

The Bright Side of Small Icosahedral Virus-like Particles

Bogdan Dragnea

1. Abstract

Small, single-stranded RNA, icosahedral viruses are found in all living kingdoms. Their simple organization and short genomes suggest that these ubiquitous viruses have evolved do more with less. One way to achieve this is to have properties emerging from components coherently working together. Such collective properties encompass mechanical and thermodynamic, but they can reflect upon synthetically added characteristics, such as optical or magnetic, acquired via virus capsid engineering. I will present a sweeping view of studies carried out in our laboratory of the mechanical, thermodynamic, and optical properties of the brome mosaic virus (BMV) and its engineered derivatives. Among the acquired collective properties stands out a quantum optical effect called super-radiance, which occurs, surprisingly, at room temperature. The room-temperature super-radiant behavior is unique so far, and therefore potentially appealing for new nanotechnological applications, including targeted drug delivery, quantum hardware technology, imaging, and photochemistry.