APPA R&D — BMBF collaborative research at FAIR

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Synopsis The APPA R&D research collaboration at the international Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany, is introduced and its activities are briefly summarized pointing out, in particular, the experimental program at the low-energy storage ring CRYRING which will become available for users already in 2018.

The research collaboration APPA R&D [1] comprises the German university groups who have set out to perform scientific research at the future international accelerator complex FAIR (Facility for Antiproton and Ion Research) under the umbrella of APPA (Atomic, Plasma Physics and Applications). The FAIR-installations (Fig. 1) are currently under construction at the site of the GSI Helmholtz Center for Heavy Ion Research in Darmstadt, Germany. APPA is one of the four research pillars of FAIR hosting the international research collaborations BIOMAT (biophysics and material research), FLAIR (physics with low-energy antiprotons), HEDgeHOB/WDM (plasma physics), and SPARC (atomic physics) who focus on investigations of matter under extreme conditions such as strong fields, high densities, high pressures, and high temperatures [2].

The APPA R&D research collaboration pursues coordinated research projects in the area of accelerator based experiments with heavy ions at the future FAIR-installation. Central issues are i) further development of the the experimental infrastructure, in particular, research and development for enhancing the scientific capabilities of the existing installations and of the future accelerator and detector systems including the respective base technologies, and ii) set-up of the APPA experiments of the modules 0-3 of the modularized start version of FAIR.

FAIR is expected to operate fully in 2024/2025. However, the existing GSI accelerators including the existing Experimental Storage Ring (ESR) are available already now as well as the low-energy storage ring CRYRING, a Swedish in-kind contribution to FAIR, which is currently being commissioned. CRYING will receive cooled and decelerated highly charged ions from ESR, thus, permitting, e.g., precision experiments that will challenge state-of-the-art calculations within the frame-work of quantum electrodynamics (QED). In addition to ESR, a separate injector can also provide ions to CRYRING, such that it can be operated and used for experiments even when ESR is serving other purposes. First user experiments will start in 2018. From then on, a rich and diverse experimental program covering topics from atomic physics, nuclear physics, material sciences, and accelerator physics will be pursued [3].

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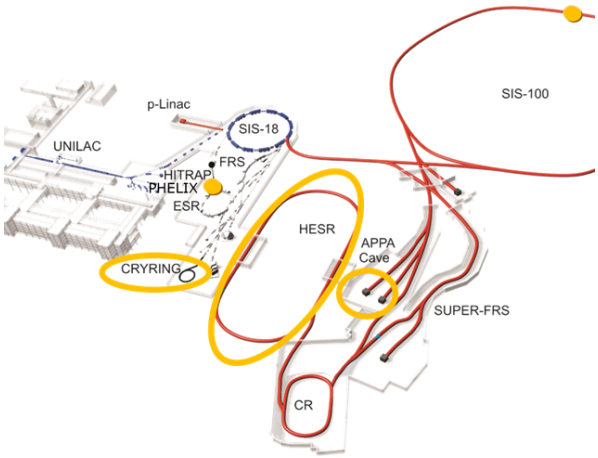

Figure 1. Experimental facilities at the Modularized Start Version (MSV) of FAIR [2]. The existing ion-beam lines and the new FAIR facilities are marked in blue and red, respectively. Sites where major APPA activities will take place are marked in yellow. Experiments in the low-energy storage ring CRYRING [3] will start in 2018. According to the current planning, FAIR will fully operate in 2024/2025.

References

[1] http://appa-rd.fair-center.eu

[2] Th. Stöhlker *et al.* 2015 *Nucl. Instrum. Meth. B* **385** 680

[3] M. Lestinsky *et al.* 2016 *Eur. Phys. J ST* **225** 797

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