

**Coulomb excitation 2010Di14**

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|-----------------|---------------------------|---------|-------------------|------------------------|
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**2010Di14:** E=2.95 MeV/nucleon <sup>73</sup>Ga beam was produced from the REX-ISOLDE facility via the U(p,X) reaction with 1.4 GeV protons. Targets were 1.7 mg/cm<sup>2</sup> <sup>120</sup>Sn or 2 mg/cm<sup>2</sup> <sup>104</sup>Pd.  $\gamma$  rays were detected with the MINIBALL array consisting of eight clusters of three HPGe crystals and charged particles were detected with a Compact Disk-shaped segmented double-sided silicon detector. Measured E $\gamma$ , I $\gamma$ , (particle) $\gamma\gamma$ -coin. Deduced levels, B(E2) values. Comparisons with available data.

<sup>73</sup>Ga Levels

| E(level) <sup>†</sup> | J $\pi$ <sup>‡</sup>                | Comments   |
|-----------------------|-------------------------------------|--|
| 0.0                   | 1/2 <sup>-</sup>                    |  |
| 0.4 4                 | 3/2 <sup>-</sup>                    | E(level): existence of a level near the 1/2 <sup>-</sup> g.s. is deduced from the observed Doppler-broadening of 199.2 $\gamma$ from the 199.2, 5/2 <sup>-</sup> level, which restricts the lifetime of the 5/2 <sup>-</sup> level considerably smaller than 3.5 ns (maximum time-of-flight between target and detector), consistent with the lifetime=3.3 ps from Weisskopf estimate for a pure 199-keV M1 transition to a level with J $\pi$ between 3/2 <sup>-</sup> and 7/2 <sup>-</sup> but not with 13 ns 2 from measured B(E2)(W.u.)=11 2 for the assumption of a pure E2 to 1/2 <sup>-</sup> g.s.<br>E(level): the energy of this level is estimated by <b>2010Di14</b> as 0.4 keV 4 from adopted E $\gamma$ =496.07 12 from 496 level and E $\gamma$ =218.08 11 and 278.5 3 cascade adding to 496.5 4. Energy is 0.15 keV 15 in Adopted Levels. |
| 199.2 5               | 5/2 <sup>-</sup>                    |  |
| 217.8 5               | 3/2 <sup>-</sup>                    |  |
| 496.2 5               | 5/2 <sup>-</sup> , 7/2 <sup>-</sup> | J $\pi$ : direct population of this state via Coulomb excitation from 1/2 <sup>-</sup> ground supports 5/2 <sup>-</sup> ( <b>2010Di14</b> ).   |
| 651.2 9               | (7/2 <sup>-</sup> )                 | The population of this state by Coulomb excitation from 1/2 <sup>-</sup> g.s. can only take place by a two-step process ( <b>2010Di14</b> ).   |
| 1395.1 12             | (5/2 <sup>-</sup> )                 | J $\pi$ : proposed by <b>2010Di14</b> from observed population compatible with single-step Coulomb excitation from 1/2 <sup>-</sup> g.s. A two-step excitation would require unreasonably large B(E2) values between this state and 3/2 <sup>-</sup> and 5/2 <sup>-</sup> states leading to strong $\gamma$ -decay branches to these states which however are not observed ( <b>2010Di14</b> ).<br>T <sub>1/2</sub> : 2.0 ps +6-5 from B(E2)(W.u.)=3.0 7 if 1395 $\gamma$ to 1/2 <sup>-</sup> g.s.   |

<sup>†</sup> From a least-squares fit to  $\gamma$ -ray energies.

<sup>‡</sup> From Adopted Levels, unless otherwise noted.

$\gamma$ (<sup>73</sup>Ga)

B(E2)(W.u.) values are extracted from experimental Coulomb excitation cross sections deduced from observed  $\gamma$ -ray yields normalized to the known cross section for excitation of the first 2<sup>+</sup> states in <sup>104</sup>Pd and <sup>120</sup>Sn targets (**2010Di14**).

| E $\gamma$ <sup>†</sup> | E <sub>i</sub> (level) | J $\pi$ <sub>i</sub>                | E <sub>f</sub> | J $\pi$ <sub>f</sub> | Mult. | Comments  |
|-------------------------|------------------------|-------------------------------------|----------------|----------------------|-------|---|
| 199.2 5                 | 199.2                  | 5/2 <sup>-</sup>                    | 0.4            | 3/2 <sup>-</sup>     |       | B(E2)(W.u.)=11 2 ( <b>2010Di14</b> )<br>5530 102 counts in 199 peak.  |
| 218.4 6                 | 217.8                  | 3/2 <sup>-</sup>                    | 0.0            | 1/2 <sup>-</sup>     |       | B(E2)(W.u.)=7.5 10 ( <b>2010Di14</b> )<br>2294 66 counts in 218 peak. |
| 279.0 7                 | 496.2                  | 5/2 <sup>-</sup> , 7/2 <sup>-</sup> | 217.8          | 3/2 <sup>-</sup>     |       | 161 29 counts in 279 peak.  |
| 298 2                   | 496.2                  | 5/2 <sup>-</sup> , 7/2 <sup>-</sup> | 199.2          | 5/2 <sup>-</sup>     |       |   |
| 434.0 15                | 651.2                  | (7/2 <sup>-</sup> )                 | 217.8          | 3/2 <sup>-</sup>     |       | 23 14 counts in 434 peak.   |
| 451.7 11                | 651.2                  | (7/2 <sup>-</sup> )                 | 199.2          | 5/2 <sup>-</sup>     |       | 68 19 counts in 452 peak.   |
| 495.8 5                 | 496.2                  | 5/2 <sup>-</sup> , 7/2 <sup>-</sup> | 0.4            | 3/2 <sup>-</sup>     |       | B(E2)(W.u.)=6.5 10 ( <b>2010Di14</b> )<br>1187 34 counts in 496 peak. |
| 651 2                   | 651.2                  | (7/2 <sup>-</sup> )                 | 0.4            | 3/2 <sup>-</sup>     |       | 49 9 counts in 651 peak.  |
| 1395.1 12               | 1395.1                 | (5/2 <sup>-</sup> )                 | 0.0            | 1/2 <sup>-</sup>     | [E2]  | B(E2)(W.u.)=3.0 7 ( <b>2010Di14</b> )                                 |

Continued on next page (footnotes at end of table)

**Coulomb excitation 2010Di14 (continued)** $\gamma(^{73}\text{Ga})$  (continued)

| $E_\gamma$ † | $E_i(\text{level})$ | Comments  |
|--------------|---------------------|---|
|              |                     | 42 7 counts in 1395 peak.<br>This $\gamma$ decays to g.s., $1/2^-$ and/or 0.4-keV, $3/2^-$ level. |

† From 2010Di14.

**Coulomb excitation 2010Di14**Level Scheme