Physics 129C, Spring 2002

Problem Set 5

Date assigned: May 2 **Due on May 9 at 1:00pm**

Announcement: There will be no class meeting on May 30.

Bring the homework to 422 Downs, attn: Takuya Okuda and Xinkai Wu.

[1] As explained in the lecture, there are 3 irreducible representations for C_{3v}. Verify the orthogonality of the representations,

$$\sum_{g\in G} D^{(\alpha)*}_{ij}(g) D^{(\beta)}_{kl}(g) = \frac{r}{d_\alpha}\delta_{ik}\delta_{jl}\delta_{\alpha\beta},$$

and the orthogonalities of the characters,

$$\sum_{\alpha} \chi^{(\alpha)}(C_i)\chi^{(\alpha)}(C_j) = \frac{r}{r_i}\delta_{ij},$$

$$\sum_{i=1}^{n_c} r_i \chi^{(\alpha)*}(C_i)\chi^{(\beta)}(C_j) = r\delta_{\alpha\beta},$$

for this group.

[2] Find all irreducible representations of C_{4v}, the congruent group of a square. Show the character table for each representation.

[3] Four masses m are connected by six springs of spring constant k in such a way that the equilibrium positions of the masses are at the corners of a regular tetrahedron. Find the frequencies of all the normal modes.