Astronomy 401

Stars

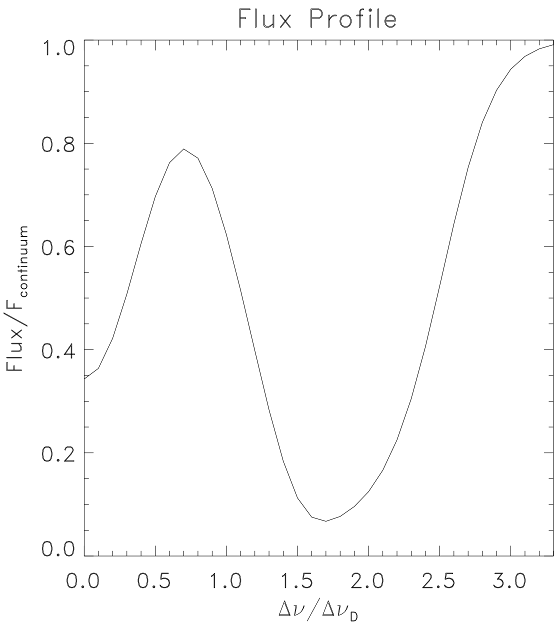
Homework # 9, Due Thursday, December 6, 2001

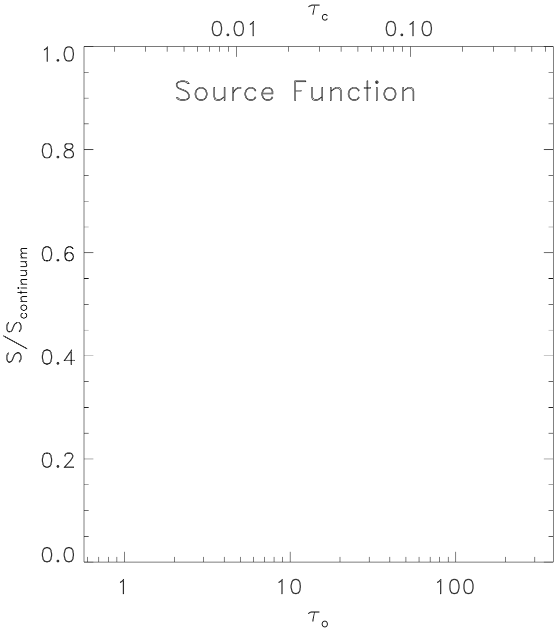
Name: ______________________

Student number: ________________

SHOW ALL YOUR WORK!

1. Determine the approximate central temperature of a star in terms of its mass and radius using the equations of stellar structure. Make the approximations necessary to to obtain an analytic solution. Apply this formula to determine the central temperature of the Sun.
2. Carroll & Ostlie: problem 9.12
3. Use the Eddington-Barbier relations to sketch the optical depth dependence of the source function (in the blank graph on the right) that produces the line profile shown in the graph on the left. Here $\Delta\nu$ is the frequency offset from the center of the line, $\Delta\nu_D$ is the Doppler width of the line, τ_o is the line center optical depth and τ_c is the continuum optical depth. Note: the absorption coefficient in a line decreases approximately as a Gaussian with increasing offset from the line center frequency.
4. Carroll & Ostlie: problem 9.22
5. Derive the formula for the pressure of a gas of non-relativistic particles.
6. Discuss how SN1987A has confirmed as well as modified our theories about supernova explosions. What was confirmed? What was unexpected?


Flux Profile
Flux/$F_{continuum}$
$\Delta\nu/\Delta\nu_D$
0.0
0.2
0.4
0.6
0.8
1.0
0.5
1.5
2.0
2.5
3.0


τ_c
0.01
0.10
Source Function
S/$S_{continuum}$
τ_o
1
10
100