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Tools for the Future of Nuclear Physics[1]

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The challenges of Nuclear Physics, especially in understanding strongly interacting matter in all its forms in the history of the universe, place ever higher demands on the tools of the field, including the workhorse, accelerators. These demands are not just higher energy and higher luminosity. To recreate the matter that fleetingly was formed in the origin of the heavy elements, we need higher power heavy-ion accelerators and creative techniques to harvest the isotopes. We also need high-current low-energy accelerators deep underground to detect the very slow rate reactions in stellar burning. To explore the three dimensional distributions of high-momentum quarks in hadrons and to search for gluonic excitations we need high-current CW electron accelerators. Understanding the gluonic structure of nuclei and the three dimensional distributions of partons at lower x, we need high-luminosity electron-ion colliders that also have the capabilities to prepare, preserve and manipulate the polarization of both beams. A search for the critical point in the QCD phase diagram demands high luminosity beams over a broad range of species and energy. With advances in cavity design and construction, beam manipulation and cooling, and ion sources and targets, the Nuclear Physics community, in the U.S. and internationally has a coordinated vision to deliver this exciting science.

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