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Dear Editors of Applied Physics Letters,

I am submitting a manuscript entitled “Optoelectronic Intelligence” for your consideration as a perspective article. Thank you for considering this article for publication in Applied Physics Letters. The fields of hardware for artificial intelligence and neuromorphic computing are expanding rapidly with new ideas for how to implement beyond-CMOS being introduced almost daily. Yet from my perspective, much of this work is missing a global perspective on what makes biological neural systems powerful as well as what has made CMOS electronics successful in the first place for realizing scalable computing systems. To realize scalable hardware for AI, we must appreciate what makes spiking neural network computation powerful as a form of information processing, and from there we must envision how to best utilize the physics of devices to realize systems capturing these principles. Our team at NIST has spent the last five years designing such systems and making experimental progress toward their realization. Based on this work, we think the argument is strong that scalable hardware for artificial intelligence will benefit from the integration of photonic and electronic physics and devices.

Our reasoning behind these arguments is the subject of this paper. I include this background description in this cover letter to make two points. First, because this vision of hardware for AI draws inspiration from the devices and networks of the brain as well as very-large-scale integrated circuits and leverages the physics of superconductors, semiconductors, and light, adequate description of the concepts requires slightly more length than the average perspective article. This manuscript is close to 4000 words (excluding abstract and figure captions). I hold the opinion that all the content in the manuscript is necessary to clearly explain the concepts and make the case for the feasibility. I hope you will agree. Second, because our approach primarily leverages the physics of integrated photonics and superconducting electronics, I have recommended peer reviewers from both of these fields. Dr. Hatakenaka, Dr. Klenov, and Dr. Hamilton work in the field of neuromorphic superconducting electronics. Dr. Andriolli, Dr. Mourgias-Alexandris, Dr. Sorger, and Dr. Shastri work in the field of neuromorphic photonics.

Thank you again for your consideration and your time,



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