Abstract
We describe the first single-lens wide-field-of-view (FOV) light field (LF) camera. Wide-FOV LF imaging has widespread applicability in augmented reality, autonomous driving, drone navigation and robotic perception in general. We use a monocentric lens to overcome the limitations of conventional lenses, and demonstrate indoor and outdoor capture of LF panoramas spanning 138° over 72 MPix. We introduce a relative spherical parameterization and virtual field flattening approach that make wide-FOV LF capture practical.

Motivation
Low-power low-latency 3D perception: Robotics, AR, VR

Monocentric Lenses
Conventional optics cannot accommodate wide-FOV LF capture, so we employ a monocentric lens built from concentric glass spheres.

Prototype
A monocentric lens produces a spherical image, which we capture using tiled sensors and lenslet arrays [6].

Representation & Processing
Relative Spherical Parameterization
- Supports a wide FOV, unlike planar LFs
- Locally similar to planar LF with radial depth
- Many LF algorithms work unmodified

Decoding and Processing
- Minor modifications to LF Toolbox [2]

Virtual Fiber Bundles
- Corrects LF curvature at sensor
- Many LF algorithms work unmodified

Conclusions
We demonstrated an optical prototype capturing 138°, 72 MPix LF panoramas. We coupled a monocentric lens and planar sensors using lenslet arrays and LF processing, and introduced a parameterization and toolchain for efficiently representing and processing wide-FOV LFs.

This work presents the first steps towards practical, compact, wide-FOV LF capture.

References