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A Vision for Non-Equilibrium Plasma Science and Applications[1]

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Non-equilibrium plasma (NEP) has a remarkable and impressive history of a series of important applications supported by foundational physics understanding. Plasma is an enabling technology in one of the most important current and future strategic industries: manufacturing integrated circuits. This technology is at the heart of the on-going revolution in communication, information processing and artificial intelligence. Future extensions to quantum materials and quantum devices appear promising and well worthy of investment in fundamental and applied plasma research. A second strategic area of emerging importance in NEP science is healthcare. Obviously, infectious disease has not been fully eradicated and plasma has a role to play in this grand challenge. There is a need for a new focus on the plasma science associated with infection control and associated biomedical applications. Finally, the decade of the 2020s will almost certainly see a rapid rise in actions to develop a more sustainable global society. The fact that chemically active plasma can be powered by renewably generated electricity makes it an attractive technology for a number of thorny problems involving large scale material and chemical processing. Recent advances in high performance computing, data science, machine learning and advanced control in the context of NEP encompass all of these emerging applications. In each of these areas, and probably others as well, NEP can and will play an important role. The sometimes bewildering diversity of topics associated with NEP applications demands strong multi-disciplinary collaborations, and this can be a significant challenge. All things considered, it is a good time to be in the field of NEP science and technology!

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