Spectroscopy of ^{19}Na via the ^{18}Ne + p resonant elastic scattering at the LLN-RIB facility[1]

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The structure of nuclei near the drip line is one of the major current interests in nuclear physics. Proton rich light nuclei are a striking example since the excited state structure is not known for many nuclei. Almost no spectroscopic information is available on ^{19}Na. Even though it is not far from stability, very little is known experimentally about its structure, there are no spin assignments, and only the location of the ground state and of the first excited state have been determined.

A collaboration led by the Louvain-la-Neuve group has performed an experiment to study the resonant elastic scattering reaction ^{18}Ne+p, using the intense ^{18}Ne beam at the LLN-RIB facility. The aim of the experiment was twofold: (i) to measure the width and the location of the second excited state of ^{19}Na, which according to the mirror nucleus ^{19}O should have spin $J^\pi = 1/2^+$; (ii) to complete a recent experiment at the SPIRAL facility which studied the ^{19}Na nuclei at higher energies.

The experimental method will be described. Briefly, a polyethylene target foil, $(CH2)_n$, was bombarded with a radioactive ^{18}Ne beam ($^{18}Ne^{2+}$ at 21 and 23.5 MeV and $^{18}Ne^{3+}$ at 28 MeV). The average beam intensity was of the order of 5×10^6 pps on target, and was kept stable for a few days for each of the three beam energies. The recoil protons were detected with the LEDA system [Louvain-Edinburgh-Detector-Array] at 32 different angles, $\theta_{\rm cm} = 90^\circ - 170^\circ$.

The on-line spectra clearly show the presence of a s-wave resonance which could be recognized as the second excited state of the proton rich nucleus ^{19}Na. This is the first time that this state has been experimentally observed. A preliminary energy calibration gives $E_{\rm R} \sim 1.0 - 1.1$ MeV and $\Gamma_{\rm p} \sim 100$ keV for this state, in good agreement with calculations using the Generated Coordinate Method. Preliminary results of a R-matrix analysis will be presented here.

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