

應用力學研究所新課程：AM 7026

名稱：微奈米電動力學

Micro- and nano-electromechanics

教師：李雨

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上課時間：13:20 – 15:10 Tuesday, 14:20 – 15:10 Thursday

上課地點：Room 231, 應用力學館

課程描述：

The goal of this course is to provide an introductory, yet detailed, discussion on the theory and experiment of electromechanics at micro- and nano-scales, with application to engineering and biology. Mechanics of a single particle is first discussed, followed by the mechanics of a medium suspended with particles. Topics to be discussed include: electrophoresis, dielectrophoresis, electrorotation, travelling wave dielectrophoresis, electric double layers, electro-osmosis, electro-thermal effect, the Nernst-Poisson-Navier theory of the flow of electrolytes, and a brief introduction to electro-rheological fluid flow. Other forces affecting the electrical manipulation of micro- and nano-particles will also be addressed.

內容：

- (1) Movement from electricity (2 hours)
- (2) A brief review on electrostatics (2 hours)
- (3) Electrophoresis (1 hours)
- (4) Dielectrophoresis (7 hours)
- (5) Electrorotation (4 hours)
- (6) Travelling wave dielectrophoresis (3 hours)
- (7) Colloids and surfaces (6 hours)
- (8) Electroosmosis (1 hour)
- (9) The Nernst-Poisson-Navier theory (2 hours)
- (10) Electrothermal effect (1 hour)
- (11) Electro-rheological fluid (2 hours)
- (12) Electromanipulation of particles (6 hours)
- (13) Nanoengineering (3 hours)
- (14) Electrode structures (6 hours)
- (15) Selected topics (2 hours)

參考文獻：

- (1) Michael P. Hughes, *Nanoelectromechanics in engineering and biology*, CRC Press, 2003 (an electronic book in NTU library).

- (2) Thomas B. Jones, *Electromechanics of particles*, 2nd edition, Cambridge University Press, 1995 (an electronic book in NTU library).
- (3) Jacob N. Israelachvili, *Intermolecular and surface forces*, Academic Press, 1992.
- (4) Robert J. Hunter, *Zeta potential in colloid science – principles and applications*, Academic Press, 1981.
- (5) U. Zimmermann and G. A. Neil, *Electromanipulation of cells*, CRC press, 1996.
- (6) Selected papers from referred journals (to be announced).

The course outline and lecture notes can be download from <ftp://ftp.iam.ntu.edu.tw> under the directory “微奈米電動力學”, with user name: electro, and password: mned1234.

評分標準：Homework and class performance 50%,
Report (written and oral presentation) 50%