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Relay transport of relativistic flows in extreme magnetic fields of stars WEIPENG YAO, BIN QIAO, ZHENG XU, Center for Applied Physics and Technology, HEDPS, SKLNPT, and School of Physics, Peking University, Beijing, 100871, China, HUA ZHANG, Institute of Applied Physics and Computational Mathematics, Beijing 100094, China, HENXIN CHANG, Center for Applied Physics and Technology, HEDPS, SKLNPT, and School of Physics, Peking University, Beijing, 100871, China, CANGTAO ZHOU, SHAOPING ZHU, Institute of Applied Physics and Computational Mathematics, Beijing 100094, China, XIAOGANG WANG, Center for Applied Physics and Technology, HEDPS, SKLNPT, and School of Physics, Peking University, Beijing, 100871, China, XIANTU HE, Institute of Applied Physics and Computational Mathematics, Beijing 100094, China — We find that transport of relativistic flows in extreme magnetic fields can be achieved in a relay manner by considering the quantum electromagnetic (QED) cascade process, where photons play a key role as a medium. During the transport, the flow emits particle energy into photons via quantum synchrotron radiation and then gain particles back by magnetic pair creation, forming a "particle-photon-particle" relay. Particle-in-cell simulations demonstrate that forward transport of the flow density is realized by a self-replenishment process with photon-pair cascades, while that of the flow energy is accomplished due to a new coupling path through radiation of photons. This novel transport mechanism is closely associated with jet generation and disk accretion around the neutron star of X-Ray Binaries, offering a potential explanation for the powerful jets observed there.

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