



香港城市大學
City University of Hong Kong

Designing and Printing 3D Objects to Facilitate the Teaching of Complex Structures in Soft Matter Physics

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Principal Investigator: Dr. Liang DAI

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Abstract:

This project aims to design and print 3D objects to help students understand various complex structures in soft matter physics (PHY3116), including DNA structures, RNA structures, liquid crystal, lipid bilayers, surfactant micelles, vesicles and others. These structures play essential roles in soft matter physics and biophysics. Viewing 2D or 3D images might help students obtain a rough understanding of these structures, but it is not effective for the understanding of the detailed structures, which also play crucial roles in physical interactions and biological processes. During our research in DNA and RNA structures (with recent papers in *Science Advances* and *Physical Review Letters* in 2022), we find that printing 3D structures can dramatically facilitate the understanding of these structures, because human eyes are more used to real 3D objects than 3D images in computers. Inspired by this, we plan to systematically design and produce 3D objects for all relevant structures in the course. In addition, we will provide free 3D printing service to students such that students can upload their structures in our webpage, and we will print 3D objects for them. A preliminary web interface has been constructed (<http://personal.cityu.edu.hk/liangdai/phy3116/>). We already have an advanced stereolithography 3D printer and just need manpower to implement this proposal. We also have a 3D printer cleaner to make sure the resin material is fully cured to keep students safe. In addition to facilitating understanding complex structures, these 3D objects should arouse students' interest in pursuing this course. Furthermore, for students, the skills of understanding complex structures through 3D design and printing can be transferred to other courses, i.e., such as learning complex structures in other fields.