Supporting Information for

Monolithic active-matrix full-color micro-LED micro-display using InGaN/AlGaInP heterogeneous integration

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This PDF file includes:

MATLAB Codes for images demonstration;
Figures S1 to S8;
Legends for Movies S1;

Other supporting materials for this manuscript include the following:

Movies S1

MATLAB codes for images demonstration

```
%% Random full-color image with a resolution 200×80 displayed on a
400×240 panel
RGB = imread('IMAGE.jpg'); % IMAGE.jpg is a 200×80 full-color
image
r = RGB(:,:,1); % extract red color value
g = RGB(:,:,2); % extract green color value
b = RGB(:,:,3); % extract blue color value
Bayer = zeros(240,400); % initialize a Bayer matrix to store
RGB value
for i = 1:1:40
    for j = 1:1:100
        % pixel A
        Bayer(3*(2*i-1)-2,2*(2*j-1)-1) = 2*g(2*i-1,2*j-1);
        Bayer(3*(2*i-1)-2,2*(2*j-1)) = 5*b(2*i-1,2*j-1);
        Bayer(3*(2*i-1)-1,2*(2*j-1)-1) = 1*r(2*i-1,2*j-1);
        Bayer(3*(2*i-1)-1,2*(2*j-1)) = 0;
        Bayer(3*(2*i-1),2*(2*j-1)-1) = 0;
        Bayer(3*(2*i-1),2*(2*j-1)) = 0;

        % pixel B
        Bayer(3*(2*i-1)-2,2*(2*j)-1) = 0;
        Bayer(3*(2*i-1)-2,2*(2*j)) = 0;
        Bayer(3*(2*i-1)-1,2*(2*j)-1) = 1*r(2*i-1,2*j);
        Bayer(3*(2*i-1)-1,2*(2*j)) = 0;
        Bayer(3*(2*i-1),2*(2*j)-1) = 2*g(2*i-1,2*j);
        Bayer(3*(2*i-1),2*(2*j)) = 5*b(2*i-1,2*j);

        % pixel C
        Bayer(3*(2*i)-2,2*(2*j-1)-1) = 0;
        Bayer(3*(2*i)-2,2*(2*j-1)) = 0;
        Bayer(3*(2*i)-1,2*(2*j-1)-1) = 0;
        Bayer(3*(2*i)-1,2*(2*j-1)) = 1*r(2*i,2*j-1);
        Bayer(3*(2*i),2*(2*j-1)-1) = 5*b(2*i,2*j-1);
        Bayer(3*(2*i),2*(2*j-1)) = 2*g(2*i,2*j-1);

        % pixel D
        Bayer(3*(2*i)-2,2*(2*j)-1) = 5*b(2*i,2*j);
        Bayer(3*(2*i)-2,2*(2*j)) = 2*g(2*i,2*j);
        Bayer(3*(2*i)-1,2*(2*j)-1) = 0;
        Bayer(3*(2*i)-1,2*(2*j)) = 1*r(2*i,2*j);
        Bayer(3*(2*i),2*(2*j)-1) = 0;
```

```
        Bayer(3*(2*i),2*(2*j)) = 0;
    end
end
Y = uint8(Bayer); % convert data storage type 'Bayer(double)' to
the image data type 'Bayer(uint8)'
imshow(Y)% show grayscale image
imwrite(Y,'IMAGE.png'); % save image in current folder
```

Figure S1

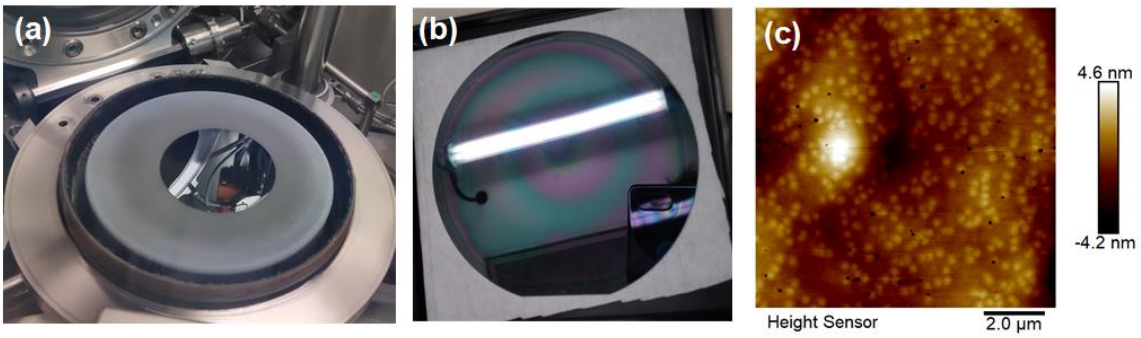


Figure S1. (a) 4-inch sample grown in our MOCVD system. (b) as-grown GaN-on-Si LED epi-wafer. (c) 10 μm × 10 μm scanning area AFM image of as-grown sample at center region.

Figure S2

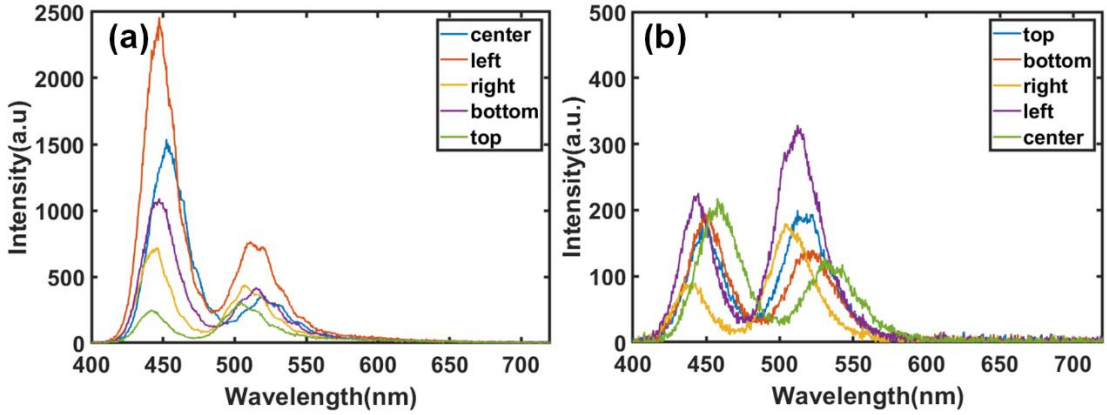


Figure S2. (a) PL spectra and (b) quick EL spectra of the 4-inch GaN-on-Si dual-wavelength LED epi-wafer.

Figure S3

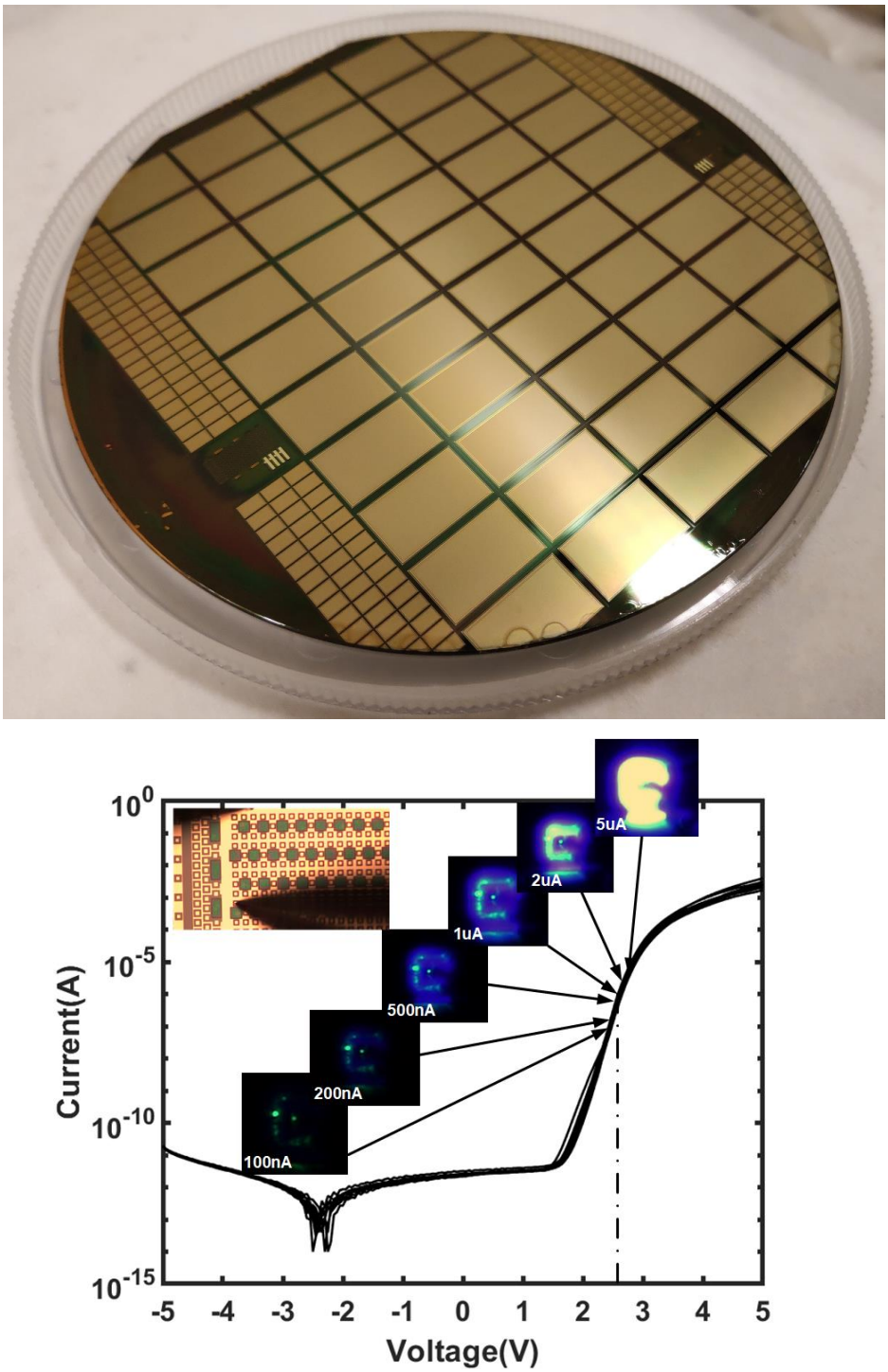


Figure S3. (a) As-fabricated GaN-on-Si dual-color micro-LED arrays on 4-inch epi-wafer. (b) GaN-on-Si dual-color pixel IV after metallization.

Figure S4

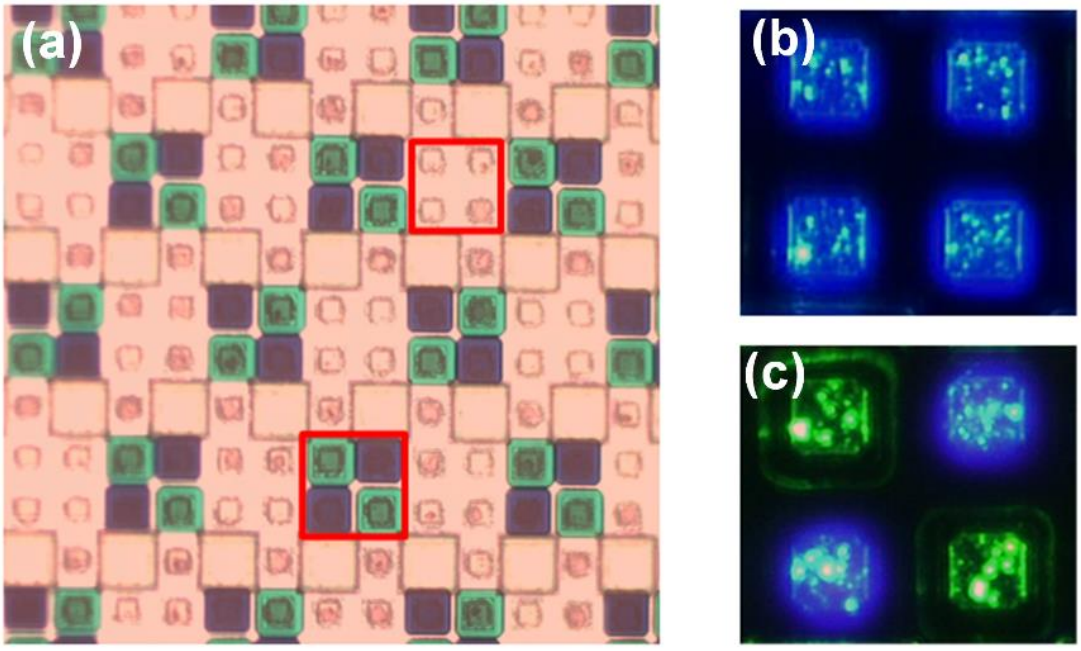


Figure S4. (a) Blue/green dual-color display with blue and green color filters patterned. (b) Dual-color emission without CF filtering. (c) Distinguishable blue and green emission with color filters.

Figure S5

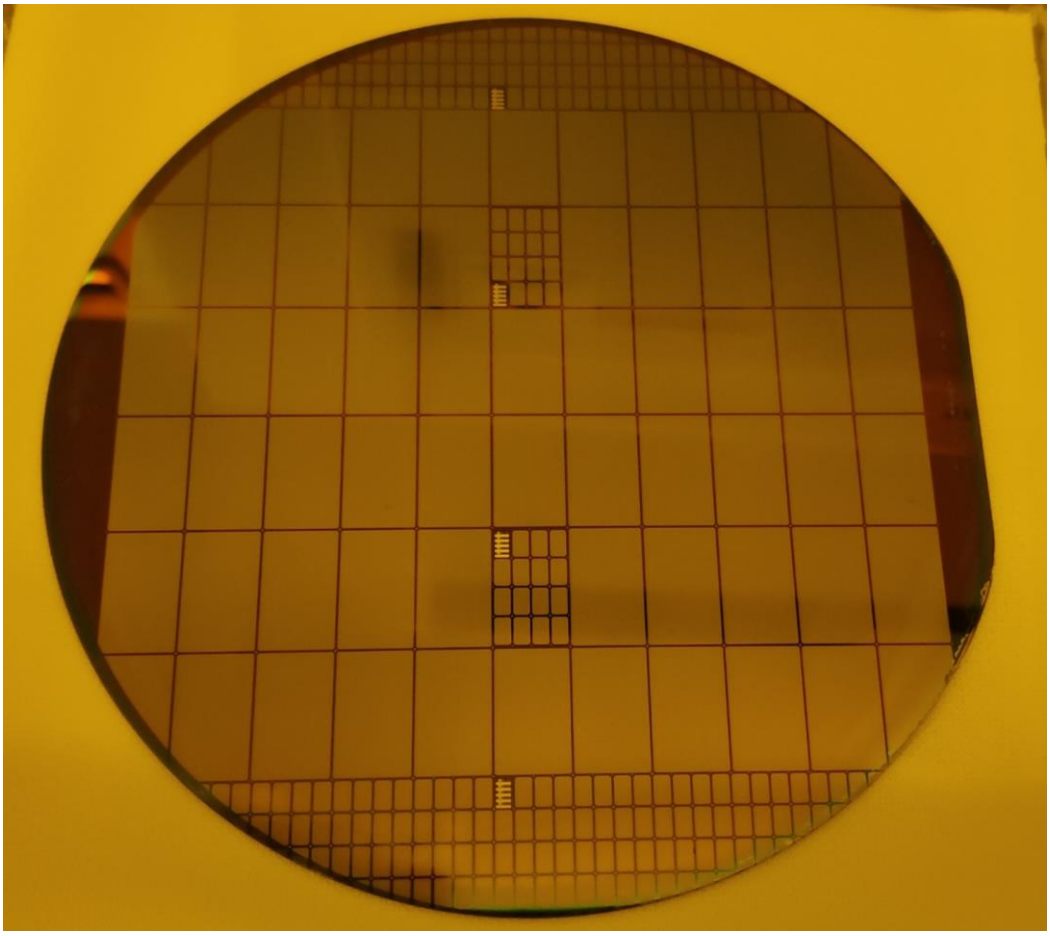


Figure S5. As-fabricated AlGaInP red micro-LED arrays on 4-inch epi-wafer.

Figure S6

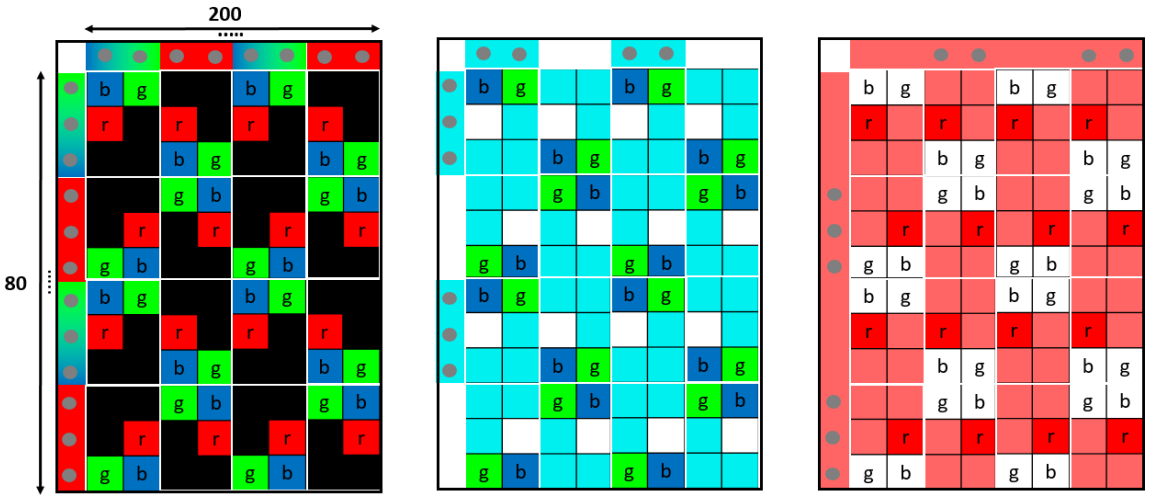


Figure S6. Design of (a) Full-color (b) InGaN dual-color (c) AlGaInP red configuration with the common-n electrode placed at the peripheral area of the display.

Figure S7

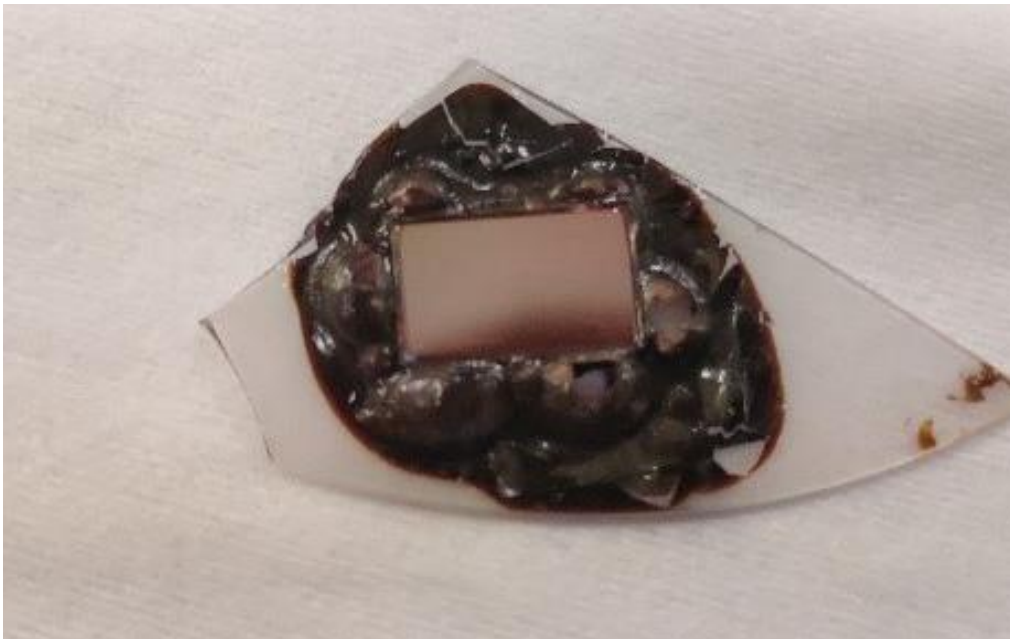


Figure S7. Photograph of the heterogeneous integrated display chip after GaAs substrate removal.

Figure S8

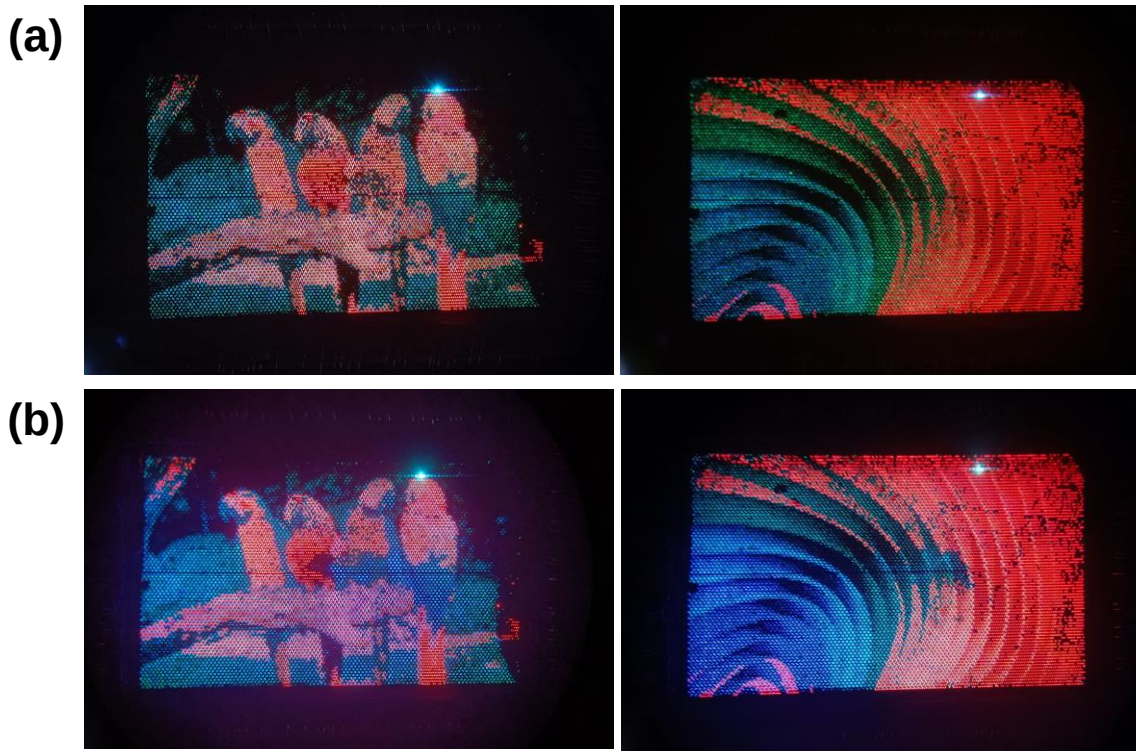
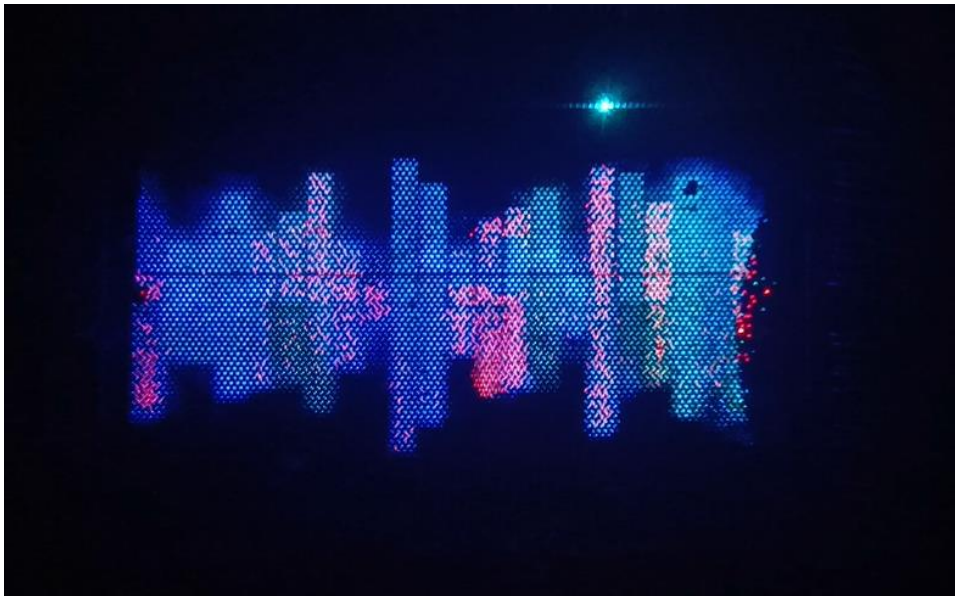


Figure S8. Display images demonstration when (a) VLED = 3.2 V. (b) VLED = 5 V.

Movie S1



Movie S1. Video demonstration.