Chapter 8

Summary and Outlook

Two Coulomb excitation experiments on stable Sn isotopes ^{112}Sn and ^{114}Sn were carried out at Inter University Accelerator Centre (India) and at GSI Helmholtzzentrum (Germany), respectively. It was concluded that the measured B(E2; $0^+_{g.s.} \rightarrow 2^+_1$) values 0.242(8)$e^2b^2$ and 0.232(8)e^2b^2 of ^{112}Sn and ^{114}Sn are significantly larger than what is expected from the shell-model calculations based on the effective interaction outside the ^{100}Sn and ^{90}Zr core. For the Sn isotopic chain one expects a parabolic behaviour of B(E2) values as a function of mass number that peaks at midshell for ^{116}Sn and falls off thereafter towards doubly-magic ^{100}Sn and ^{132}Sn. The experimental B(E2) values, on the neutron-rich side follow the theoretical predictions. However, for the lighter Sn isotopes one observes an enhancement of the electromagnetic transition propabilities. This is clearly seen from the measured B(E2) value of ^{112}Sn which is 20% larger than ^{120}Sn. Both B(E2) values of ^{112}Sn and ^{114}Sn show this unexpected increase. The large scale shell model fails to describe the B(E2) systematics for the Sn isotopes but the relativistic quasi particle random phase approximation predicts this trend qualitatively. These two experiments clearly demonstrated the need for stable beam facilities to measure very accurate data which helps in solving the open questions in nuclear physics field.

In near future (2010) the B(E2; $0^+_{g.s.} \rightarrow 2^+_1$) value of ^{104}Sn will be measured in relativistic Coulomb excitation at GSI. This experimental technique was especially developed to perform measurements with low intensities but using rather thick targets of approximatly 0.4g/cm^2.

For decay experiments an active stopper detctor was developed for the RISING project at GSI in order to study β-decay and conversion electron spectroscopy following projectile fragmentation/fission reactions. This system employs six double sided silicon strip detectors in the final focal plane of the GSI FRagment Separator (FRS) to detect both the fragment implantations and their subsequent β-decays. It has a very high efficiency for β-particles due to the low detection threshold of 150keV. The obtained excellent energy resolution of 20keV was used in some experiments for conversion electron spectroscopy.

In future the active stopper detector will be replaced by Advanced Implantation Detector Array (AIDA), which is part of Nuclear STructure, Astrophysics and Reactions (NUSTAR) project [73, 74] at Facility of Antiproton and Ion Research (FAIR) [75]. Fourteen countries across the globe are participating in the FAIR project including INDIA. AIDA will be used for implantation-decay experiments in which charged particle decays with energies from tens of keV to MeV are measured. AIDA will also consist of large area double-sided silicon strip detector (DSSSD) which is schematically illustrated in fig. 8.1. It will be operated in conjuction with other detection systems, such as gamma-ray and neutron detector arrays. The aim is to acheive this within microseconds of multi-GeV exotic ion implants.

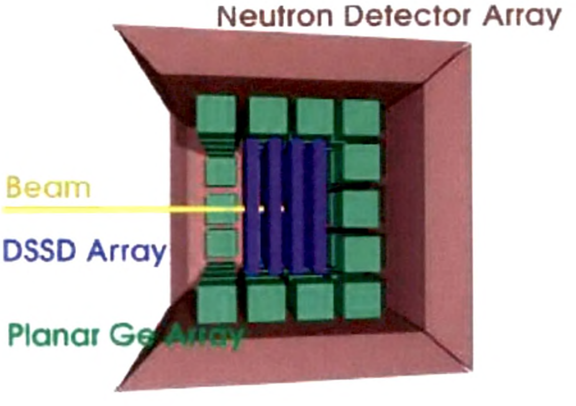

Figure 8.1: Schematic picture of detector assembly for AIDA