Study of low-lying resonant states in $^{16}$F using an $^{15}$O radioactive ion beam

DONGWON LEE, LBNL, KARI PERAJARVI, STUK, Finland, JAMES POWELL, JIM O’NEIL, LBNL, DENNIS MOLTZ, University of California, Berkeley, VLADILEN GOLDBERG, Texas A&M University, JOSEPH CERNY, LBNL

— Among the $A=16$, $T=1$ isobaric triad, many states in $^{16}$O and $^{16}$N have been well established, but less has been reported about $^{16}$F. Experimental studies with stable beams have established spin-parity values for the first four low-lying states of $^{16}$F, but only upper limits or rough estimates of their level widths have been reported. The spins and parities of the low-lying states have been found to be $0^-$, $1^-$, $2^-$, and $3^-$ in ascending order in energy, and are believed to have $^{15}$O core-single proton configurations of $1p_{1/2}^- 2s_{1/2}$ for the $0^-$, $1^-$, and $1p_{1/2}^- 1d_{5/2}$ for the $2^-$, $3^-$. A recently developed $^{15}$O ($T_{1/2} = 122$ sec.) radioactive ion beam from the BEARS (Berkeley Experiments with Accelerated Radioactive Species) facility was used to study the structure of $^{16}$F using $^{15}$O+p elastic scattering and the Thick Target Inverse Kinematics method on a polyethylene target. The level widths of the first four states in $^{16}$F were determined using R-matrix analysis, and our results show that the $0^-$ state has a level width of $22.8 \pm 14.4$ keV, and that the broad $1^-$ state has a width of $103 \pm 12$ keV. The level width of the $2^-$ state is found to be $4.0 \pm 2.5$ keV which is much narrower than the compiled value, while $15.1 \pm 6.7$ keV for the $3^-$ state is in good agreement with previous studies.

Dongwon Lee
LBNL

Date submitted: 25 Jun 2007

Electronic form version 1.4