Syllabus for Physics 239
Group Theory (II)

Spring 2018-2019, Physics Department, UCSD

INSTRUCTOR: Congjun Wu (5430 MH)

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Time/Place: TuTh 9:30am - 10:50am, 5623

Instructor Office hour: Thursday 1:30pm-2:30pm

Text Books:

1. Howard Georgi *Lie Algebras In Particle Physics: from Isospin To Unified Theories*, Westview Press; 1 edition (October 24, 1999).

2. P. Ramond, *Group theory, A Physicist's Survey, Cambridge University Press 2010.*

Class Schedule

1. SU(2) group and Elements of Lie group

   Lecture 1: Representation of the rotation group – the D-matrix

   Lecture 2: Lie's theorems I, II, III

   Lecture 3: Monopole harmonics

2. Permutation group

   Lecture 4: General properties of permutation group

   Lecture 5: Young pattern and Young tableau, representations of permutation group

3. SU(3) and SU(N) groups

   Lecture 6: SU(3) algebra, α, ω, α' basis

   Lecture 7: The triplet representation, Chevalley basis Lecture 8: Application in Physics – harmonic oscillator, Elliott model, Sakata model, and 8-fold way Lecture 9: Representation of the SU(N) group

4. Compact Lie algebra

   Lecture 10: Roots, Cartan sub-algebra

   Lecture 11: Dynkin diagrams – classification of compact simple Lie algebra

   Lecture 12: Representations of compact simple Lie algebra

5. More on Lie groups

   Lecture 13: SO(2N), SO(2N+1), Γ-matrices

   Lecture 14: Sp(2N)

   Lecture 15: Application in spin $\frac{3}{2}$ systems – Sp(4), SU(4), SO(5), SO(7), SO(8)

6. Other topics

   Lecture 16: Time-reversal and magnetic group

   Lecture 17: Space-time group and space-time crystal

   Lecture 18: Magnetic translation, projective representation

   Lecture 19: Braid group