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Biophysics at Biomat

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FAIR will be a unique worldwide facility for biophysics applications. With the closure of the SIS18 at GSI, there will be no facilities able to provide heavy ions at energies above 400 MeV/n in Europe. The synchrotrons used for heavy-ion therapy, currently HIT (Germany) and CNAO (Italy), are running programs in medical physics with a limited beamtime due to the priority for patients' treatment and QA. The European Space Agency (ESA) used SIS18 at GSI for the European Space Radiation Health Program in the past 5 years. The use of very heavy ions (up to Fe or Ni) at very high energy (>1 GeV/n) makes FAIR a unique facility for space radiation research. The 1-year mission on the International Space station (starting in 2015) and the exploration programs (including Mars base) makes the problem of the exposure to galactic cosmic radiation particularly relevant. Radiation is a potential showstopper for exploration, and both NASA and ESA are investing large resources for reducing risk uncertainties and developing effective countermeasures. A large fraction of the equivalent dose in deep space comes from ions with energies 1-10 GeV/n, but the biological effects of these ions are largely unknown. The response of human tissues to Fe-ions at energies > 1 GeV/n will be the day-1 Biophysics experiment at FAIR. Biomedical research will also be extended to FAIR. One of the main problems in particle therapy is range uncertainty. The Bragg peak is potentially able to deliver a very high dose in a small tumor volume close to organs at risk, but this high precision makes particle therapy much more sensitive to uncertainties in target positioning, motion, and beam delivery than X-rays. FAIR can help solving projects with pilot projects on particle radiography (using 4-5 GeV protons) and radioactive ions (useful for PET imaging). A large International community, with interests in particle therapy and space radiation protection, will exploit the FAIR facility for solving these biomedical problems in the future years.

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