



Contribution ID: 131

Type: **Contribute Oral**

## FRIB ECR Ion Sources Operation and Future Development

*Thursday, 21 September 2023 09:50 (20 minutes)*

The Facility for Rare Isotope Beams (FRIB) has become operational as a user facility in April 2022. The primary beam power available on target routinely now reaches 5 kW and preparations for operation at 10 kW are underway with an ultimate design goal to deliver 400 kW within the next 6 years. FRIB front end currently operates two ECR ion sources: a room temperature ECR ion source operating at 14 GHz, ARTEMIS, in operation since 2016, and a High-power superconducting Nb-Ti ECR ion source (HP-ECR) in operation at 18 GHz since January 2023. The HP-ECR has demonstrated the magnetic field necessary for operation at 28 GHz and preparations are underway for high power operation, including the installation of a 28 GHz gyrotron microwave system, upgraded radiation shielding, improved new plasma chamber, high temperature oven and so on. In addition, to mitigate single point failure for intense highly charged ion beam and maintain high availability, a second 28 GHz ECR ion sources based on a Nb<sub>3</sub>Sn sextupole is being developed in collaboration with the superconducting magnet group at Lawrence Berkeley National Laboratory (LBNL) that developed the original cold mass for the 28 GHz HP-ECR. This paper presents progress made in some of these areas as well as summarize the current state of the FRIB ion sources and future development.

This work was supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under the Cooperative Agreement DE-SC0000661

### Funding Agency

U.S. Department of Energy Office of Science

### Email Address

guoju@frib.msu.edu

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Yes

### Presenter if not the submitter of this abstract

**Primary author:** Dr GUO, Junwei (Facility for Rare Isotope Beams)

**Co-authors:** Mr MORRIS, Dan (Facility for Rare Isotope Beams); Dr MACHICOANE, Guillaume (Facility for Rare Isotope Beams); Prof. WEI, Jie (Facility for Rare Isotope Beams); Mr TOBOS, Larry (Facility for Rare Isotope Beams); Mr BULTMAN, Nathan (Facility for Rare Isotope Beams); Mr MORRISON, Philip (Facility for Rare Isotope Beams)

Isotope Beams); Mr RENCOSOK, Randy (Facility for Rare Isotope Beams); Mr GEE, Terrell (Facility for Rare Isotope Beams); Prof. XU, Ting (Facility for Rare Isotope Beams); Dr MARURTA, Tomofumi (Facility for Rare Isotope Beams); Dr RAO, Xing (Facility for Rare Isotope Beams); Dr DU, Xiaoji (Facility for Rare Isotope Beams); Dr CHOI, Yoonhyuck (Facility for Rare Isotope Beams); SHEN, Tengming (Lawrence Berkeley National Laboratory); ARBELAEZ, Diego (Lawrence Berkeley National Laboratory); FERRACIN, Paolo (LBNL); PRESTEMON, Soren (Lawrence Berkeley National Laboratory)

**Presenter:** Dr GUO, Junwei (Facility for Rare Isotope Beams)