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Charge Breeding Techniques for European Facilities

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In the frame of two european collaborative projects, EMILIE and ENSAR 2, the charge breeding techniques are being improved.

While SPIRAL 1 at GANIL and SPES will use an ECR charge breeder, ISOLDE is upgrading its charge breeder. The two techniques present different advantages and drawbacks which were thoroughly studied during the past decade.

The ECR charge breeder has recently benefited from different upgrades. As an example, the SPIRAL 1 charge breeder has reached a new level of performances with its upgraded vacuum, injection / extraction optics and RF coupling. Better understanding of the capture process could be obtained. Despite these progresses, the observed behavior of the charge breeding time as a function of the support gas and plasma parameters raises new questions. This behavior is presently being studied by simulation before new on-line data is obtained with the SPIRAL 1 charge breeder.

Efficient acceleration of medium mass ($A > 40$) to heavy ions to high energy requires the use of a highly performing EBIS charge breeder. ISOLDE is presently working on the improvement of the EBIS electron optics, making use of a new high-compression gun at low energies and high current and large trapping capacities. While EBIS charge breeders provide the highest charge states, the pulsed structure of the Highly Charged Ion (HCI) beam makes their use cumbersome for many experiments. The EMILIE debuncher has been constructed at LPC Caen for an easy manipulation of the longitudinal phase space of the HCI beam to match the needs of the experiments. The availability of fast and high repetition rate ion production in combination with debunching technology allows to build a versatile and flexible injection system for various linac- and cyclotron-based post acceleration schemes.

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