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**Inhomogeneous superconducting state in $\beta''$-(BEDT-TTF)$_2$SF$_5$CH$_2$CF$_2$SO$_3$** GEORGIOS KOUTROULAKIS, Univ of California - Los Angeles, H. KÜHNE, Hochfeld-Magnetlabor Dresden (HLD), Helmholtz-Zentrum Dresden-Rossendorf, R. KATO, Condensed Molecular Materials Laboratory, RIKEN Advanced Science Institute, J. A. SCHLUETER, Materials Science Division, Argonne National Laboratory, J. WOSNITZA, Hochfeld-Magnetlabor Dresden (HLD), Helmholtz-Zentrum Dresden-Rossendorf, S.E. BROWN, Univ of California - Los Angeles — We present $^{13}$C nuclear magnetic resonance (NMR) measurements on the quasi-2D organic superconductor $\beta''$-(BEDT-TTF)$_2$SF$_5$CH$_2$CF$_2$SO$_3$, at ultra-low temperature ($T$ ∼100mK). For a magnetic field applied precisely within the conducting layers, the field evolution of the NMR spectrum reveals a phase transition within the superconducting state ($H_{c2}$ >12T) near to the Pauli limit $H_P$ ∼9.5T. The transition is identified by the significant line-broadening of the spectrum, associated with the electronic spin polarization distribution due to the emergence of spatially inhomogeneous superconductivity, the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state. The character of this novel SC state is studied via static and dynamic (i.e. spin-lattice relaxation) NMR measurements. Moreover, the stability of the putative FFLO phase upon rotation of the field away from the in-plane condition is investigated.

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