SPECTROSCOPY OF β - DELAYED CHARGED PARTICLES AT PROJECTILE FRAGMENT SEPARATORS

Z. Janas

Institute of Experimental Physics, Warsaw University, Poland

The first observation of the emission of particles from excited nuclear states populated in β-decay was reported already in the early days of nuclear physics when the "long-range α-particles" were observed by Rutherford during his studies on natural radioactive decay chains. The modern era in the field began in the 1960s, when the β-delayed proton decay has been observed and characterized. Since then a remarkable number of β-delayed proton and alpha emitters has been identified and it has been proven that studies of β-delayed charged particle emission provided a wide variety of spectroscopic information on the energies, spins and parities, isospins, widths and densities of nuclear levels involved in the decay as well as information on the β-decay properties of the precursor. In fact, the observation of β-delayed particle emission has often been used as a sensitive signature of the decay of unknown nuclei.

Studies of β-delayed particle emission gain their importance with the increasing distance from the valley of stability. More exotic neutron-deficient nuclei exhibit both higher decay energies and lower charged-particle separation energies. Far enough from stability β-delayed proton or alpha particle emission becomes a dominating decay mode.

In the last years the combination of the projectile fragmentation reaction and in-flight separation technique has been proven to be a powerful tool in producing nuclei at the limits of stability. Decay studies of very neutron-deficient projectile fragments lead to discovery of several new β-delayed proton emitters and allowed observation of exotic, β-delayed multiparticle decay modes.

In the talk, basic principles of the method will be described and the recent results of β-delayed particle emission studies at the fragment separators will be reviewed. Various possibilities of extracting interesting spectroscopic information from the β-delayed particle studies will be illustrated by the most representative examples. In this context, special emphasis will be put on the detection set-ups used in the β-delayed particle measurements at the fragment separators. In particular, limitations of the solid-state implantation technique will be discussed and alternative methods of charged particles detection will be presented.