

DETERMINATION OF RESONANCE PARAMETERS FOR $^{16}\text{O}+^{16}\text{O}$ ELASTIC SCATTERING

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Recent measurements^{1,2} have shown that molecular resonances exist for the $^{16}\text{O}+^{16}\text{O}$ system in the energy range $E_{c.m.}=15.5-18$ MeV. The J^{π} values of these resonances are unknown with the exception of the resonances around 16 MeV¹. They are, however, of great importance in order to clarify the resonance structure. In order to determine the unknown J^{π} values we have performed a phase shift analysis of high resolution $^{16}\text{O}+^{16}\text{O}$ elastic scattering data.

In this analysis the phases of the $l=8-12$ partial waves have been varied freely. For all other partial waves (up to $l=18$) optical model phases (Gobbi potential³) have been used. The phases show irregularities at the known resonance energies. This is shown in fig.1 which exhibits an Argand diagram for the

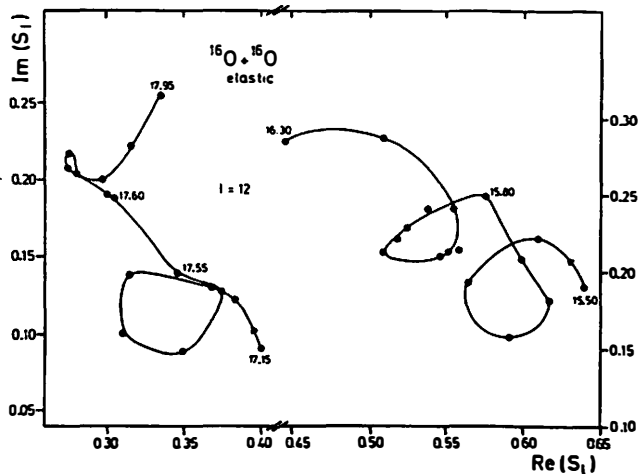


Fig. 1. Argand diagrams of the $l=12$ phases.

$l=12$ partial wave. Obviously this diagram contains pronounced loops indicative for the existence of true resonances. (Argand diagrams of the $l=8$ and $l=10$ partial waves show similar loops. The resonance energies E_R and the J^{π} values deduced from the phases are given in table 1.

The phases have also been used to calculate the total reaction cross section σ_R shown in fig.2. It agrees remarkably well with the total reaction cross section as obtained from the same data by means of the sum-of-differences method² (lower curve in fig.2).

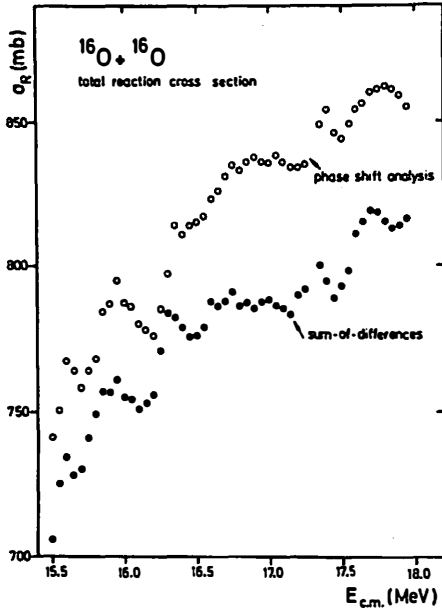


Fig. 2. Total reaction cross section.

J^{π} and σ_R values deduced in this work have been used to determine elastic widths of several resonances. It turns out that these widths are only a small portion of the single particle width. This shows that the observed resonances do not have a dinuclear structure.

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Table 1

Resonance energies E_R and J values of resonances in the $^{16}\text{O}+^{16}\text{O}$ system as obtained from the phase shift analysis.

E_R (MeV)	15.60	15.95	16.05	16.30	16.37	17.10	17.40
J	12	12	8	8	10	10	12

References

- 1 M. Gai et al., Phys.Rev.Lett. 47 (1981) 1878
- 2 W. Tiereth et al., Phys.Rev. C28 (1983) 735
- 3 A. Gobbi et al., Phys.Rev. C7 (1973) 30