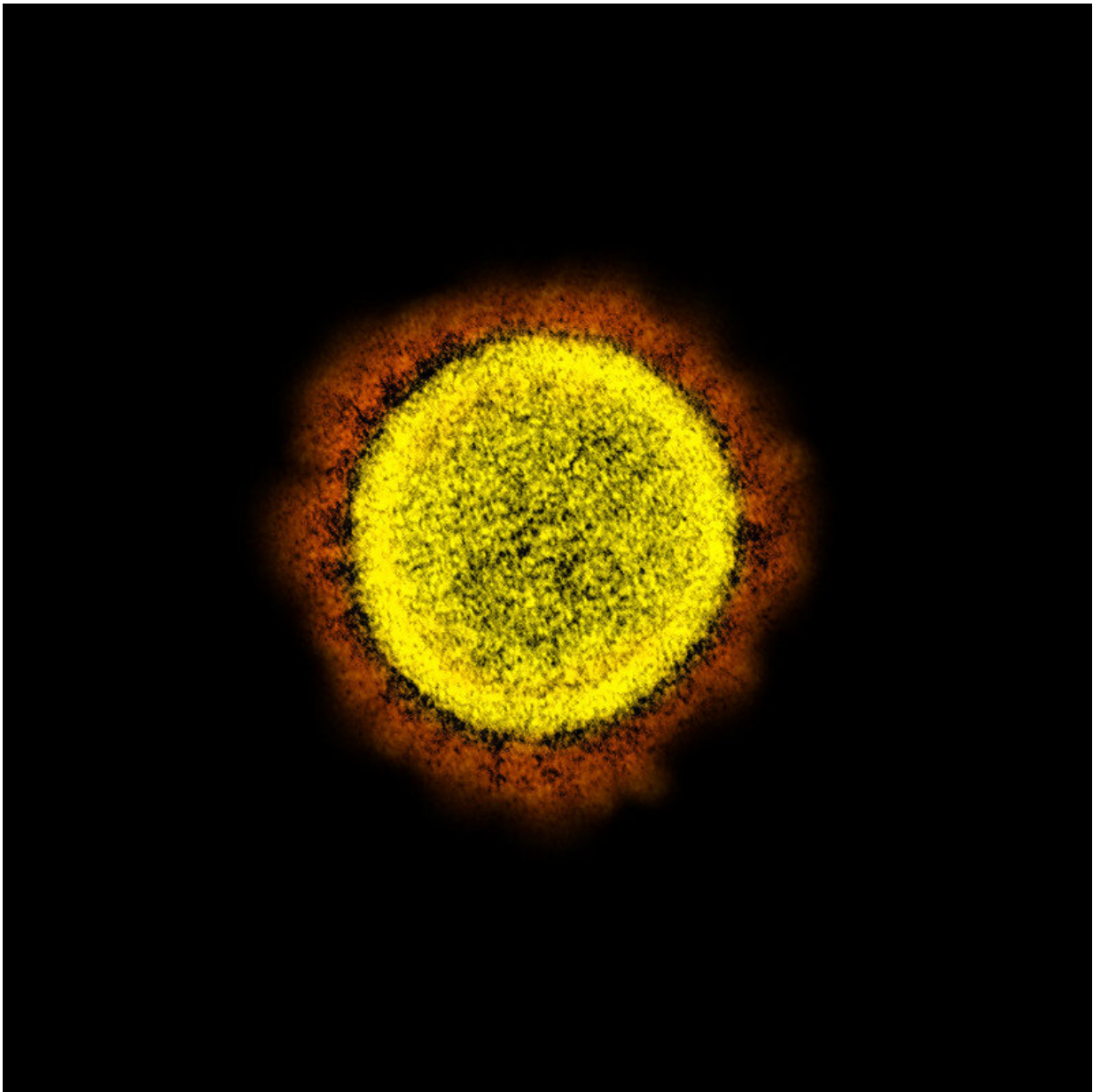


# Global weight of all active SARS-CoV-2 viruses is between 0.1 and 10 kilograms

June 10 2021, by Bob Yirka

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Novel Coronavirus SARS-CoV-2 Transmission electron micrograph of SARS-CoV-2 virus particles, isolated from a patient. Image captured and color-enhanced at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland. Credit: National Institute of Allergy and Infectious Diseases, NIH

A combined team of researchers from the Weizmann Institute of Science in Israel and the California Institute of Technology in the U.S. has calculated the weight of all the SARS-CoV-2 viruses infecting people around the world at any given time. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes how they made their calculations and explain how their work can help to better understand what happens in the human body during viral infections.

The researchers started their effort by noting that a single SARS-CoV-2 virus weighs approximately 1 femtogram. They then used data from studies with Rhesus monkeys that measured the viral load in different body parts during an infection. That data was multiplied by different factors to convert viral loads to humans, who have much larger organs. Their calculations showed that a person with COVID-19 contained approximately 1 to 10 micrograms of virus. They noted that the virus has infected from one to 10 million people during the pandemic at any given time. Simple multiplication showed that the combined weight of all the viruses would come to 0.1 to 10 kilograms. To put the weights in context, they suggest the combined total comes to the weight of a single apple to that of a toddler.

The researchers suggest that calculating the [weight](#) of the virus also provides a leverage perspective, noting that a single atomic bomb might have approximately 100 kg of fissile material, but still is able to create mass destruction.

The researchers also note that calculating such numbers helps to gain a clearer perspective on what happens in the body when viruses such as SARS-CoV-2 infect people. Comparing the number of viruses in any given infection can also give a perspective on how the virus evolves during a single infection. This led them to calculate the likely number of mutations a virus would generate during a single infection by inferring information from prior studies involving similar viruses. Their calculations showed that over the course of a single [infection](#), the SARS-CoV-2 virus would undergo approximately 0.1 mutations in its genome. And since there are four to five days between times of infections, the [virus](#) could theoretically generate three mutations per month, which aligns with what other researchers have found.

**More information:** Ron Sender et al, The total number and mass of SARS-CoV-2 virions, *Proceedings of the National Academy of Sciences* (2021). [DOI: 10.1073/pnas.2024815118](https://doi.org/10.1073/pnas.2024815118)

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