Fight Coronavirus with Corona Discharge

Safe Masks & Safe Surfaces for Everyone

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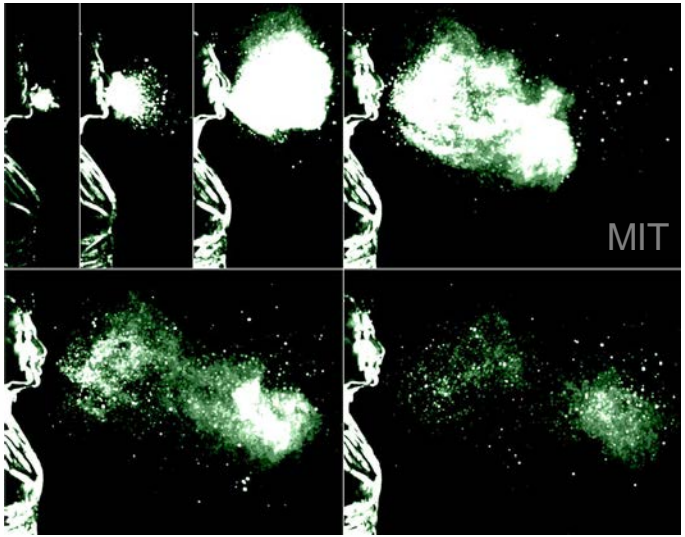
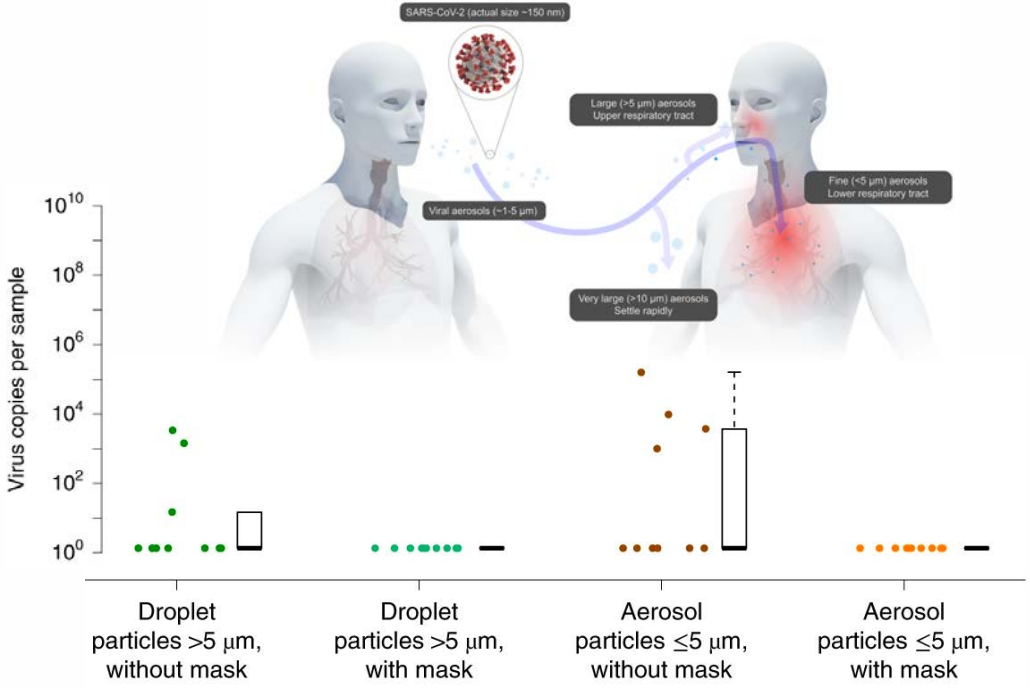
Types of Masks

Property	Cloth mask	Surgical mask	N95 mask	Medical N95 mask
Appearance				
Material	Cotton/Silk/Nylon	Polypropylene fiber	Polypropylene fiber	Polypropylene fiber
Pore size	~100 μm	~10 μm	~5 μm	~5 μm
Filtration	~40%	~80%	~95%	~95%
Vs. Water	Hydrophilic	Hydrophobic	Hydrophobic	Waterproof
Distancing	>6 feet	>3 feet	>1 feet	>1 feet
Suggestion	Wash and dry everyday	For everyone New one everyday	For front line	For Medical care

Why masks work?



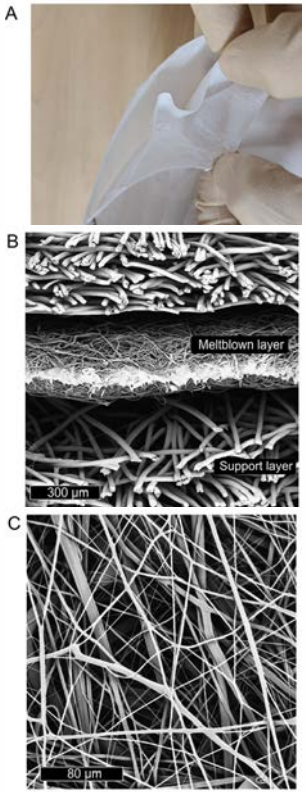


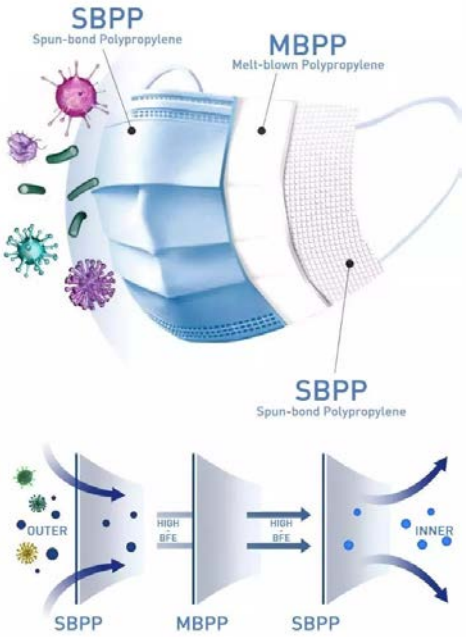
- No mask travel distance: >6 feet
- Patient wear mask: ~20%
- Healthy personnel wear mask: <10%

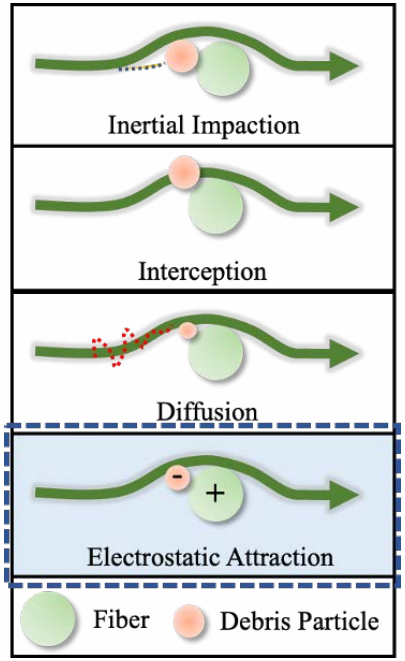
- Coronavirus size: ~150 nm
- Travel in droplets: ~5 µm

P Zhou. Nature, 2020.
L Liao, ACS Nano, 2020.

Why masks work?



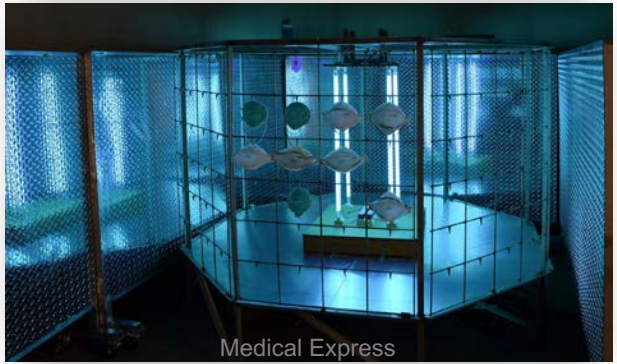




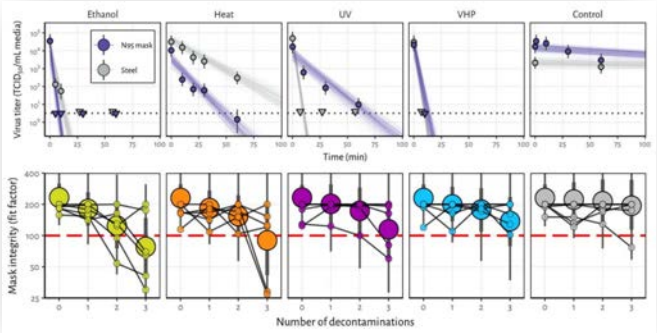
- Both pore size and electrostatic charges play significant roles

L Liao, ACS Nano, 2020.
www.CDC.com

Mask shortage and issues in reuse

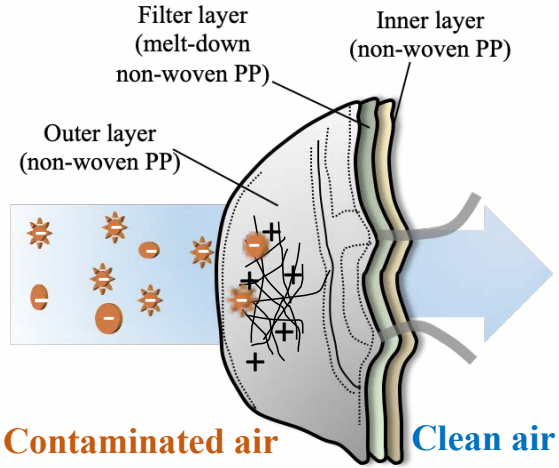


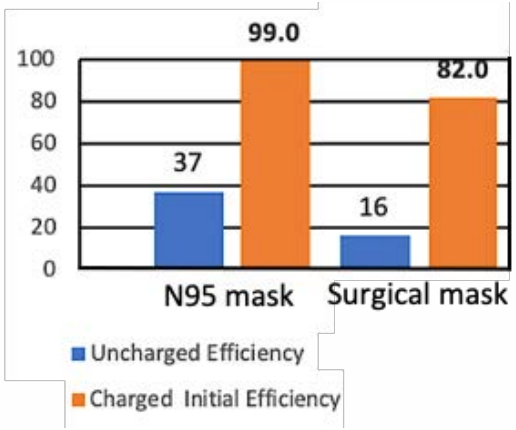
- 3.5 billion need vs. 44 million stockpile
- Hospitals and civilians reuse masks
- Safety concerns
- Significant filtration efficiency drop



R. Fisher. Medrxiv, 2020.

Role of electrostatic charges

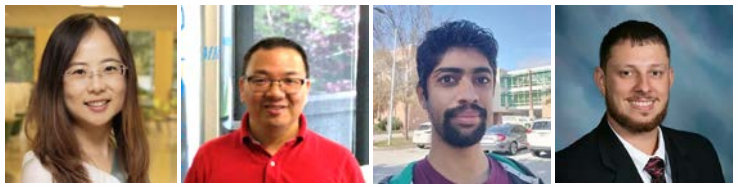




- Charged 95% vs. Uncharged 37%

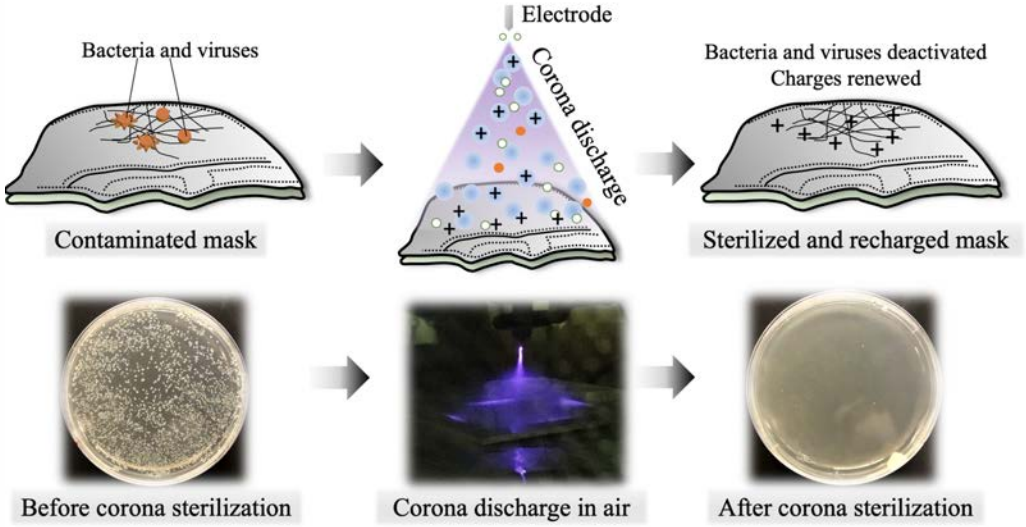
P Tsai. UTRF News, 2020.

Recharge for Guaranteed Safe Reuse



PI: Dr. Y Zhong Co-PI: Dr. L Ye S Krishnamoorthy V Paley

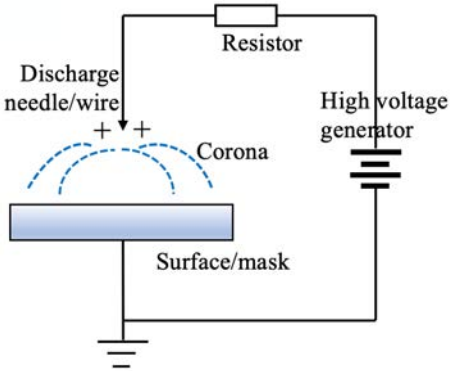
- USF COVID-19 Rapid Response Grant
- NSF RAPID Award

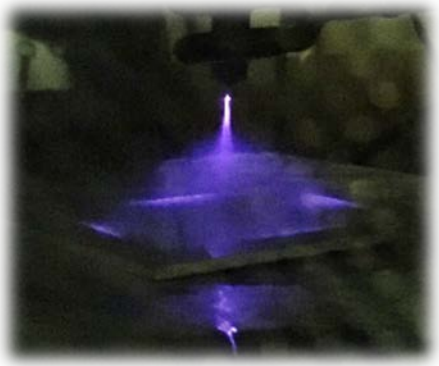


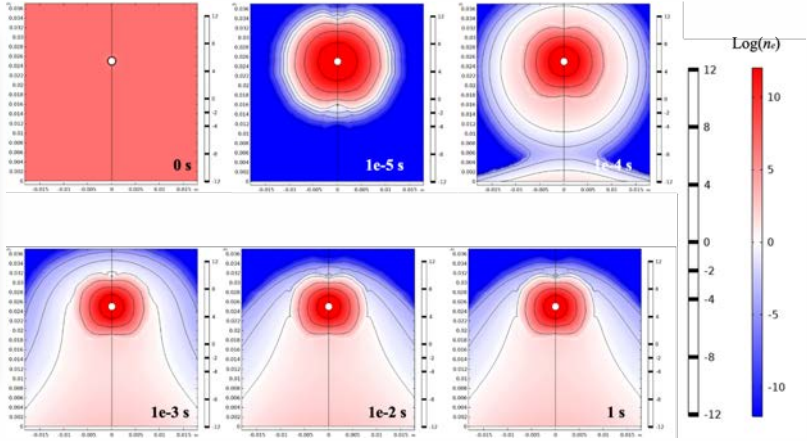
Sterilize and recharge masks simultaneously

➡ **Guaranteed safe reuse**

Corona discharge

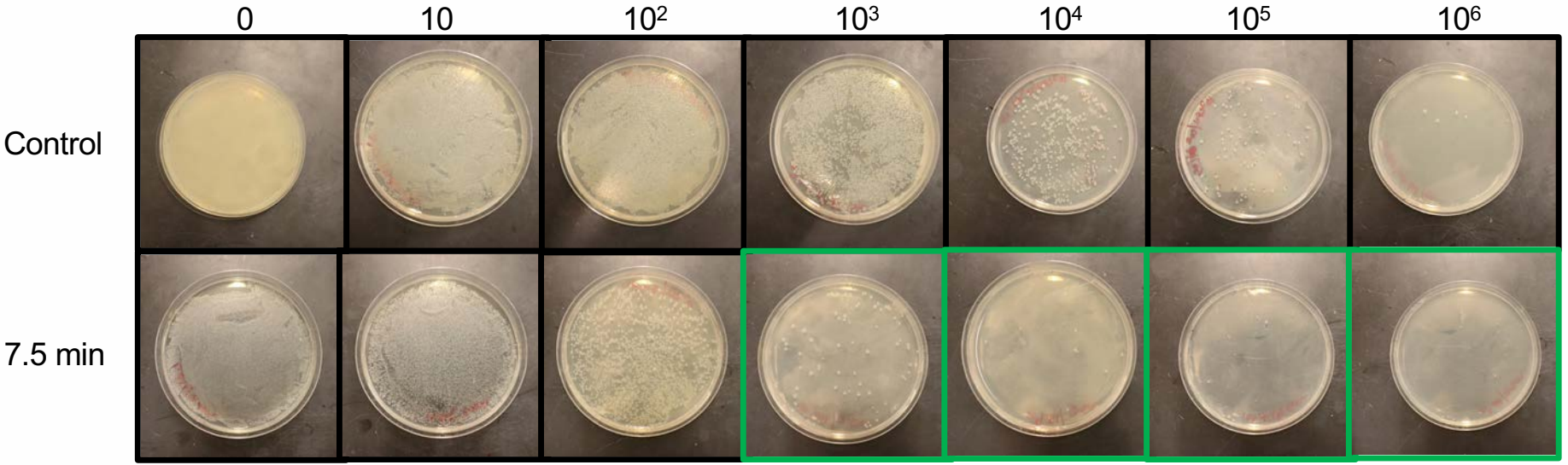






- High voltage on sharp electrode in ambient atmosphere
- Fast and low cost

Influence of treatment time



Increase sterilization effect further

- **Electrode design**
  - Needle
  - Wire
  - 3D printed electrode

→ **Wire electrode**
→ **Larger area**
→ **Log reduction to 4~5**

- **Environment control**
  - Open
  - Closed

→ **Ozone can reach up to 10 ppm**
→ **Closed environment contain ozone**
→ **Enhance sterilization effectively**
→ **Log reduction to 4~5**

- **Cycled treatment**
  - 3 times
  - Storage time in between

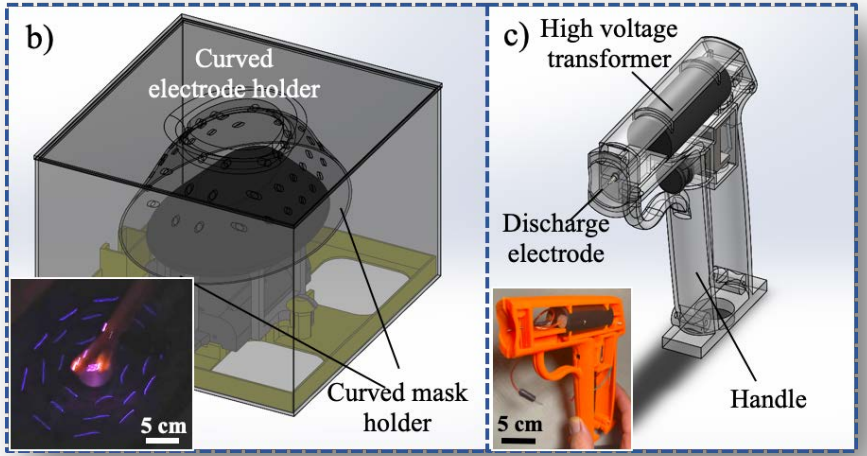
→ **Cycled treatment enhance log reduction**
→ **Reach log reduction of 6**
→ **Good enough for surgical use**

- **Polarity**
  - Positive
  - Negative

→ **Positive and negative corona share very similar sterilization effect**

Commercialization

99.9% → 99.9999%, 1000 times better



- Portable and affordable devices (<$50) for the public
- Masks to any surfaces → reduce disinfectant use
- Testing SARS-CoV-2 virus and spores

For more information

Thanks!

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