Answers to problem set 10
FYS4130 at UiO, Spring 2012

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10.1

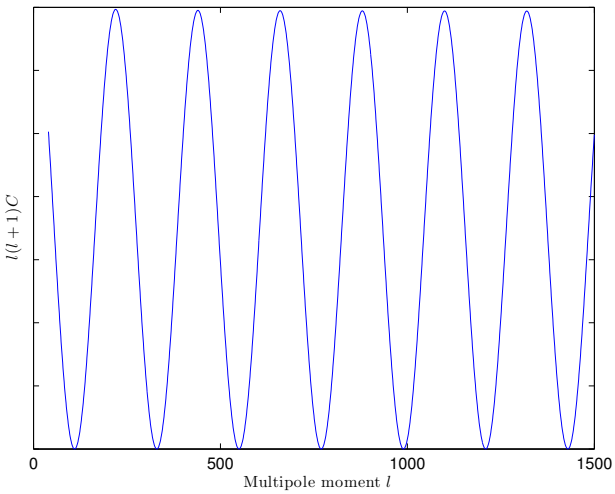
a)

$$\hat{\Theta} = \Theta_0 \cos\left(\sqrt{\frac{c^2k^2}{3(1+R)}}\, t\right)$$

$$\hat{C}(\mathbf{k}, t) = \frac{A}{k^2}\cos^2\left(\sqrt{\frac{c^2k^2}{3(1+R)}}\, t\right)$$

$$L = 74 \text{ Mlyr} = 6.98 \cdot 10^{25} \text{ cm}$$

b) Very nearly a single harmonic frequency, whereas Fig. 10.14 in the textbook has much more structure. The period in l matches fairly well.



10.4

a)

$$M = \frac{g\mu_B}{2}\tanh\left(\frac{g\mu_B H}{2}\beta\right)$$

$$\chi_0 \approx \frac{(g\mu_B)^2}{4}\beta$$

b)

$$C(-t) = C(t) \Rightarrow C(t) = \frac{(g\mu_B)^2}{4} e^{-\Gamma|t|}$$
$$\tilde{C}(\omega) = \frac{(g\mu_B)^2}{2} \frac{\Gamma}{\Gamma^2 + \omega^2}$$

c)

$$\chi(t) = \begin{cases} \beta \frac{(g\mu_B)^2}{4} \Gamma e^{-\Gamma t} & , t > 0 \\ 0 & , t < 0 \end{cases}$$
$$\tilde{\chi}(\omega) = \beta \frac{(g\mu_B)^2 \Gamma}{4} \frac{\Gamma + i\omega}{\Gamma^2 + \omega^2}$$

d)

$$p(\omega) = \frac{\beta (g\mu_B)^2 \Gamma \omega^2 H_0^2}{8(\Gamma^2 + \omega^2)}$$