# Mangetic Field Structure Near the Event Horizon of Sgr A*

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It is widely believed that the magnetic field plays an important role in the Active Galactic Nuclei through the accretion process as well as jet formation. However, to date there has been no direct confirmation of existence of magnetic field around the event horizon scale of super-massive black holes. In order to study the detailed physical properties of the vicinity of super-massive black holes, we have observed Sgr A*, the super-massive black hole at the Galactic center, with a 1-mm VLBI array in the US. The array consists of four telescopes at three stations, namely, CARMA in California, SMT in Arizona and SMA/JCMT in Hawaii, and has the maximum baseline of ~4000 km.

We have detected for the first time the linear polarization from the emission at a scale of ~6 black hole radii (Figure 1). The data indicate that the magnetic field structure is partially ordered as seen in Figure 2. The figure shows the relation of the polarization fraction against the visibility amplitude, and images A–D corresponds to models with various magnetic field structures. Model B matches well with the observations, and Model D, which is based on the GRMHD simulation, is also consistent with the observations. The first detection of magnetic field around the black hole certifies that the forthcoming observations of super-massive black holes with EHT (Event Horizon Telescope) will enable us to better understand the physical properties in the vicinity of the super-massive black holes.

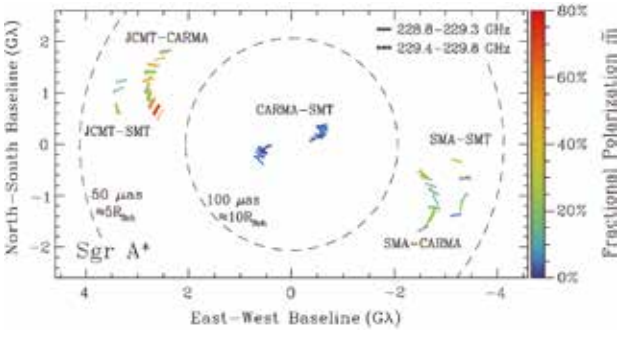


**Figure 1**: Fractional polarization and polarization angle of Sgr A* along the baselines. The direction of lines shows the polarization angle and the color shows the fractional polarization.

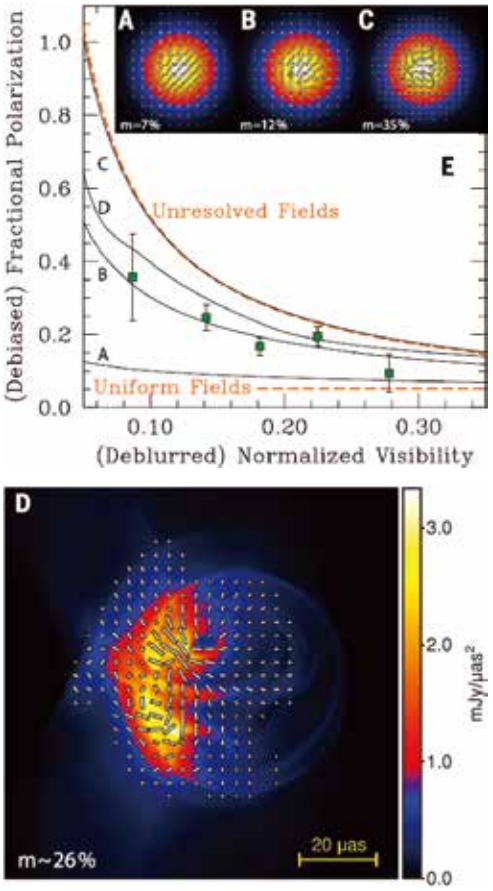


**Figure 2**: Relation with the polarization fraction and the visibility amplitude (top). Images A–D show models with various structure of magnetif field. Model B well matches with the observations, and model D, which is based on the GRMHD simulation is also consistent with the observations.

## Reference

[1] Johnson., M. et al.: 2016, *Science*, **350**, 1242.