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Topological Weyl singularity in the Andreev spectrum of multi-terminal Josephson junction[1] TOMOHIRO YOKOYAMA, The Institute for Solid State Physics, The University of Tokyo, YULI NAZAROV, Kavli Institute of Nanoscience, Delft University of Technology — We theoretically investigate a multi-terminal Josephson junction. Such junctions can be realized, for instance, with crossed InSb nanowires. N superconductors can define N-1 independent superconducting phase differences. The spectrum of Andreev bound states in the junction is 2π periodic in all the phase differences. By regarding the phase differences as "quasimomenta" for crystal, the Andreev spectrum can be proposed as "an energy band structure in artificial material." We exhibit a topological Weyl singularity in the Andreev spectrum. [2] We examine a model using scattering matrix based on a Beenakker's determinant equation to calculate the Andreev levels. The Weyl singularity requires more than three superconducting terminals. In a 3D space of the phase differences, the Weyl points come always in groups of four. They are present even in the absence of SO interaction, thus even for doubly degenerate spectrum. The SO interaction splits the conical spectrum of the Weyl points, however does not vanish the points. The Weyl points can be removed by the pair annihilation when one tunes the scattering matrix.

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[2]T. Yokoyama and Yu. V. Nazarov, Phys. Rev. B **92**, 155437 (2015).

Tomohiro Yokoyama
The Institute for Solid State Physics, The University of Tokyo

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