

# Charge-4e and charge-6e flux quantization and higher charge superconductivity in kagome superconductor ring devices

Jian Wang

*Peking University, Beijing, China*

Despite of the various forms of superconductivity, conventional or unconventional, topologically trivial or nontrivial, the condensation of charge- $2e$  Cooper pairs has remained the origin and character of all superconductivity, as described by the BCS theory. We report our experimental discoveries of the charge- $4e$  and charge- $6e$  superconductivity in ultrathin ring devices fabricated using the kagome superconductor  $\text{CsV}_3\text{Sb}_5$  [1]. These new phase coherent states are discovered by the observation of the quantized magnetic flux in units of  $h/4e$  and  $h/6e$  in systematic magneto-transport measurements. Our observations provide direct experimental evidence for the existence of phase coherent paired quantum matter beyond the charge- $2e$  superconductors, and provide ground work for exploring the physical properties of the charge- $4e$  and charge- $6e$  superconductivity as unprecedented phases of matter beyond the condensation of Cooper pairs described by the BCS theory.

[1] Jun Ge<sup>#</sup>, Pinyuan Wang<sup>#</sup>, Ying Xing, Qiangwei Yin, Anqi Wang, Jie Shen, Hechang Lei, Ziqiang Wang, and **Jian Wang**\*. "Evidence for multi-charge flux quantization in kagome superconductor ring devices" [arXiv: 2201.10352](https://arxiv.org/abs/2201.10352) to be published in *Physical Review X*