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Cyclotrons for precision neutrino measurements[1]

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The IsoDAR cyclotron was initially conceived as the high intensity proton driver for neutrino experiments. Either as the injector to an 800 MeV superconducting ring cyclotron for CP violation studies in the neutrino sector or as a standalone driver producing 60 MeV protons for a search for sterile neutrinos. Since then, multiple additional applications have been proposed in medical isotope production, energy research and materials science. The aim of the IsoDAR cyclotron design is to provide 10 mA of protons at 60 MeV in cw mode. This is an order of magnitude higher current than commercially available machines can produce. Three novelties allow this jump forward: Pre-bunching and injecting through an RFQ inserted axially into the cyclotron; accelerating H_2^+ ions rather than protons; designing for optimal utilization of the vortex effect. Here, I will present the latest beam dynamics results and the technical design of ion source, RFQ and cyclotron, using these three novelties. I will describe the IsoDAR experiment, producing neutrinos through isotope decay-at-rest, and how we will make a decisive measurement within 5 years of running.

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