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(U*) Laser-based mask characterization for prophylaxis of Covid-19

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During the Covid-19 pandemic, face masks have become the new norm with their widespread use in public as part of a multi-barrier approach for infection control, including physical distancing, hand hygiene, and altered social behaviour. Masks provide benefits to both the mask wearer and to those in their proximity when they are worn by all individuals in a common area. The gold standard in personal protective equipment (PPE) remains the N95 respirator, made of synthetic materials with electrostatic properties that filter and retain more than 95% of aerosols <1 μm and larger in size. N95 respirators degrade during washing and disinfection, and as such are single use disposable PPE. Similarly, surgical-style masks made of polypropylene and non-woven materials are unsuited to frequent washing/decontamination with heat or detergents. Owing to their disposable nature, most commercially available PPE such as the above are unsustainable for supplying the public due to supply interruptions, high cost over time, and a lack of aesthetic attributes (colour, pattern) to encourage use.

As a result, textile manufacturers and a new cottage industry of homemade mask makers, including volunteers making donated masks for vulnerable populations, can provide fabric face masks to the public. Recently, the U.S. CDC indicated that commercial manufacturers of face masks will require testing although the conditions of such standards have yet to be outlined. Recently, Dr. Tam has made recommendations for mask materials to elevate the quality of masks being worn by the public, however these recommendations are not easily translatable to actual mask construction and such recommendations are based on very limited testing of fabric masks.

This presentation will discuss the development of a test apparatus for assessing mask efficacy by measuring the aerosols transmitted through the masks. We use a laser-based system, using relatively inexpensive diode lasers to illuminate the exhaled particles, a webcam for data acquisition, and Python-based particle tracking software. We make the approximation that the intensity of the scattered light from the droplets is proportional to the size of the droplet, but we will be able to quantify the droplet size by analyzing the data with Mie scattering theory.

Reference:
https://advances.sciencemag.org/content/6/36/eabd3083?te=1&nl=running&emc=edit_ru_20200822

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