UNIVERSIDADE DE SÃO PAULO

INSTITUTO DE FÍSICA
CAIXA POSTAL 20516
01000 - SÃO PAULO - SP
BRASIL

1 **publicações**

2 IFUSP/P-403

COULOMB EXCITATION OF ^{189}Os

by

S. Jha

Instituto de Engenharia Nuclear, Rio de Janeiro, Brasil

W.A. Seale, R.V. Ribas, E.W. Cybulska and M.N.Rao

Instituto de Física, Universidade de São Paulo

J.D. Rogers

Universidade de Campinas, Campinas, Brazil

G.M. Julian

Miami University, Ohio, U.S.A.

Maio/1983

Coulomb Excitation of ^{189}Os

S. Jha*
Instituto de Engenharia Nuclear, Rio de Janeiro, Brazil

W.A.Seale, R.V. Ribas†, E.W. Cybulska and M.N. Rao†
Instituto de Física, Universidade de São Paulo, São Paulo, Brazil

J.D. Rogers
Universidade de Campinas, Campinas, Brazil

and

G.M. Julian
Miami University, Ohio, U.S.A.

Coulomb excitation studies have been performed on enriched ^{189}Os target with 56 MeV ^{16}O beam. Gamma rays were measured in coincidence with the back scattered ^{16}O ions. Rotational bands built on $\frac{3}{2}^-[512]$, $\frac{1}{2}^-[510]$ up to spin 11/2 have been identified.

[NUCLEAR REACTION $^{189}Os(^{16}O,^{16}O')$; E = 56 MeV, enriched target measured E_γ, I_γ]

The structure of nuclei in the Os-Ir-Pt region has been the subject of several recent theoretical investigations, with essentially two contrasting points of view. On the one hand is the work of Meyer-ter-Vehn (Ref. 1) in which the spectra of the unique parity states of the odd-A nuclei in this region are described successfully by coupling a single j quasiparticle to rigid triaxially symmetric core, while on the other hand microscopic collective model calculations (Ref. 2) of potential energy surfaces predict soft triaxial shapes.

*Supported by CNPq and CNEN, Brazil; on sabbatical leave from the University of Cincinnati, Cincinnati, Ohio, U.S.A.

†Partially supported by CNPq, Brazil.

Experimentally, even though a reasonable amount of work has been published on the even Z - even N and odd Z - even N nuclei, the available information on even Z - odd N nuclei is still scant. In particular there has been no detailed Coulomb excitation studies of the odd-A Os nuclei.

In this note we present the results of an investigation of Coulomb excitation of ^{189}Os with a 56 MeV ^{16}O beam from the Pelletron tandem accelerator of the University of São Paulo. A thick ($\sim$ 100mg/cm^2) target was prepared by pressing enriched ($\gtrsim$ 95%) ^{189}Os powder onto a lead foil. The backscattered ^{16}O ions were detected in an annular silicon detector. A gamma-ray spectrum in coincidence with the backscattered ^{16}O ions was measured with a Ge(Li) detector at 0°, which subtended a large solid angle at the target in order to increase the coincidence efficiency. The observed gamma-ray energies and relative intensities (singles) are given in Table 1. A level scheme based on these results is presented in Fig. 1.

The rotational bands (Ref. 3,4) built on the ground ($3/2^-$) and the 36 keV ($1/2^-$) states are excited up to the spin of $11/2^-$. The $7/2^-$ state at 216.3 keV was previously believed not to be populated in Coulomb excitation (Ref. 5), whereas the present relative intensities are consistent with a strong populatio of this level. The level at 275.8 keV is known from the decay of ^{189}Ir and ^{189}Re. A comparison of the known and observed branching ratio of the 245 and 275 keV γ-rays leads to the double placement of the 245 keV γ-ray. Two levels at 622 and 346 keV were previously assigned to correspond to the $9/2^-$ levels in the two observed bands (Ref. 3,4). Based on our γ-ray energies we obtain 630.4 and 350 keV for these two states.

Seven levels between an excitation energy of 500 to 820 keV were known from the (d,d') work of ref. 3 with an ℓ-transfer of 2. We observe γ-rays corresponding to g.s. transitions from all seven levels. In addition, the

transitions which could correspond to the decay of the level at 557.5 keV to the 233.5 and 95.2 keV levels were seen. The γ-ray assigned as the g.s. transition from the 667.4 keV level shows a Doppler-broadened line shape in both the singles and the coincidence spectra. The analysis of the line shape of this γ-ray with a Monte-Carlo program is being performed to extract the lifetime of this level.

A few of the observed γ-rays of small relative intensity have not been placed on the level scheme. The other known or predicted bands viz., $7/2^-[514]$, $5/2^-[512]$, $1/2^-[521]$ and $11/2^+$ [615] were not considered in this work. The present level scheme and in particular the double placements of the 163.8, 146.7 and the 280.8 keV γ-rays are based only on level energy differences and a γ-γ coincidence experiment is planned to resolve the finer details of the level scheme. A comparison of the present results with calculations based on the different available models would be of interest.

REFERENCES

1. J. Meyer-Ter-Vehn, Nucl. Phys. A249 (1975) 111 and A249 (1975) 141.
2. V. Götz, H.C. Pauli, K. Adler and K. Junker, Nucl. Phys. A192 (1975) 141.
3. P. Morgen, D. Onsgaard, B.S. Nielsen and C. Sondergaard, Nucl. Phys. A252 (1975) 477.
4. D. Benson Jr., P. Kleinheinz and R.K. Sheline, Phys. Rev. C14 (1976) 2095.
5. A.Z. Hrynkiewicz, R. Sawicka, J. Styczen, S. Szymczyk and M. Szawlowski, Acta. Phys. Polonica, vol. XXXI (1967) 437.

TABLE 1. ENERGIES AND RELATIVE INTENSITIES (SINGLES) OF γ-RAYS IN ^{189}Os

$E_\gamma \pm 0.5$ a) (keV)	RELATIVE INTENSITY	$E_\gamma \pm 0.5$ (keV)	RELATIVE INTENSITY
138.6	10	397.2	31
146.7 b)	68	403.6 f)	10
149.5	109	410.9	27
154.5 c)	40	416 ± 1 g)	--
163.8 b)	26	428.5	12
185.5	160	462.4	(43) h)
186.6 d)	253	470.0 f)	(32) h)
188.6	87	481.0 f)	7
197.2	114	488.5 e)	9
205.7 e)	74	496.0 f)	6
216.5	581	499.9	7
219.2	1318	532.2	24
233.5	166	550.7 f)	9
245.0 b)	41	558.2 i)	36
270.6	6	565.7 f)	3
276.1	2	575 ± 1 j)	2
280.8 b)	53	585.3 f)	12
296.5	20	597.9 k)	7
323.6	13	603.3 f)	7
360.4 f)	3	628.0 f)	5
362.8 f)	5	634.2	7
371.5 d)	8	667.4	49
375.3	21	735.5	32
378.3	14	817. ± 1	7

a) γ-rays also seen in coincidence with backscattered ^{16}O ions

b) placed twice in the level scheme

c) ^{188}Os

d) ^{190}Os

e) ^{192}Os

f) unassigned

g) mixed with ^{26}Al 417 KeV γ in singles

h) on the tail of the Doppler-broadened ^{23}Na 440 keV γ-ray in singles

i) mixed with ^{190}Os γ-ray

j) could be the 794.3 → 219.2 keV transition

k) could be the 667.4 → 69.5 keV transition