



Ca' Foscari
University
of Venice
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Heatomics for life

Friday, May 8, 2.30 PM
Conference Room Orio Zanetto, Alfa Building

Heat is essential for life. In living organisms, the generation of mechanical and chemical work to accomplish specific tasks inevitably leads to energy dissipation in the degraded form of heat—the most fundamental signature of life. Despite major progress in processing large biological data sets across all *omics* layers, we still lack a clear understanding of how to measure heat generation at the nanoscale, known as the entropy production rate, σ . I present a recently introduced *variance sum rule* for measuring σ

with attowatt sensitivity ($1 \text{ aW} = 10^{-18} \text{ Watts}$) from the flickering motion of a microscopic probe. We apply it to produce the first heat map of human red blood cells and to derive σ from hidden degrees of freedom in molecular processes. The variance sum rule provides a new resource for energy inference, enabling σ measurements in living and active matter. The science of heatomics aims to uncover the principles governing heat power in living matter.

Event organized by
Prof. **Achille Giacometti** and
Prof. **Guido Caldarelli**