Microscopic cluster model analysis of ^{14}O + p elastic scattering

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The ^{14}O + p elastic scattering is discussed in detail in a fully microscopic cluster model [1]. The ^{14}O cluster is described by a closed p shell for protons and a closed $p3/2$ subshell for neutrons in the harmonic-oscillator model. The nucleon-nucleon interaction is tuned on the energy levels of the ^{15}C mirror system. With the generator-coordinate [2] and microscopic R-matrix [3] methods, phase shifts and cross sections are calculated for the ^{14}O + p elastic scattering. An excellent agreement is found with recent experimental data [4], which present $1/2^+$ and $5/2^+$ resonances near 1.3 and 2.8 MeV, respectively. A comparison is performed with phenomenological R matrix fits, where the resonance properties (energy and width) are free parameters. Resonances properties in ^{15}F are discussed, and compared with data available in the literature [4]. Figure 1 shows the experimental cross section [4] at 180°, compared with the microscopic calculation and R-matrix fits at channel radii $a = 4$ fm and $a = 5$ fm.

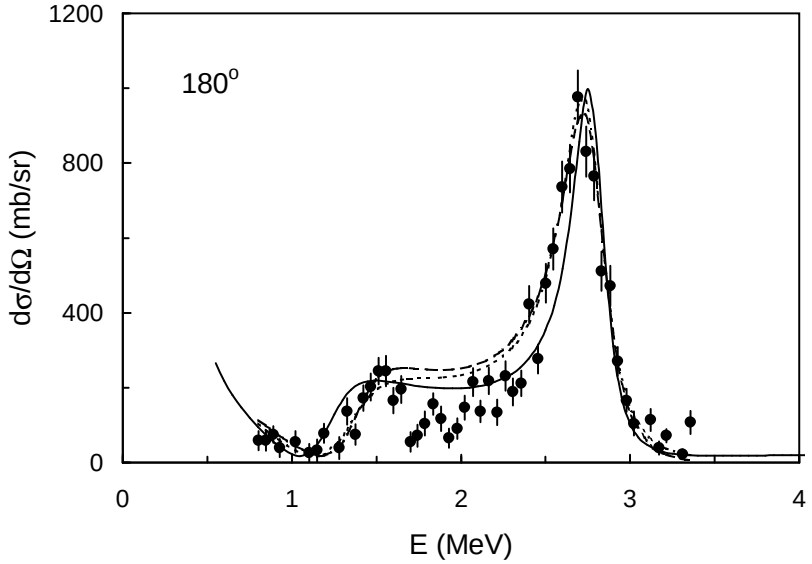

Figure 1: *Excitation functions for the ^{14}O + p elastic scattering at* 180° *calculated with the microscopic model (solid line) and with phenomenological R-matrix fits for a* = 4 *(dotted line) and 5 fm (dashed line). Experimental cross sections are from Ref. [4].*

[1] D. Baye, P. Descouvemont and F. Leo, submitted to Phys. Rev **C**.
[2] Y.C. Tang, in *Topics in Nuclear Physics II*, Lecture Notes in Physics, vol. **145** (Springer, Berlin, 1981), p. 572.
[3] D. Baye, P.-H. Heenen, and M. Libert-Heinemann, Nucl. Phys. **A291** (1977) 230.
[4] V.Z. Goldberg *et al.*, Phys. Rev. C **69** (2004) 031302.