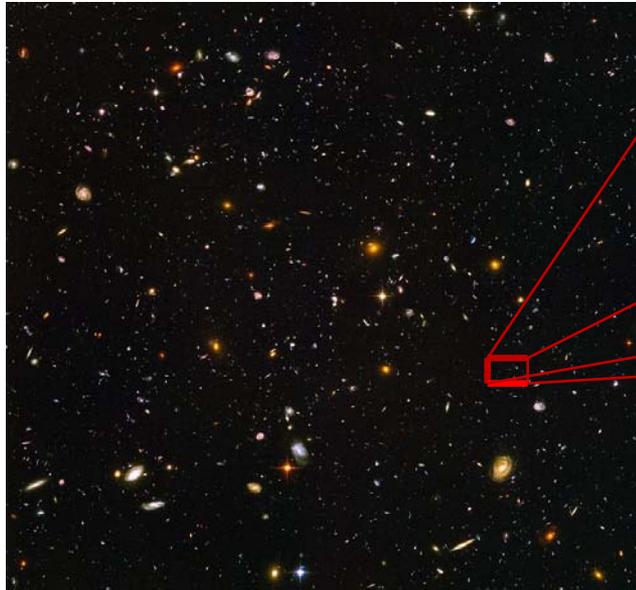
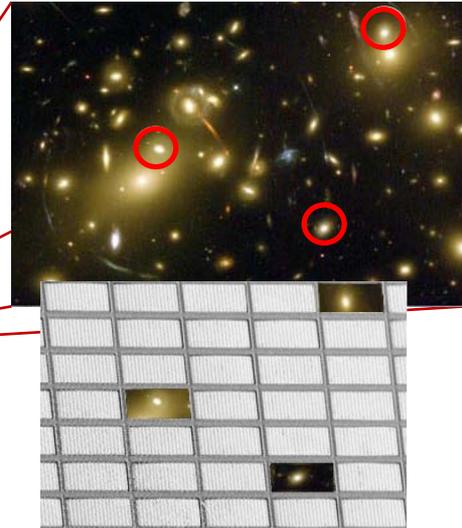


Next Generation Microshutter Array

Hubble Space Telescope Deep Field:



Microshutter arrays are used as programmable multi-object aperture on NIRSpec JWST



Increasing spectrometer efficiency > 100 times
(proportional to the number of objects observed simultaneously)

Potential application in the future missions

- ***ATLAST***
- ***HORUS***
- ***Terrestrial Planet Finder***
- ***UV Explorer missions***

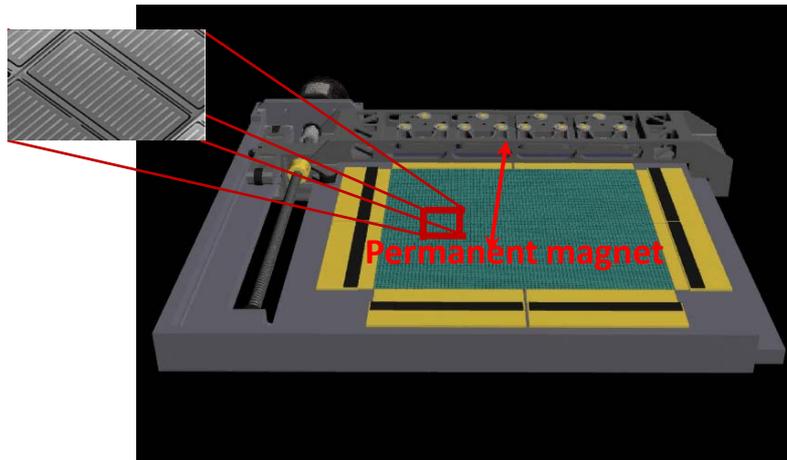
Dr. Harvey Moseley, GSFC



Next Generation Microshutter Array

Existing microshutter technology

JWST MSA

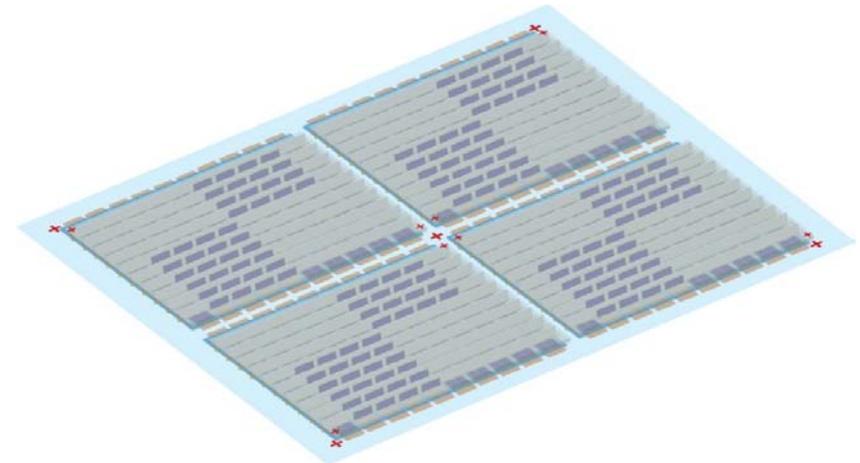


- narrowly tailored to JWST NIRSpec requirements
- limited array size
- requires hybridization
- actuation by macroscopic magnet with mechanical transport mechanism
- all shutters have to be actuated to latched and small number of shutters

Next generation telescopes such as the Advanced-Technology Large-Aperture Space Telescope (ATLAST), HORUS, Terrestrial Planet Finder require much larger programmable field masks to accommodate their field of view

Next Generation Microshutter arrays

NGMSA



- electrostatic actuation – no macromechanism required
- large scale mosaicing - no limit on size
- light weight
- simplified actuation

Next Generation Microshutter Array

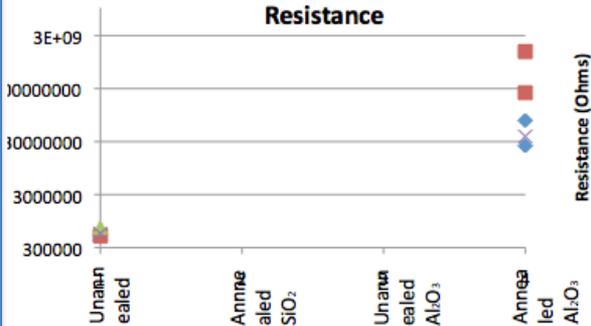
Development and testing :

- electrostatic actuation (analytic and testing)
- device insulator materials – voltage/material trade
- anti-stiction coating tested
- updated fabrication design

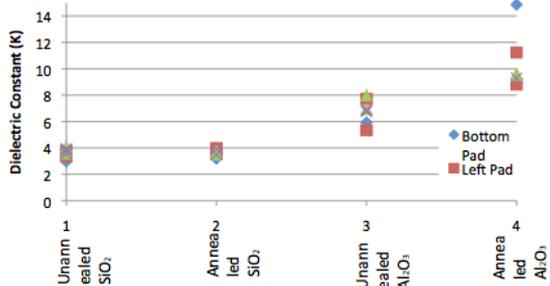
Dielectric testing:

We tested SiO_2 and Al_2O_3 with various crystal structures and identified annealed Al_2O_3 as the insulator for NGMSA electrostatic actuation due to its much high resistivity and dielectric constant

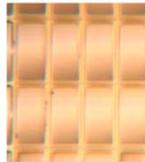
Thin Films vs. Static High Voltage Resistance



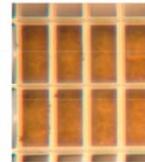
Thin Films vs. Dielectric Constant



Electrostatic actuation accomplished



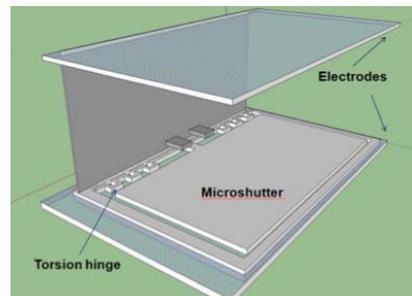
Closed shutters



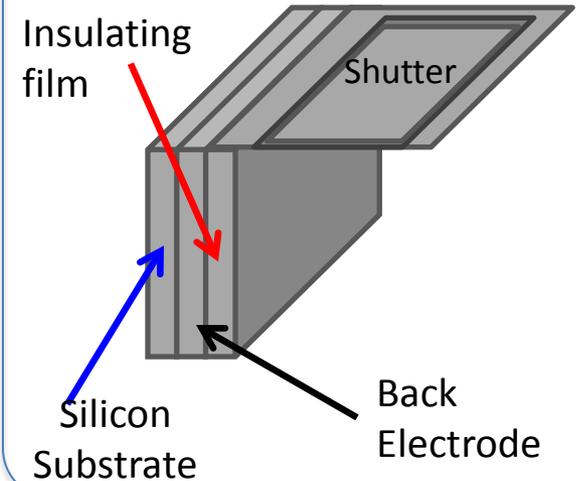
84 V-DC plus 72 V-AC – shutters open

Modeling of the hinge geometry and materials

variations: simplified processing, reduced torques required to actuate.



Updated shutter cell design



Path forward

- Finalize the layout and material selection
- Fabricate the test units
- Demonstrate the proof of overall concept and fabrication process on small (100x100) units
- Pursue further collaboration for future missions/projects

