

# $\beta$ -delayed charged particle decays of $^{22}\text{Si}$ and $^{23}\text{Si}$

*Tuesday, 9 June 2015 18:30 (1h 30m)*

Delayed charged particle spectroscopy following the  $\beta$  decay of nuclei at, or near, the proton drip line provides an excellent technique for studying the evolution of nuclear structure and testing isospin symmetry in weakly bound nuclei. The  $\beta$  decays of  $^{22,23}\text{Si}$  are particularly attractive cases since these are the lightest (bound) nuclei with ground-state isospin projections of  $T_z=-3$  and  $T_z=-5/2$ , respectively. Based on their large decay  $Q$ -values, a number of exotic charged-particle decay channels are potentially open including  $\beta$ -delayed proton ( $\beta p$ ),  $\beta^2 p$ , and  $\beta^3 p$ . To date, very limited spectroscopic information is available for the decays of these exotic nuclei.

In this work, a novel arrangement of three double-sided Si strip detectors (DSSD) surrounded by 16 high-purity Ge detectors of the Segmented Germanium Array (SeGA) was employed at the National Superconducting Cyclotron Laboratory (NSCL, USA) to characterize the  $\beta$ -delayed charged-particle decays of  $^{22}\text{Si}$ , and  $^{23}\text{Si}$ . Coincidences between the emitted charged particles detected in the DSSD and the  $\gamma$  rays detected in SeGA have revealed several previously unknown excited states in the daughter nuclei  $^{22}\text{Al}$  and  $^{23}\text{Al}$ , respectively. Evidence for previously unobserved decay pathways have also been deduced including several weak  $\beta$ -delayed proton branches and even the existence of  $\beta$ -delayed two proton emission from  $^{22}\text{Si}$ . In this presentation, I will present the detailed level schemes that have been deduced for the decays of  $^{22}\text{Si}$  and  $^{23}\text{Si}$  and discuss how this measurement will be used to provide one of the first experimental determinations of the ground-state masses of these nuclei.

**Primary authors:** Dr GRINYER, Geoffrey Fathom (GANIL); Mr BABO, Mathieu (GANIL)

**Co-authors:** Prof. GADE, Alexandra (Michigan State University); Dr KLOSE, Andrew (National Institute of Standards and Technology); Dr RATKIEWICZ, Andrew (Rutgers University); Dr BECERRIL REYES, Anna Delia (National Superconducting Cyclotron Laboratory, MSU); BROWN, B. Alex (National Superconducting Cyclotron Laboratory, MSU); Dr BAZIN, Daniel (National Superconducting Cyclotron Laboratory, MSU); Dr WEISSHAAR, Dirk (National Superconducting Cyclotron Laboratory, MSU); Mr MONTES, Fernando (NSCL); LORUSSO, Giuseppe (RIKEN); Dr CRAWFORD, Heather L. (LBNL); Mr SCHATZ, Hendrik (National Superconducting Cyclotron Laboratory, MSU); Dr PEREIRA, Jorge (National Superconducting Cyclotron Laboratory); Mr SMITH, Karl (University of Notre Dame); Dr GIMENEZ DEL SANTO, Marcelo (University of São Paulo); Prof. MANTICA, Paul F. (National Superconducting Cyclotron Laboratory, MSU); Dr VOSS, Philip J. (Simon Fraser University); Mr STROBERG, Ragnar (National Superconducting Cyclotron Laboratory, MSU); Mr WRINKLER, Ryan John (National Superconducting Cyclotron Laboratory, MSU); Dr WINKLER, Ryan (National Superconducting Cyclotron Laboratory, MSU); Mr MCDANIEL, Sean (MITRE Corporation); Dr GEORGE, Sebastian (Max-Planck-Institut fuer Kernphysik); Dr BAUGHER, Travis (Rutgers University); Dr SOPHIA, Vinnikova (National Superconducting Cyclotron Laboratory, MSU); Dr MEISEL, Zachary (National Superconducting Cyclotron Laboratory, MSU)

**Presenter:** Mr BABO, Mathieu (GANIL)

**Session Classification:** Poster session

**Track Classification:** At and beyond the dripline and new modes of radioactivity