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**Advancement of Highly Charged Ion Beam Production by
Superconducting ECR Ion Source SECRAL**

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At Institute of Modern Physics, CAS, the superconducting ECR ion source SECRAL has been put into operation for about 10 years now. It has been the main working horse to deliver intense highly charged heavy ion beams for the accelerators. Since its first plasma at 18 GHz, R&D work towards more intense highly charged ion beam production as well as the beam quality investigation has never been stopped. When SECRAL was upgraded to its typical operation frequency 24 GHz, it had already showed its promising capacity of very intense highly charged ion beam production. And it has also provided the strong experimental supply for the so called scaling laws of microwave frequency effect. However, compared to the microwave power heating efficiency at 18 GHz, 24 GHz microwave heating doesn't show the ω^2 scale at the same power level, which indicates that microwave power coupling at gyrotron frequency needs better understanding. In this paper, after a review of the operation status of SECRAL with regard to the beam availability and stability, the recent study of the extracted ion beam transverse coupling issues will be discussed, and the test results of the both TE₀₁ and HE₁₁ modes will be presented. A general comparison of the performance working with the two injection modes will be given, and a preliminary analysis will be introduced. The latest results of the production of very intense highly charged ion beams, such as 1.42 emA Ar¹²⁺, 0.9 emA Xe²⁷⁺ and so on, will be presented.