

HYbrid Recoil mass Analyzer at IUAC - First results using gas-filled mode and future plans

N. Madhavan^{1*}

¹*Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi - 110067, INDIA*

HYbrid Recoil mass Analyzer (HYRA) [1] is a unique, dual-mode spectrometer designed to carry out nuclear reaction and structure studies in heavy and medium-mass nuclei using gas-filled and vacuum modes, respectively. HYRA (funded by Department of Science and Technology, Government of India) has the potential to address newer domains in nuclear physics accessible using high energy, heavy ion beams from superconducting LINAC accelerator (being commissioned) and ECR based high current injector system (planned) at IUAC. The first stage of HYRA is operational and initial experiments have been carried out using gas-filled mode for the detection of heavy evaporation residues ($A \sim 200$ amu and $E \sim 7$ MeV) and heavy quasi-elastic recoils ($A \sim 208$ amu and $E \sim 100$ MeV) at 0° . Excellent primary beam rejection and transmission efficiency (comparable with other gas-filled separators) have been achieved using a smaller focal plane detection system. Optimization of procedures for beam tuning, gas pressure/field setting, background rejection, etc. combined with the detection of evaporation residues well below the Coulomb barrier and the observation of alpha decay at the focal plane have given immense confidence to plan measurements of weaker channels. Adequate flexibility is provided in the system to further increase the detection efficiency of slow moving evaporation residues. The solid angle of acceptance of the first stage, operated in vacuum mode, has also been extracted using alpha particles from radioactive source. The second stage of HYRA is expected to be set up by middle of next year to facilitate experiments using inverse kinematics. There are plans to couple HYRA to other detector arrays such as Indian National Gamma Array (INGA) [2] and 4π spin spectrometer [3] for ER tagged spectroscopic/spin distribution studies and for focal plane decay measurements. The journey so far (highlighting recent results with gas-filled mode) and the path ahead will be presented on behalf of all investigators, group members and users of HYRA.

References

- [1] N. Madhavan et al., Proceedings of DAE-BRNS Symposium on Nuclear Physics, **47A**, p. 50-53 (2004).
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- [3] I. Mazumdar et al., Private Communication.

*Electronic address: madhavan@iuac.res.in