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NOTETAKER CHECKLIST FORM

(Complete one for each talk.)

Name: Malgorzata Marciniak **Email/Phone:** mmarciniak@lagcc.cuny.edu 5734620411

Speaker's Name: Myfanwy Evans

Talk Title: Periodic Tangling of FIlaments

Date: 10 /01 /2018 **Time:** 11 :00 ~~am~~ / pm (circle one)

Please summarize the lecture in 5 or fewer sentences:
Microstructure created of thin long tangles tight to each other creates unusual mechanical properties of the materials. Description of those structures can be complicated. This talk gives a constructive approach for creating tangled filaments in a periodic box. Example of keratin filaments in human skin cells.

CHECK LIST

(This is **NOT** optional, we will **not pay** for **incomplete** forms)

- ☑ Introduce yourself to the speaker prior to the talk. Tell them that you will be the note taker, and that you will need to make copies of their notes and materials, if any.
- ☑ Obtain ALL presentation materials from speaker. This can be done before the talk is to begin or after the talk; please make arrangements with the speaker as to when you can do this. You may scan and send materials as a .pdf to yourself using the scanner on the 3rd floor.
  - **Computer Presentations**: Obtain a copy of their presentation
  - **Overhead**: Obtain a copy or use the originals and scan them
  - **Blackboard**: Take blackboard notes in black or blue **PEN**. We will **NOT** accept notes in pencil or in colored ink other than black or blue.
  - **Handouts**: Obtain copies of and scan all handouts
- ☑ For each talk, all materials must be saved in a single .pdf and named according to the naming convention on the "Materials Received" check list. To do this, compile all materials for a specific talk into one stack with this completed sheet on top and insert face up into the tray on the top of the scanner. Proceed to scan and email the file to yourself. Do this for the materials from each talk.
- ☑ When you have emailed all files to yourself, please save and re-name each file according to the naming convention listed below the talk title on the "Materials Received" check list. (*YYYY.MM.DD.TIME.SpeakerLastName*)
- ☑ Email the re-named files to notes@msri.org with the workshop name and your name in the subject line.

Speaker: Myfanwy Evans

Title: Periodic tangling of filaments

Note Taker: Malgorzata Marciniak

Overview:

1. Tangling will be built from non-intersecting lines on two dimensional surfaces. At fist compact, then periodic and later with increasing the genus.
2. Touch base on triply periodic minimal surfaces
3. Three physical settings:
   A) terpolymer self-assembly,
   B) corneocyte cells in skin and solvation free energy,
   C) Auxetic tensegrities from periodic weavings.

Motivations for exploring tangling: protein folding, polymeric materials, DNA tangling, tangled molecules, entangled defect lines in liquid crystals.

Torus knots: (https://en.wikipedia.org/wiki/Torus_knot) ordered by crossing numbers, structures and examples

What about knots on higher genus tori? Characterization with "railway tracks and switches," examples when the knots have multiple components

Taxonomy of possible structures with changes in twists and changes in track numbers, with different number of components, twist disparities (and different genus of the torus).

Examples of architectures from graphs of cyclomatic number 3 (https://en.wikipedia.org/wiki/Circuit_rank)

The table of existing knot tables was reconstructed from the taxonomy.

Note: highly tangled structures are often un-knots.

Periodic Tangling:

-Example of tubular hexagonal surface with two different loops

-Example of a 3-periodic tangling: 2-tubified network that are 3-periodic that have a quotient graph of the rectangular torus and trigonal torus.

-Example of a simple rod packing

- Example of a beta manganese rod packing

- Sigma plus rod packing

Symmetric Tangles on surfaces EPINET (epinet.anu.edu.au)

We have the theoretical framework to completely enumerate three periodic tangles.

Line Packings 3D weavings form 2D line packing. The simplest line packing build rod packings, well known in structural chemistry and the study of material organic frameworks. Examples of beta manganese rod packing and sigma plus rod packing again.

1. **Terpolymer self-assembly** different pitch helix to obtain packings of trees.
2. **Corneocyte microstructure** the swelling of skin cells and wrinkling is a phenomena where exposure to water cells increasing to many time their original size. The unique swelling property of the structure allows us to infer via theoretical modeling the geometry of the filament arrangement.

   Morphometric approach to solvation free energy : Hadwiger's Characterization Theorem

   $$F_{vol} = pV + \sigma A + \kappa C + \bar{\kappa} X$$

   (Geometric morphometrics is an approach that studies shape using Cartesian landmark and semilandmark coordinates that are capable of capturing morphologically distinct shape variables. Geometric morphometrics is part of a larger subfield in anthropology, which has more recently been named virtual anthropology)
3. **Auxetic tensegrities from woven structures** mechanism of skin structure, constructing a network, elastic connector and rigid bars.

Upcoming book "The Structure of Tangling" with Stephen Hyde, 2019, Oxford University Press