"Active Topology" by Cristina Marchetti (UCSB)

**Date:** Thursday, November 7, 2019 - 4:00pm  
**Series:** Physics and Astronomy Colloquium

Thursdays, 4:00-5:00 pm

1-434 Physics and Astronomy  
Reception from 3:15-3:30 p.m. (unless otherwise posted)

Guest Speaker: Cristina Marchetti (UCSB)

**Talk Title:** “Active Topology”

Abstract: In two-dimensional systems, such as thin films of superfluids, crystals, liquid crystals and magnets, topological defects are key to understanding the transition between ordered and disordered states. Almost fifty years ago, Berezinskii, Kosterlitz and Thouless showed that these systems disorder through a topological phase transition associated with the proliferation of unbound pairs of vortices of opposite charge. The essence of this transition relies on the mapping of the statistical physics of defects onto a Coulomb gas. In active liquid crystals, topological defects become motile particles and drive the transition from spontaneous laminar flow to self-sustained turbulent-like motion. In this talk I will outline the statistical physics of defects in active nematics and their possible role in materials science and biology. By viewing the active nematic as a collection of swarming and interacting active defects, the onset of active turbulence can be described as an activity-driven defect unbinding transition. A hydrodynamic theory of a gas of unbound defects captures a new state of hierarchically organized active matter - a defect flock where defects themselves line up and order into a collectively flowing liquid. The hydrodynamic treatment of active defects provides a framework to address fundamental questions of defect organization in active matter and paves the way for the design of active devices with targeted transport functionalities through the controlled variation of activity.

**For more information, contact** Yaroslav Tserkovnyak

We thank the following people for their contributions to the wine fund for the post-colloquium reception:  
Professors Katsushi Arisaka, Andrea Ghez, Karoly Holczer, Huan Huang, HongWen Jiang, Per Kraus, Alexander Kusenko, Matthew Malkan, Mayank Mehta, Warren Mori, Ni Ni, Seth Putterman, Yaroslav Tserkovnyak, Vladimir Vassiliev, Shenshen Wang, and Nathan Whitehorn.

**Location:**  
1-434 PAB