My publications and research background (Topic 1)

Soft condensed matter physics: crystallization, glass and jamming

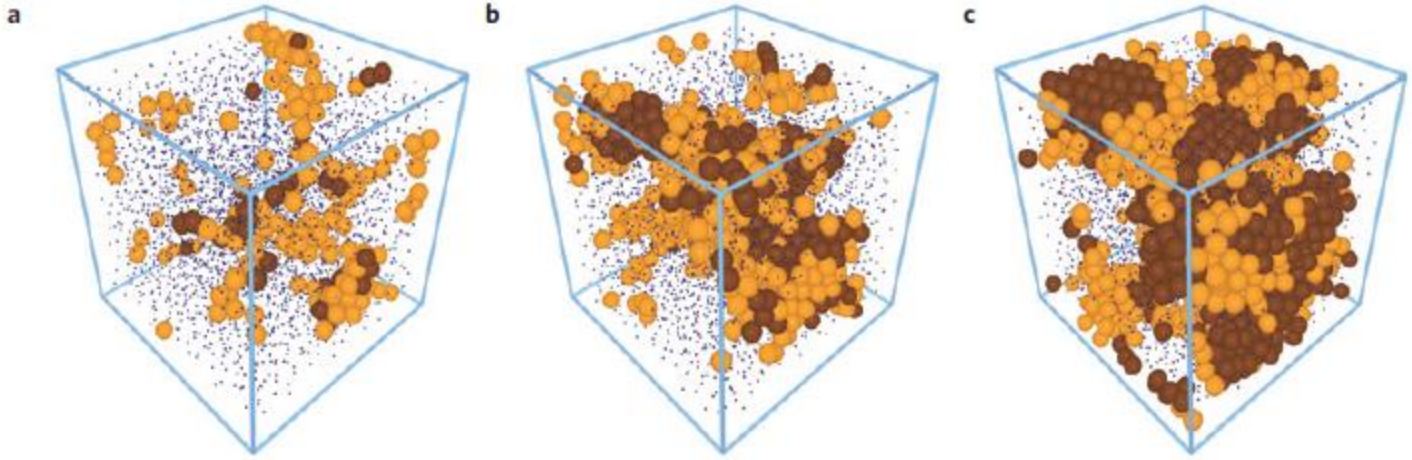


Fig: nucleation and crystallization process during colloidal crystallization observed by using confocal microscopy

Nature Physics 10, 73-79 (2014)

News and Views by Nature Physics 10, 12-13 (2014)

***Phys. Rev. Lett.* 108, 095501 (2012).**

Future research plan on this topic:

Dynamics of phase transitions

1)Isotropic-to-nematic transitions

2)Solid-solid transitions

Methods:

Fast-scanning confocal microscopy

Structure analysis tool

My Publications and research background (Topic 2)

Fluid mechanics in simple and complex fluid: coalescence, splashing of droplets

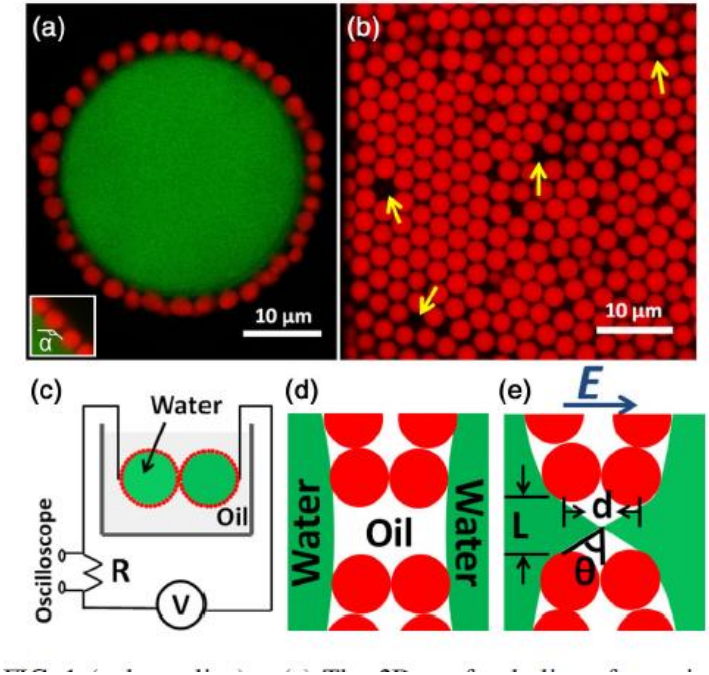


Fig: coalescence of Pickering emulsion droplets under electric field

Phys. Rev. Lett. **110** 064502 (2013).

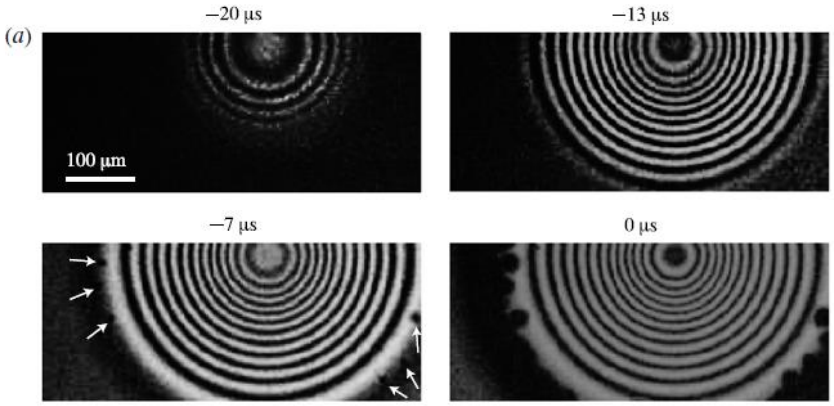


Fig: air entrapment during water droplets splash on smooth solid surface

J. Fluid Mech. **716**, R9 (2013).

Future research plan:

Structures and dynamics at interfaces

1) Ultra-stable liquid-liquid interface

2) Hydrodynamics and electrostatic interactions at interfaces

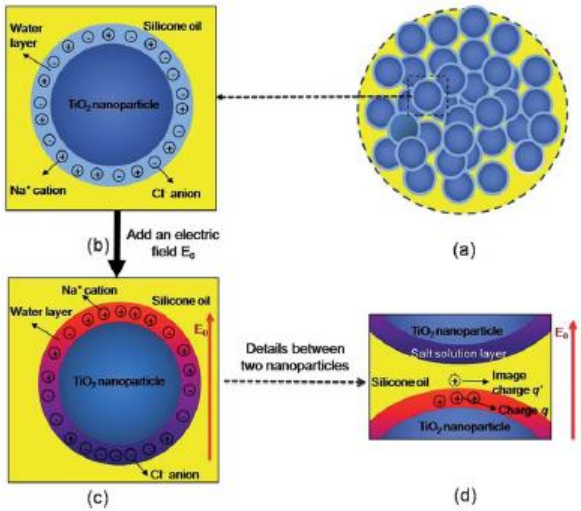
Methods:

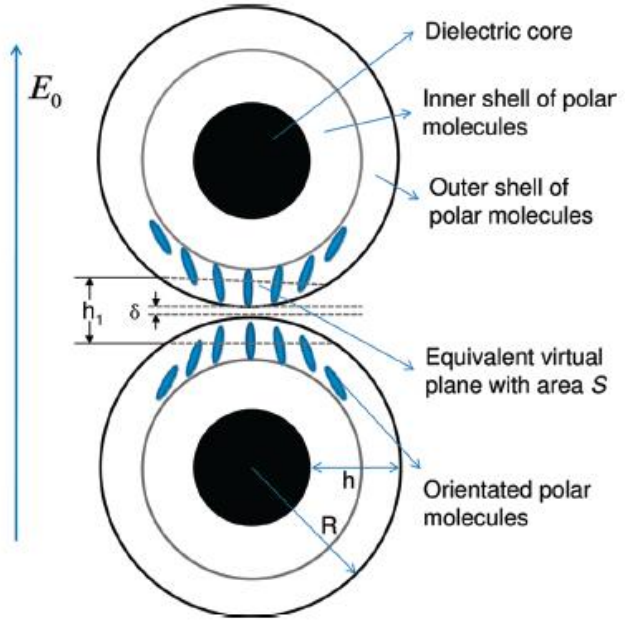
Fast-imaging camera and microscopy

Interfacial hydrodynamics analysis

My publications and research background (Topic 3)

Rheology and electrorheology





Soft Matter **6**, 4800-4806 (2010).

J. Phys. Chem. B ***113***, 9092–9097 (2009).

J. Phys. Chem. B ***113***, 5412–5417 (2009)

Future research plan:

Shear thinning and shear thickening in complex fluid

1) **flow-structure coupling**
2) **interaction-flow coupling**

Methods:

Fast-scanning confocal microscopy

Rheometer

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Education:

2004-2010 Fudan University, Department of Physics, Ph.D. Study.

2000-2004 Shandong University, School of Physics and Microelectronics, Undergraduate Study.

Employment:

2010-2014 The Chinese University of Hong Kong, Department of Physics, Post-doctoral Researcher.

2014- Fudan University, Department of Physics, Associate Professor

Scientific Accomplishments:

2010-2013 Post doc research at The Chinese University of Hong Kong

- Develop a new method for bond order analysis and apply it to illustrate kinetic pathways in colloidal crystallization. Our new analysis reveals multiple-symmetry precursors and nuclei, as well as the transformation pathways among them. It also illustrates the density-symmetry decoupling in the crystallization of soft-potential colloids. Our study clarifies the properties of intermediate nucleation structures and brings new insights to the kinetic pathways of crystal nucleation (Nature Physics, **10**,73-79 (2014). This paper is highlighted in "News and Views" in Nature Physics, **10**,12-23 (2014)).

- Clarify the effect of liquid-bridge stability on the coalescence of Pickering emulsion droplets. By combining high-speed photography and electrical measurement, we revealed two distinct coalescence approaches for Pickering emulsion droplets: a continuously-merging approach and a connecting-then-breaking approach. The two behaviors are determined by the defect size in particle shells. This study demonstrates fundamentally different merging physics in complex systems and enriches the classical research of coalescence (*Phys. Rev. Lett.* **110**, 064502 (2013).).

- Illustrate the origin of quasi-localized low-frequency vibrational modes in amorphous solids. By directly visualizing phonon modes in disordered colloidal systems; we discovered strong coupling between transverse excitations and defective structures. This discovery explains the origin of the quasi-localized low-frequency modes (*Phys. Rev. Lett.* **108,** 095501 (2012).).

2004-2010 PH.D study at the Fudan University.

- Discover the effect of surface ions on yield stress of electrorheological fluid. By confining ions on nanoparticle surfaces, we realized a novel system with a tunable peak in yield stress. We revealed that the competition between polarized ions and transmitted ions produces this peak. This work brings new method for manipulating electro-static interaction between particles (*Soft Matter* **6**,4800-4806, (2010)).

- Explain the giant electrorheological effect with the model of orientational polarization by polar molecules. With finite-element numerical calculations, we proposed a model based on head-tail connection of polar molecules under high electric field. This model satisfactorily explains the giant electrorheological phenomenon experimentally observed (*J. Phys. Chem. B **113**,* 9092–9097, (2009)).

Teaching Experience and Student Supervision:

2010-2013	Guo Chen, Graduated student in Department of Physics, The Chinese University of Hong Kong.
2006	Hongjin Yu, Fourth-year undergraduate student in Physics Department, Fudan University.
2005	Teaching Assistant, Physics Department, Fudan University.

Honors and Awards:

2009	1st rank , Graduated student scholarship, Fudan University.
2008	1st rank , Graduated student scholarship, Fudan University.
2007	2nd rank , Graduated student scholarship, Fudan University.

Publications:

Papers published and accepted:

1. **P.Tan,** N. Xu and L. Xu, "Visualizing kinetic pathways of homogeneous nucleation in colloidal crystallization." Nature Physics **10**, 73-79 (2014).
   This paper is highlighted in "News and Views" in Nature Physics, **10**,12-23 (2014).
2. Q. Jin, **P. Tan**, Andrew B. Schofield and L. Xu, "Eliminating cracking during drying." *Eur. Phys. J. E* **36**, 28 (2013).
3. Y. Liu, **P. Tan** and L. Xu, "Compressible air entrapment in high-speed drop impacts on solid surfaces." *J. Fluid Mech.* **716**, R9 (2013).
4. G. Chen, **P. Tan*,** S. Y. Chen, J. P. Huang, W. J. Wen and L. Xu*(co-corresponding author), "Coalescence of Pickering emulsion droplets induced by an electric field." *Phys. Rev. Lett.* **110**

064502 (2013).

5. **P. Tan**, N.Xu, A. B. Schofield and L. Xu, "Understanding the low-frequency quasilocalized modes in disordered colloidal systems." *Phys. Rev. Lett.* **108,** 095501 (2012).
6. **P. Tan** and L. Xu, "Some typical self-organization phenomena in soft condensed matter physics." *物理(Physics)* **41**(1), 2012.
7. **P. Tan**, J. P. Huang , D. K. Liu, W.J.Tian and L. W. Zhou, "**C**olloidal electrostatic interactions between TiO_2 particles modified by thin salt solution layers." *Soft Matter* **6**, 4800-4806 (2010).
8. **P. Tan**, W. J. Tian, X. F. Wu, J. Y. Huang, L. W. Zhou and J. P. Huang, "Saturated orientational polarization of polar molecules in giant electrorheological fuids." *J. Phys. Chem. B **113**,* 9092–9097 (2009).
9. **P. Tan**, W. J. Tian, J. P. Huang and L. W. Zhou, "On the Lorentz local electric field in soft-matter systems." *J. Phys. Chem. B **113**,* 5412–5417 (2009).

Papers in preparation:

1. **P. Tan** and L. Xu, "Relationship between tetra-hydra networks and nucleation during colloids crystallization."
2. **P. Tan**, L. J. Wang, N. Xu and L. Xu, "Relationship between glassy real dynamics and vibrational spectra in disordered colloidal systems."
3. **P. Tan**, N. Xu and L. Xu, "Connection between low-frequency modes and local structural entropy in disordered colloidal crystal."

Invited Presentations:

1. "Spectra representation of real dynamics in supercooled liquid," University of Science and Technology of China Soft Condensed Matter Seminar, August 10, 2013.
2 . "Imaging precursor-mediated crystallization in colloidal soft repulsive systems," Shanghai Jiao Tong University Soft Condensed Matter Seminar, December 10, 2012.
3. "Understanding the low-frequency quasilocalized mode in disordered colloidal systems," The 8^{th} Soft Matter and Biophysics Meeting of China, August 20, 2012.
4. "Manipulating colloidal electrostatic interactions with confined exogenous ions," The Chinese Physical Society Autumn Meeting, September 17, 2009.

Contributed Presentations:

1. "Visualizing universal pathways of homogeneous nucleation in colloidal crystallization," poster presentation in Barcelona 7th International Discussion Meeting on Relaxations in Complex Systems, June 21, 2013.