

$^9\text{Be}(^{44}\text{S}, ^{42}\text{Si}\gamma)$ **2007Ba47,2006Fr13**

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen [#] and Balraj Singh		NDS 135, 1 (2016)	31-May-2016

2007Ba47 (also **2006GrZZ**): determination of first 2^+ state in $^9\text{Be}(^{44}\text{S}, ^{42}\text{Si}\gamma)$ reaction. The 39 MeV/nucleon ^{44}S beam from fragmentation of ^{48}Ca beam at 60 MeV/nucleon in the SISSI device at GANIL facility. Isotopic identification by energy loss and time-of-flight method. The nuclei produced in the second fragmentation were transmitted through the SPEG spectrometer, where a total of 132 nuclei were observed corresponding to a cross section of 0.80 mb *10* in **2007Ba47** (0.102 mb *26* in **2006GrZZ**). The γ ray detector array was 4π Chateau de Crystal consisting of 74 BaF₂ detectors.

2006Fr13 (also **2005Fr19**): $E(^{44}\text{S})=98.6$ MeV/nucleon secondary beam produced from fragmentation of ^{48}Ca beam at 140 MeV/nucleon with a ^9Be target. Fragments were separated by A1900 separator at NSCL, MSU facility. The ^{44}S beam impinged another ^9Be target and the residues were analyzed by S-800 spectrograph. The knockout residues were identified by time-of-flight, energy loss measurement, position and angle information. The γ rays were detected in coincidence with knockout residues of ^{42}Si using SeGA array of highly-segmented HPGe detectors.

Total cross section for $^{42}\text{Si}=0.12$ mb *2* in comparison with 0.32 mb from theoretical predictions, or 0.16 mb if suppression factor of ≈ 0.5 is used for two-nucleon shell-model strength. Calculations also predict 90% of the cross section for the population of the g.s., the contribution from the excited states to the total cross section is expected to be small (**2006Fr13**).

No discrete γ rays observed in this reaction (**2006Fr13**).

The results suggest $Z=14$ subshell closure and ^{42}Si as a doubly-magic nucleus (**2006Fr13**).

 ^{42}Si Levels

E(level)	J^π	Comments
0	0^+	Low energy of 2^+ state and comparison of measured half-life with QRPA calculations (2004Gr20) suggest that ^{42}Si is deformed and that there is collapse of $N=28$ closed shell at $Z=14$. But the small production cross section of ^{42}Si in both studies (2006Fr13 and 2007Ba47) suggest closed shell nature of ^{42}Si .
770 19	(2^+)	E(level): from 2007Ba47 .

 $\gamma(^{42}\text{Si})$

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
770 19	770	(2^+)	0	0^+	E_γ : from 2007Ba47 , γ observed in coincidence with ^{42}Si nuclei.

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Level Scheme

