}{F_{\text{GAL}}} = 10^{(M_{\text{SKY}} - M_{\text{GAL}})/-2.5}$$

$$= 10^{(21.8 - 23.25)/-2.5}$$

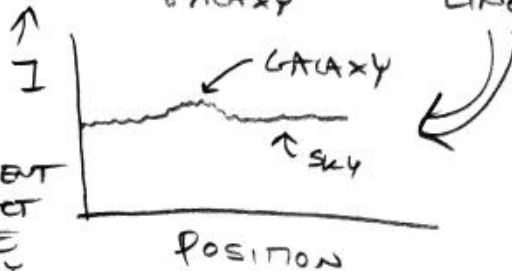
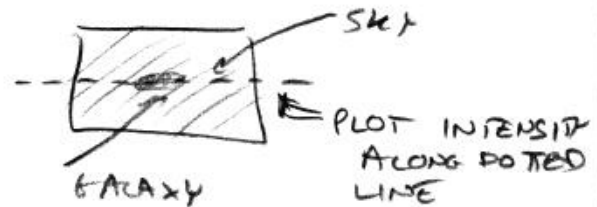
$$= \underline{\underline{3.8}}$$

⇒ SO GALAXY CENTRAL BRIGHTNESS IS  $\frac{1}{4}$  NIGHTSKY!

G675: R-BAND SKY BRIGHTNESS = 20.9

⇒ FROM TABLE,  $I(r)$  FOR G675 REACHES MAG 2) @  $r=r_e$

IT IS POSSIBLE TO OBSERVE THINGS WITH LOWER SURFACE BRIGHTNESS THAN THE SKY! I DO IT ALL THE TIME



YOU HAVE TO INTEGRATE LONG ENOUGH SO THAT YOU HAVE A GOOD ENOUGH MEASUREMENT OF THE SKY TO SUBTRACT IT OUT → OTHERWISE, THE GALAXY IS LOST IN SKY NOISE.

3 "THE SKY IS BLUE"

THE LIGHT WE SEE FROM THE SKY IS SCATTERED SUNLIGHT. MORE BLUE LIGHT IS SCATTERED, SO IT LOOKS BLUE.

THE LIGHT OF THE MOON IS REFLECTED SUNLIGHT. WHEN THE MOON IS UP, THERE'S MORE SUN-COLORED LIGHT OUT THERE, AND MORE OF THE BLUE PART OF THAT LIGHT WILL BE SCATTERED TOWARDS YOU, INCREASING THE BLUE SKY BRIGHTNESS MORE THAN THE RED.

4 NGC 1399,  $I_V(r) = 16 \frac{\text{mag}}{\text{D}''} @ R=0$

$d$   $\Rightarrow$  IN ONE  $\text{D}''$ ,  $F_V = \frac{L_V}{4\pi d^2} \Rightarrow L_V = 4\pi d^2 F_V$



ONE  $\text{D}''$  IS LOOKING AT  $r^2$  SQUARE PC

$r = d (1'') \left( \frac{1 \text{ rad}}{206265''} \right)$

$r = \frac{d}{206265}$

THUS WE HAVE  $\frac{L}{r^2} = \frac{4\pi F_V d^2 (206265)^2}{d^2}$

d IS GONE 😊  
WHAT IS  $F_V$ ? 😞

SUN:  $F_{\odot, 10\text{pc}} = \frac{L_{\odot}}{4\pi (10\text{pc})^2}$

$M_{\text{GAL}} - M_{\odot, 10\text{pc}} = -2.5 \log \frac{F_V}{F_{\odot, 10\text{pc}}}$

$F_V = F_{\odot, 10\text{pc}} 10$

$= \frac{L_{\odot}}{4\pi (10\text{pc})^2} 10^{(M_{\text{GAL}} - M_{\odot}) / -2.5}$



14 cont'd

THUS 
$$\frac{L}{L_{\odot}} = \frac{4\pi(206265)^2}{4\pi(10\text{pc})^2} \frac{(M_{\text{gas}} - M_{\odot}) / -2.5}{L_{\odot}}$$

$$\frac{L}{L_{\odot}} = 14,000 \frac{L_{\odot}}{L_{\odot}}$$

10 ↑ 16  
4.8 ↑  
WHOO HOO!

M32: SAME CALCULATION, ONLY  $M_{\text{gas}} \approx 11$

M32: 
$$\frac{L}{L_{\odot}} = 1.4 \times 10^6 \frac{L_{\odot}}{L_{\odot}} \Rightarrow \underline{\underline{\text{LOTS}}}$$

5

VERY DISTANT  $\Rightarrow$  FAR BACK IN TIME

SPIRALS: SIMILAR TO TODAY, STAR FORMATION GOING ON

- ISOT
- FEWER STARS WITH HIGH METALLICITY (NOT ENOUGH GENERATIONS)
  - HIGHER GAS FRACTION (NOT AS MUCH USED UP)
  - BLUER (MORE GAS, MORE FUEL, CAN BE MORE VIGOROUS \* FORMATION, THUS MORE HOT YOUNG BLUE STARS)  $\propto$  HIGHER STAR FORMATION

ELLIPTICALS: NO COOL GAS, NO STAR FORMATION NOW

BACK FAR ENOUGH IN TIME, WE SHOULD SEE THE ERA OF STAR FORMATION

- BLUER (YOUNG STARS)
- MORE GAS INCLUDING COOL GAS (WHAT STARS ARE BEING MADE FROM)
- HIGHER SFR (OBVIOUSLY)