课程名（Coursename）
Symmetry and Perturbation Theory

课程代码（Coursenumber）
B7

课程对象（Audience）
Undergraduate

开课教师（Teacher）
Prof. M. Sprik and Dr A. Alavi

学期（Semester）
M 6–8 & L 1–3

课程描述（Description））
Perturbation theory is an important technique in quantum chemistry. Although few systems can be solved exactly, we can study the effects of a small change to the Hamiltonian of a system, and using this technique we can predict, for example, how a molecule responds to an applied electric field or to the presence of a neighbouring molecule. The method provides a framework for understanding anharmonic effects in vibrational spectra, intensities in spectra generally, and many other phenomena. The methods by which symmetry can be used to simplify calculations have been introduced in earlier courses. Here we shall examine some of the theory that underlies these methods, and extend it to further applications.

Prof. M. Sprik
1–6 Nondegenerate perturbation theory. The first order wavefunction. Polarisability of the hydrogen atom. Rayleigh-Schrödinger perturbation theory. Variation perturbation theory. Degenerate perturbation theory e.g. the H atom in an electric field. Molecular vibrations. Anharmonic vibrations. Fermi resonance for CO2. Time dependent perturbation theory. Transition probabilities. Frequency dependent polarisabilities. Dispersion forces.
Dr A. Alavi
7–12 Introduction and basic ideas. Representations. What is a representation? Equivalent representations. Characters and classes. The Great Orthogonality Theorem. The symmetric representation. Symmetry and physical properties of molecules. The projection formula. Spherical harmonics and the full rotation group. Direct product representations. Calculation of integrals. The symmetrized and antisymmetrized square. The Jahn Teller theorem. Choosing
12 Lecture Course Synopses
the symmetry group. What symmetries can be ignored? Approximate symmetries. Selection rules. Rotational spectroscopy. Vibration–rotation spectroscopy. Electronic spectroscopy.

课时信息（Totalhours）

教参信息（Textbookinfo）
1 Symmetry And Perturbation Theory: Proceedings Of The International Conference SPT 2004 Cala Genone, Italy, 30 May – 6 June 2004 by Giuseppe Gaeta, Barbara Prinari, Stefan Rauch-Wojciechowski, and Susanna Terracini (Hardcover - Mar. 30, 2005)
ISBN-13: 978-9812561367
世界各地拥有馆藏的图书馆（OCLC）:45
2 Fundamentals of the Physics of Solids: Volume 3 - Normal, Broken-Symmetry, and Correlated Systems by J. Sólyom (Hardcover - Oct. 28, 2010)
ISBN-13: 978-3642045172
世界各地拥有馆藏的图书馆（OCLC）:3
3 SCADRON70: Workshop on Scalar Mesons and Related Topics Honoring Michael Scadron's 70th Birthday (AIP Conference Proceedings / High Energy Physics) by G. Rupp, Eef van Beveren, Pedro Bicudo, and Brigitte Hiller (Hardcover - July 22, 2008)
ISBN-13: 978-0735405547
世界各地拥有馆藏的图书馆（OCLC）:46
4 Perturbative and Nonperturbative Aspects of Quantum Field Theory: Proceedings of the 35. Internationale Universitätswochen für Kern- und Teilchenphysik, ... March 2-9, 1996 (Lecture Notes in Physics) by H. Latal and W. Schweiger (Hardcover - Mar. 21, 1997)
ISBN-13: 978-3540624783
5 Quantum Physics by Florian Scheck (Hardcover - May 3, 2007)
ISBN-13: 978-3540256458
世界各地拥有馆藏的图书馆（OCLC）:181
6 Local and Semi-Local Bifurcations in Hamiltonian Dynamical Systems: Results and Examples (Lecture Notes in Mathematics) by Heinz Hanssmann (Paperback - Nov. 14, 2006)
ISBN-13: 978-3540388944
世界各地拥有馆藏的图书馆（OCLC）:203
7 Bifurcations in Hamiltonian Systems: Computing Singularities by Gröbner Bases (Lecture Notes in Mathematics) by Henk Broer, Igor Hoveijn, Gerton Lunter, and Gert Vegter (Paperback - Apr. 28, 2003)
ISBN-13: 978-3540004035
世界各地拥有馆藏的图书馆（OCLC）:221
8 Quantum Fields on a Lattice (Cambridge Monographs on Mathematical Physics) by Istvan Montvay and Gernot Münster (Paperback - Mar. 13, 1997)
ISBN-13: 978-0521599177
9 50 Years Of Yang-mills Theory by Gerardus t Hooft (Hardcover - Feb. 28, 2005)
ISBN-13: 978-9812389343
世界各地拥有馆藏的图书馆（OCLC）:203
10 The Field Theoretic Renormalization Group in Critical Behavior Theory and Stochastic Dynamics by A. N. Vasilev (Hardcover - Apr. 23, 2004)
ISBN-13: 978-0415310024
世界各地拥有馆藏的图书馆（OCLC）:129