PHYSICS
COLORADO STATE UNIVERSITY

CSU PHYSICS COLLOQUIUM

Looking at life through randomness

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Abstract

One-third of the talk: We repeat experiments to average out Gaussian distributed randomness; exception of which can create challenge. As an example, I will discuss how to estimate microscope drift in such cases. I will then introduce Poisson process, a process that has constant probability of occurring in each spatial or temporal step. Many natural processes including radioactive decay, photons from a laser, biomolecular interactions, chocolate chips in cookies, cell distribution in *in vitro* tissue model, and so on can be either described or approximated as a single or a chain of Poisson processes. With some examples, I will show how students have taken part in research-integrated teaching where they apply the concepts of randomness taught in class to their own research interests. Poisson process approach have also been used to understand the random interactions between matrix metalloproteases and collagen fibrils, which will be presented during the rest of the talk.

Two-third of the talk: Collagen, the most abundant protein in the human body, forms networks of fibrils and plays an important role in maintaining tissue and organ integrity. Highly resistant to proteolysis, fibrillar collagen is degraded by specific matrix metalloproteases (MMPs) secreted by cells. This degradation of fibrillar collagen underlies processes including tissue remodeling, wound healing, and cancer metastasis. However, the mechanism of collagen fibril degradation remains poorly understood because of its insolubility in water and extended form. We will discuss how tracking and analyzing the random diffusive motion of labeled MMPs on native collagen fibrils at the single-molecule level can be used for a better understanding of the degradation process.