HW4 Smantha Chang-Chun Chen

1. Star light

IMF of M82 is ~ 2.3 (Smith et al. 2001)
$M=10^3$ M_sun
Metallicity Z = 2 *Z_sun (Amazing light, Raymmd, Y.C.)

I choose figure 5 based on the information above.

formula:
$L_\nu = L_\lambda \lambda^2/c$
L_sun ~10^{26} Watt

Stellar emissions dominate from 0.1μm to 10 μm.

2. Dust emission

I choose SiC 21 with gain size 10^{-3} μm to fit data.

$P_{dust} = 3 * \pi * B * Q / a * V$
Plank function: $B(T) = 2\ h\nu/ e^{(h\nu/T\, kB)- 1}$

Dust emission will be significantly important in range 10~2*10^2 μm.

3. Synchrotron radiation

First of all, I roughly determine the power law slope p as 2.28 from the observation data.

$P_{syn} \propto B\sin\alpha * \Gamma(p/4 + 19/12) * \Gamma(p/4-1/12) * m_e^{(-p/2-1/2)} * q^{(5/2+p/2)} * (c^{-p/2-3/2}) * (\lambda * B\sin\alpha)^{(p-1)/2}$

I used this equation to define the shape of synchrotron emission. And then I changed Bsinθ and C (two arbitrary constants) to make the emission as close to the curve of observation as possible.

Synchrotron emissions dominate starting from 2*10^3 μm lower energy band with wave length ~10^5.

4. Free-free emission

From a reference I got a temperature of dust T_{dust} ~45K (The Interstellar medium in Galaxy. Harley A Thronson).

temperature = 45K
$P_{ff} = G * e^{-h\nu/k_B T}$
G: arbitrary constant used to fit the data.

Free-free emission will become important between wavelength 3*10^2 ~2*10^3 μm.

5. References

Smith, L. J., Gallagher, J. S., 2001, MNRAS, 326, 1027
The Interstellar medium in Galaxy, Harley A Thronson
Amazing light, Raymmd, Y.C.