Lui Lam's Scholarly Works in Last 30 Years (1987-2017)

Prof. Lui Lam, since joining SJSU in 1987, has done important things in the professions—**from physics to chemistry and to the humanities**—he engaged in with international impacts. In total, Lam has published **186 papers** (113 of them at SJSU, 20 with SJSU student coauthors) and **16 books**. In particular:

1. Bowlic Liquid Crystals

Lam **invented** in 1982 a new type of liquid crystals (LCs) called **Bowlic** (*monomers*)—one of three existing types of LCs in the world (Fig. 1). In 1987, he went on to invent bowlic *polymers*.

- Both bowlic monomers and polymers were synthesized by others, confirming Lam's predictions.
- Today, bowlic is an important topic in LC research with interesting applications including a new type of LC display.
- The word "bowlic" created by Lam is routinely used by others in their papers and is recognized officially by the International Union of Pure and Applied Chemistry (IUPAC) and in *Handbook of Liquid Crystals*.
- In view of its importance, the editor of *Liquid Crystals Today* has invited Lam to write a review on bowlics [1].
- Bowlic is a new type of chemical compound invented by a physicist, as recognized by IUPAC.

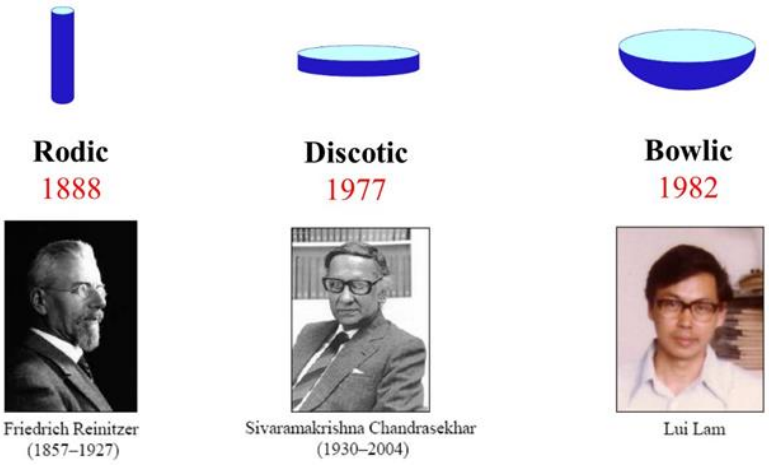

Fig. 1. Three types of liquid crystals in the world. Bowlic, the 3rd type, was invented by Lam.

2. Soliton in Liquid Crystals

Propagating solitons in (shearing) liquid crystals was **pioneered** by Lam in 1982. At SJSU, Lam continued to lead this field, culminating in the book *Solitons in Liquid Crystals* (1992), coedited with Jacques Prost, a top scholar and student of the Nobel laureate Pierre de Gennes (Fig. 2). Out of Lam's 23 soliton papers, 14 were published at SJSU, including a student's master thesis and an invited review in the journal *Chaos Solitons Fractals* (1995).

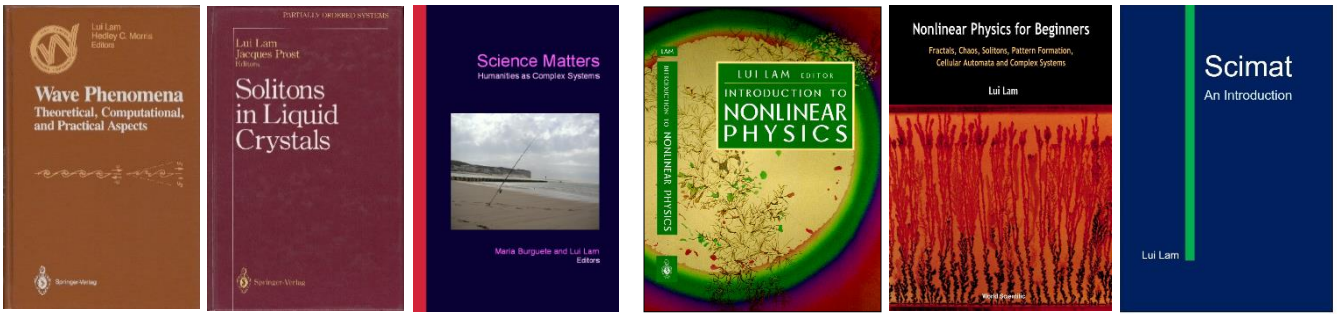

Fig. 2. *Left to right*: Three book series founded and edited by Lam [first book of Woodward Conference (Springer), Partially Ordered Systems (Springer), Science Matters (World Scientific)], and Lam's three textbooks (Springer 1997; World Scientific 1998, 20xx).

3. Pattern Formation

Pattern formation was the first project Lam did with students at SJSU, in experiments and theory. In particular,

- First group in the world to generate and study **surface filamentary patterns** in thin cells containing air, liquid, or liquid crystals.
- Our experimental research on electrodeposit pattern formation has been profiled in *San Jose Mercury News*, Oct. 14, 1990.
- Our experimental pattern formation result was featured in the "San Jose State University, School of Science Brochure, Fall 1990."
- One student project, "Instabilities of finite water columns," **won the Allied-Signal Award** of the Society of Physics Students.
- Our experimental finding was printed on the cover of the book *Fractal and Disorder* (North-Holland, 1992).
- We **discovered multiple morphological changes** in electrodeposit patterns--which was included in a poster by the American Physical Society in the Centenary Celebration, in Atlanta, Georgia, March 1999.
- Ten papers with student authors were published in famous journals *and* SJSU's own book series, **Woodward Conference Series** (established by Lam and colleagues, published by Springer, Fig. 2).

4. Active Walk

The second **invention** by Lam (in 1992) at SJSU is **Active Walk**—a new paradigm for self-organization and pattern formation in simple and complex systems, **developed completely with SJSU students** (see Fig. 3). In an AW, the walker (an agent) changes the deformable landscape as it walks and is influenced by the changed landscape in choosing its next step.

It has been applied successfully to various systems from the natural sciences, social science and the humanities [2]. In particular it was used by the Canadians in modeling oil recovery, a Harvard Medical School Fellow in modeling tumor growth, the Germans in modeling ant swarms and pedestrian traffic, and the Taiwanese in pattern formation. The Germans' work [3] was developed into a subfield in physics, applicable in crowd control that saves lives from rampage. Two **invited reviews** were published, with our results printed on the cover of the journal in color pictures [2].

The impact of AW goes far, which was still being cited 25 years after its initial publication.

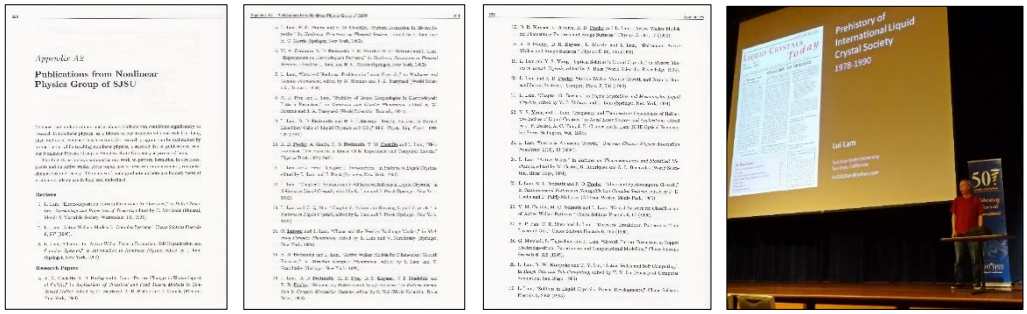

Fig. 3. *Left to right*: List of 31 papers with student coauthors in 18 of them, from *Nonlinear Physics for Beginners* book (1998); Lam's talk on the founding of the International Liquid Crystal Society (ILCS) at Kent, Ohio (2016).

After the invention of Active Walk with successful applications in many complex systems, Lam turned his attention to the most complex system in the universe—**humans**, and ventured into the humanities disciplines.

5. Histophysics

Histophysics is the new discipline **initiated** by Lam in 2002 that uses physics methods to study history. It shows human history to be a science, too, confirming the historian Robin Collingwood (1889-1943). Different scientific approaches/techniques to do history, apart from the usual narrative approach, are introduced with examples. Among other things, Lam discovered the second *quantitative* law in history and the first one with *predictive power* as well as a general phenomenon in complex systems called **Bilinear Effect** [4].

6. Arts

People's understanding of what art is (often associated with aesthetics) crumbled in 1917 with the appearance of Marcel Duchamp's *Fountain*. The art question was thus an unsolved problem for 2,400 years since Plato. In 2011, Lam proposed a **new interpretation** of the **origin and nature of arts** which is most reasonable [5].

7. Created a new multidiscipline (Scimat) and cofounded the Scimat Program —an international movement for bettering humanity

In 2007/2008, Lam created a new multidiscipline called **Scimat** (Science Matters) that deals with the science of humans. It aims to raise the scientific level of the humanities by encouraging interaction between humanists and scientists. Lam is the cofounder and coordinator of the International Science Matters Committee (with Nobel laureate) since 2007. The **Scimat Program** has also established a biennial international scimat conference series and *three* scimat book series (see: www.sjsu.edu/people/lui.lam/scimat). It is in the process of pushing a new general-education course *Humanities, Science, Scimat* (Fig. 2) for all undergrads in all universities (already test taught twice in China), and setting up 100 scimat centers around the world. All for a better world. (See 2017 conference poster "Bettering Humanity" at www.scimat-2015.com.) Apart from Bowlic, Active Walk and the ILCS, the Scimat movement could be Lam's most important contribution to the academic world (and humanity) for years to come.

8. Science Education

Lam's contribution to the development of science education at SJSU includes:

- **Established and taught two new graduate courses**: Nonlinear Physics, and Nonlinear Systems; a new upper-division course: The Real World (1997); and a **new general-education course** for incoming freshmen of any major: The Real World (2002).
- Published two **textbooks** on nonlinear physics—*Nonlinear Physics for Beginners* for undergraduates and *Introduction to Nonlinear Physics* for graduate students (Fig. 2). The latter is called "probably the best introductory textbook on nonlinear science I have recently seen," in a review appeared in *Pure and Applied Geophysics*.
- **Established a public lecture series, God, Science, Scientists**, Dec. 1999. (Charles Townes, Nobel Laureate and inventor of laser, was the third speaker on Feb. 12, 2001.)
- Volunteered and encouraged students to volunteer as tutors at the brand new high school in downtown San Jose, Downtown College Preparatory, 2000.
- Established a public lecture series, **Science and Art**, May 2001.
- Considered by the **Foundation For the Future** at Bellevue, WA, to be one of "the world's most prominent thinkers"; invited to their "Humanity 3000" seminar, August 2001, to give a keynote lecture on "Modeling History and Predicting the Future: The Active Walk Approach"; was the only physicist invited among 23 world experts, including Harvard's Edward O. Wilson and Oxford's Richard Dawkins.
- Invited by SETI (Search for Extraterrestrial Intelligence) to give a talk on "A Science-and-Art Interstellar Message: The Self-Similar Sierpinski Gasket" at the workshop in Paris, March 18, 2002.

In short, Lam's contribution to research and his impact among peers worldwide are reflected by the following:

- Invented bowlic liquid crystals, active walks, and histophysics; contributed to art studies
- Established 4 conference series (3 local ones at SJSU and 1 international)
- Helped organized numerous international conferences
- Served as editor in *all* liquid crystal journals
- Established 3 book series (Fig. 2).
- Published 3 textbooks (after created and taught two new nonlinear physics courses, Fig. 2).
- Founded the International Liquid Crystal Society [6] (Fig. 3).
- Invented a new multidiscipline (scimat) and cofounded an international movement in bettering humanity

Through these efforts, Lam has helped to put SJSU and CSU on the world map, academically speaking.

References: [1] L. Wang, D. Huang, L. Lam and Z. Cheng, "**Bowlics**: History, advances and applications," *Liquid Crystals Today* **26**(4), 85 (2017). [2] L. Lam, "**Active Walks**: First twelve years," *Int. J. Bifurcations and Chaos* **15**, 2317 (2005); **16**, 239, (2006). [3] D. Helbing et al, "Modelling the evolution of human trail systems," *Nature* **388**, 47 (1997); "**Active walker model** for the formation of human and animal trail systems," *Phys. Rev. E* **56**, 2527 (1997). [4] L. Lam et al, "**Bilinear Effect** in Complex Systems," *Europhysics Letters* **91**, 68004 (2010). [5] L. Lam, "**Arts**: A Science Matter," in *Arts*, eds. M Burguete and L. Lam (World Scientific, 2011). [6] L. Lam, "Prehistory of the **International Liquid Crystal Society**: A personal account," *Molecular Crystals and Liquid Crystals* **647**, 351 (2017).