The Crystal Ball programme at MAMI

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The talk will outline recent results and future plans of the Crystal Ball at MAMI collaboration. The collaboration works at the real photon hall (A2) of the Mainz microtron (MAMI). In this hall the electron beam is converted to a real photon beam using the Glasgow/Mainz photon tagging spectrometer and a new additional endpoint photon tagger. These apparatus provide energy tagged photons from 0.1 to 1.65 GeV with a high degree of linear ($\sim$ 75%) or circular ($\sim$ 85%) polarisation.

A range of targets are utilised in the experimental programme. The Mainz/Dubna frozen spin target provides highly polarised ($\sim$90%) nucleons which can be spin aligned either longitudinally or transverse to the photon beam. Liquid hydrogen, deuterium and solid state targets are also available. Reaction products produced by the the photon beam impinging on the target are detected in the Crystal Ball (CB) and TAPS detector arrays. The CB comprises 672 NaI calorimeter elements, each $\sim$0.41m long and covering θ =20-160° with a close to complete azimuthal acceptance. The forward angle region is covered by an array of 384 BaF_2 and 72 $PbWO_4$ detectors. Charged particles incident on the Crystal Ball are tracked using a cylindrical Multi Wire Proportional Chamber. Protons, electrons and pions can be separated by $\Delta E - E$ techniques utilising a segmented cylinder of 4mm thick plastic scintillator. Charged Kaons which stop in the CB or TAPS can be identified by detecting their subsequent weak decay.

The research programme at the facility will enable new, precision data to challenge our understanding of nucleons, nuclei and mesons. The measurement programme of meson photoproduction from the nucleon will provide quality data to constrain the properties of nucleon resonances, establish the nucleon excitation spectrum and test chiral perturbative QCD predictions. Polarised Compton scattering from polarised nucleon targets will provide new, precise data to establish the polarizabilities of the nucleon. The intensity of the MAMI photon beam makes possible large statistical samples of photoproduced mesons such as η and η', allowing their decays to be studied in detail and rare decays used to test fundamental symmetries. Additionally a programme of measurements on nuclear targets will address physics topics including medium modification of hadrons, mesonic bound nuclei and precision nuclear structure. Recent highlights and future plans from the programme will be presented.

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