2026 START Program
CFP Brief

THEME: **03.** Multimedia

SUB-THEME: **3.2.** Advanced Immersive Display Technology

Context/ Overview

Future displays will evolve to blend perfectly into the user's environment, breaking the physical and visual limits of current screens. To achieve this, the development of large flexible and glasses-free 3D displays is essential.

First, large flexible technology is required to overcome the limits of fixed screens. By using a flexible design that can hide the screen or adjust its curve, we can improve space efficiency and make displays more versatile

This allows the display to adapt to the environment rather than the environment being forced to fit the device.

Second, glasses-free 3D technology is necessary to upgrade the viewing experience. By combining 3D visuals that don't need glasses with AI-based real-time conversion, we can turn displays into immersive, spatial entertainment platforms.

This will allow multiple users to simultaneously experience identical 3D depth and volume without the need for wearable devices (e.g., headsets, AR/VR glasses) and make high-quality, realistic entertainment a natural part of daily life.

This CFP welcomes research and solutions for advanced and immersive display technologies. Submissions could fall under one or both of the following tracks:

Track 1: Flexible/Stretchable Display

Problem Statement

Flexible displays use materials like polyimide or plastic instead of rigid glass, allowing them to bend and flex. For large foldable TVs, they require the high electron mobility and uniformity required to drive large-area display panels.

Different Thin-Film Encapsulation: This layer must protect the display from environmental factors like moisture and dust while maintaining flexibility and avoid delamination. Unlike Smaller Sized flexible display, more works are needed to address new form factor display.

Why this is Important?

1. This is particularly beneficial for large-screen devices like TVs or monitors, which can be rolled up/bend for storage or installation.

2. Flexible displays are less prone to breakage compared to traditional glass-based screens, as they can absorb impacts better

3. Flexible displays open up new possibilities for device design, enabling unique form factors that were previously impossible

Objectives & Scope

To solicit proposals for the flexible display solution :

1. New Substrate Material Research
2. New Encapsulation Technology for the large screen display panels.
3. New Flexible/Bendable/Stretchable Backplane circuit that can withstand bending requirement.

Specific Topics & focus areas*

1. Stretchable Light-Emitting Cells
2. Low Temperature Process technology for manufacturing flexible displays.
3. Maintaining high electron mobility over large surface
4. Process Technology: inkjet printing technics for flexible displays
5. Open Technical Proposals for New Ideas
6. Feedback Integration
7. Iterative Feedback on Topic decision and project milestones

※ The topics are not limited to the above examples and the participants are encouraged to propose other original ideas.

Track 2: Open-Space Multi-User Ultra-High-Resolution 3D Display

Problem Statement

1. **Resolution vs. Viewing Angle Trade-off**
   Existing glasses-free 3D technologies (e.g., lenticular lenses, parallax barriers) suffer from a severe drop in individual resolution as the number of viewpoints increases. It is practically impossible for multiple users to experience 4K-level quality simultaneously.

2. **Physical Constraints (Closed Volumetric/Holographic)**
   Current volumetric displays are confined within glass tubes or specific chambers, lacking scalability. Traditional holographic displays face physical and computational barriers, primarily due to diffraction angle limits, making a 50+ inch display highly unfeasible.

3. **Isolated Experiences**
   Wearable solutions like HMDs and AR glasses induce motion sickness (Vergence-Accommodation Conflict) and isolate users, disrupting the natural, shared immersion required for collaborative environments.

Why this is Important?

1. **Innovation in B2B Collaboration & Simulation**
   This technology will create immense value as a high-end solution capable of entirely replacing physical models in various fields: medical (multi-person surgical simulations), architecture/engineering (digital twin-based design reviews), and defense (tactical battlefield displays).

2. **Evolution of Entertainment & Digital Signage**
   By providing an overwhelming visual experience to crowds (multi-user capability), this solution will dominate the next-generation DOOH (Digital Out-of-Home) display market in theme parks, premium exhibitions, and large shopping malls.

3. Market Prospects
   While the XR and spatial computing markets are growing rapidly, the discomfort of hardware remains the largest barrier to mass adoption. If successful, this project will be a game-changer, shifting the display paradigm and serving as the true "shared metaverse infrastructure" that transcends wearable limitations

Objectives & Scope

The primary purpose is to discover new dimensions of optical design and rendering algorithms that overcome the physical limitations of existing optical systems. The core objective is to secure foundational technology that allows multiple users to share a high-resolution, floating 3D image in an open space, with the naked eye, and without any spatial or physical constraints.

1. Multi-view Directional Light Control
   Technology that dynamically tracks the eye positions of two or more users in real-time and steers 4K- level 3D images exclusively to those coordinates. A novel optical and mechanical approach is required to ensure that the resolution does not degrade as the number of users increases.

2. Large-scale Aerial Imaging Optics
   Technology that projects a 50-inch or larger image into the empty space in front of the screen, rather than on a physical surface. This requires innovative optical components (e.g., metasurfaces, micro-mirror arrays) that make users completely unaware of transparent glass or acrylic panels, creating the illusion of objects floating entirely in thin air.

3. Real-time Ultra-realistic Rendering & Compute Optimization
   Data processing technology designed to deliver 4K+ 3D quality to multiple users simultaneously with zero latency. Algorithmic breakthroughs are essential to compute massive amounts of 3D spatial data in real-time to control the light sources.

Specific Topics & focus areas*

1. Multi-view Control Elements
   - High-speed, ultra-precise user gaze and pupil tracking algorithms (AI Vision-based).
   - Design of Liquid Crystal Lenses or Diffractive Optical Elements (DOE) for dynamic light steering.
   - Optical design technologies to minimize multi-user viewpoint interference (Crosstalk).

2. Spatial Imaging & Screen-free Elements
   - Retro-reflection materials or Metamaterials that manipulate light paths to form images in mid-air.
   - Optical camouflage techniques to completely hide the physical bezels or panel textures.
   - Light source design to maximize visual depth cues when users interact with the floating aerial images.

3. Rendering & Compute Elements
   - Foveated rendering (rendering in 4K only where the user's gaze is fixed while lowering peripheral resolution).
   - Deep learning-based real-time View Synthesis networks for generating Super Multi-view images.
   - Parallel processing architectures and compression/transmission technologies for massive 3D volumetric data.

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