Erratum: Covariant calculation of mesonic baryon decays [Phys. Rev. C 72, 015207 (2005)]

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TABLE I. Covariant predictions for π decay widths by the GBE CQM [7] and the OGE CQM [8] along the PFSM in comparison to experiment [9] and a relativistic calculation for the II CQM along the Bethe-Salpeter approach [6]. In the last two columns the nonrelativistic results from an EEM are given. In all cases the theoretical resonance masses as predicted by the various CQMs have been used in the calculations.

Decay $\to N\pi$	Experiment (MeV)	Relativistic			Nonrel. EEM	
		GBE	OGE	II	GBE	OGE
$N(1440)$	$(227 \pm 18)^{+70}_{-59}$	30	59	38	7	27
$N(1520)$	$(66 \pm 6)^{+9}_{-5}$	21	23	38	38	37
$N(1535)$	$(67 \pm 15)^{+28}_{-17}$	25	39	33	559	1183
$N(1650)$	$(109 \pm 26)^{+36}_{-3}$	6.3	9.9	3	157	352
$N(1675)$	$(68 \pm 8)^{+14}_{-4}$	8.4	10.4	4	13	16
$N(1700)$	$(10 \pm 5)^{+3}_{-3}$	1.0	1.3	0.1	2.2	2.7
$N(1710)$	$(15 \pm 5)^{+30}_{-5}$	19	21	n/a[a]	8	6
$\Delta(1232)$	$(119 \pm 1)^{+5}_{-5}$	35	31	62	89	85
$\Delta(1600)$	$(61 \pm 26)^{+26}_{-10}$	0.5	5.1	n/a	93	86
$\Delta(1620)$	$(38 \pm 8)^{+8}_{-6}$	1.2	2.8	4	76	177
$\Delta(1700)$	$(45 \pm 15)^{+20}_{-10}$	3.8	4.1	2	10.4	9.1

[a]Not available.

Recently we have presented covariant predictions for π and η decay modes of N and Δ resonances from relativistic constituent quark models (RCQMs) based on one-gluon-exchange (OGE) and Goldstone-boson-exchange (GBE) dynamics [1]. The results were calculated with a spectator-model decay operator in point-form relativistic quantum mechanics (PFSM). Unfortunately, we encountered an error in the computer code, which was found only now upon developing the program completely anew. The bug sat in the Lorentz boost transformations on the residual nucleon state, which were calculated with an incorrect mass value for the nucleon.

TABLE II. Same as Table I but with experimental resonance masses instead of the theoretical ones.

Decay $\to N\pi$	Experiment (MeV)	Relativistic		Nonrel. EEM	
		GBE	OGE	GBE	OGE
$N(1440)$	$(227 \pm 18)^{+70}_{-59}$	28	39	6	14
$N(1520)$	$(66 \pm 6)^{+9}_{-5}$	22	23	38	36
$N(1535)$	$(67 \pm 15)^{+28}_{-17}$	24	38	579	1231
$N(1650)$	$(109 \pm 26)^{+36}_{-3}$	6.3	10.5	158	327
$N(1675)$	$(68 \pm 8)^{+14}_{-4}$	9.1	9.9	15	15
$N(1700)$	$(10 \pm 5)^{+3}_{-3}$	1.1	1.3	2.9	2.9
$N(1710)$	$(15 \pm 5)^{+30}_{-5}$	15	12	6.0	3.2
$\Delta(1232)$	$(119 \pm 1)^{+5}_{-5}$	33	31	81	85
$\Delta(1600)$	$(61 \pm 26)^{+26}_{-10}$	0.2	2.4	56	31
$\Delta(1620)$	$(38 \pm 8)^{+8}_{-6}$	1.4	2.8	74	176
$\Delta(1700)$	$(45 \pm 15)^{+20}_{-10}$	4.6	5.4	14	14

The corrected results are presented in Tables I–VII. They replace the tables with the same numbers in the original paper [1]. All the numerical values for decay widths from our PFSM calculations of mesonic decays reported previously [2–5] must now be considered as obsolete and should be replaced by the ones given here.

Although some of the predictions for the π and η decay widths are changed considerably, the main conclusions of our previous works remain fully valid. In particular, the relativistic effects still turn out to be very large. The covariant results show a behavior completely different from the nonrelativistic ones. The direct relativistic predictions from both the OGE and GBE RCQMs always underestimate the experimental data. The results are still congruent with the ones found by the Bonn group along a Bethe-Salpeter approach [6]; in fact their pattern has now become even more similar to the predictions of the instanton-induced (II) RCQM. The deficiencies in the comparison to experimental data demonstrate a principal shortcoming of the decay mechanism applied so far.

TABLE III. Covariant predictions for π decay widths of the GBE, OGE, and II CQMs (as in Table I) presented as percentages of the experimental π decay widths in comparison to experimental $N\pi\pi$ branching ratios.

Decays $\to N\pi$	J^P	Experiment (MeV)	Relativistic			% of Exp. Width			Experimental $N\pi\pi$ branching ratio
			GBE	OGE	II	GBE	OGE	II	
$N(1440)$	$\frac{1}{2}^+$	$(227 \pm 18)^{+70}_{-59}$	30	59	38	13	26	17	30–40%
$N(1520)$	$\frac{3}{2}^-$	$(66 \pm 6)^{+9}_{-5}$	21	23	38	32	35	58	40–50%
$N(1535)$	$\frac{1}{2}^-$	$(67 \pm 15)^{+28}_{-17}$	25	39	33	37	58	49	1–10%
$N(1650)$	$\frac{1}{2}^-$	$(109 \pm 26)^{+36}_{-3}$	6.3	9.9	3	6	9	3	10–20%
$N(1675)$	$\frac{5}{2}^-$	$(68 \pm 8)^{+14}_{-4}$	8.4	10.4	4	12	15	6	50–60%
$N(1700)$	$\frac{3}{2}^-$	$(10 \pm 5)^{+3}_{-3}$	1.0	1.3	0.1	10	13	1	85–95%
$N(1710)$	$\frac{1}{2}^+$	$(15 \pm 5)^{+30}_{-5}$	19	21	n/a[a]	127	140	n/a	40–90%
$\Delta(1232)$	$\frac{3}{2}^+$	$(119 \pm 1)^{+5}_{-5}$	35	31	62	29	26	52	n/a
$\Delta(1600)$	$\frac{3}{2}^+$	$(61 \pm 26)^{+26}_{-10}$	0.5	5.1	n/a	1	8	n/a	75–90%
$\Delta(1620)$	$\frac{1}{2}^-$	$(38 \pm 8)^{+8}_{-6}$	1.2	2.8	4	3	7	11	70–80%
$\Delta(1700)$	$\frac{3}{2}^-$	$(45 \pm 15)^{+20}_{-10}$	3.8	4.1	2	8	9	4	80–90%

[a]Not available.

In view of the corrected values for decay widths the following new qualifications of the results must now be made in detail.

The results for the π decay mode of $N(1520)$, $N(1535)$, $N(1650)$, and the $\Delta(1620)$ come much closer to the ones of the Bonn group without significantly moving the remaining ones away. Furthermore, the $N(1535)$ played an exceptional role in our previous results, because its π decay width had been found to be large enough to be congruent with the experimental value. In the corrected results we now observe also an underestimation of the experimental width in this channel. This is much more consistent with the rest of the decays and also with the observations of the Bonn group.

Regarding the η decay widths, we find them also reduced in the cases of $N(1535)$ and $N(1650)$, where sizable values are reported from experiment. For the remaining nucleon resonances the η decay widths remain rather small.

Generally, the observations made in Ref. [1] remain valid. The main conclusions of the original paper are not affected.

TABLE IV. Covariant predictions for η decay widths by the GBE CQM [7] and the OGE CQM [8] along the PFSM in comparison to experiment [9]. In the last two columns the nonrelativistic results from an EEM are given. In all cases the theoretical resonance masses as predicted by the various CQMs have been used in the calculations.

Decay $\to N\eta$	Experiment (MeV)	Relativistic		Nonrel. EEM	
		GBE	OGE	GBE	OGE
$N(1520)$	$(0.28 \pm 0.05)^{+0.03}_{-0.01}$	0.1	0.1	0.04	0.04
$N(1535)$	$(64 \pm 19)^{+28}_{-28}$	27	35	127	236
$N(1650)$	$(10 \pm 5)^{+4}_{-1}$	50	74	283	623
$N(1675)$	$(0 \pm 1.5)^{+0.3}_{-0.1}$	1.5	2.4	1.1	1.8
$N(1700)$	$(0 \pm 1)^{+0.5}_{-0.5}$	0.5	0.9	0.2	0.3
$N(1710)$	$(6 \pm 1)^{+11}_{-4}$	0.02	0.06	2.9	9.3

TABLE V. Same as Table III but with experimental resonance masses instead of the theoretical ones.

Decay $\to N\eta$	Experiment (MeV)	Relativistic		Nonrel. EEM	
		GBE	OGE	GBE	OGE
$N(1520)$	$(0.28 \pm 0.05)^{+0.03}_{-0.01}$	0.1	0.1	0.05	0.04
$N(1535)$	$(64 \pm 19)^{+28}_{-28}$	30	39	155	283
$N(1650)$	$(10 \pm 5)^{+4}_{-1}$	50	69	286	543
$N(1675)$	$(0 \pm 1.5)^{+0.3}_{-0.1}$	2.0	2.0	1.6	1.5
$N(1700)$	$(0 \pm 1)^{+0.5}_{-0.5}$	0.9	1.0	0.4	0.3
$N(1710)$	$(6 \pm 1)^{+11}_{-4}$	0.05	0.27	2.2	4.6

TABLE VI. Scaled predictions for π decay widths by the GBE CQM [7] and OGE CQM [8] along the PFSM in comparison to results existing in the literature from calculations along PCMs by Stancu and Stassart [10] (SS), by Capstick and Roberts [11] (CR), and by Theussl *et al.* [8] (TWDP).

Decay $\to N\pi$	Experiment [9] [MeV]	PFSM		PCM		
		GBE	OGE	SS	CR	TWDP
$N(1440)$	$(227 \pm 18)^{+70}_{-59}$	102	227	433	493	517
$N(1520)$	$(66 \pm 6)^{+9}_{-5}$	71	88	71	100	131
$N(1535)$	$(67 \pm 15)^{+28}_{-17}$	85	150	40	207	336
$N(1650)$	$(109 \pm 26)^{+36}_{-3}$	21	38	5.3	115	53
$N(1675)$	$(68 \pm 8)^{+14}_{-4}$	29	38	31	33	34
$N(1700)$	$(10 \pm 5)^{+3}_{-3}$	3.4	5.0	17	36	6
$N(1710)$	$(15 \pm 5)^{+30}_{-5}$	65	81	3.2	12	54
$\Delta(1232)$	$(119 \pm 1)^{+5}_{-5}$	119	119	115	104	120
$\Delta(1600)$	$(61 \pm 26)^{+26}_{-10}$	1.7	20	0.04	40	43
$\Delta(1620)$	$(38 \pm 8)^{+8}_{-6}$	4.1	11	0.4	21	26
$\Delta(1700)$	$(45 \pm 15)^{+20}_{-10}$	20	16	23	27	28

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TABLE VII. Predictions for π decay widths by the GBE CQM [7] and OGE CQM [8] along the PFSM for different magnitudes of the quark-meson coupling constant $g_{qq\pi}$.

Decay $\to N\pi$	Experiment	$\frac{g_{qq\pi}^2}{4\pi} = 0.67$		$\frac{g_{qq\pi}^2}{4\pi} = 0.82$		$\frac{g_{qq\pi}^2}{4\pi} = 1.19$	
		GBE	OGE	GBE	OGE	GBE	OGE
$N(1440)$	$(227 \pm 18)^{+70}_{-59}$	30	59	37	72	53	105
$N(1520)$	$(66 \pm 6)^{+9}_{-5}$	21	23	26	28	37	41
$N(1535)$	$(67 \pm 15)^{+28}_{-17}$	25	39	31	48	45	69
$N(1650)$	$(109 \pm 26)^{+36}_{-3}$	6.3	9.9	7.7	12	11	18
$N(1675)$	$(68 \pm 8)^{+14}_{-4}$	8.4	10	10	12	11	18
$N(1700)$	$(10 \pm 5)^{+3}_{-3}$	1.0	1.3	1.2	1.6	1.8	2.3
$N(1710)$	$(15 \pm 5)^{+30}_{-5}$	19	21	23	26	34	37
$\Delta(1232)$	$(119 \pm 1)^{+5}_{-5}$	35	31	43	38	62	55
$\Delta(1600)$	$(61 \pm 26)^{+26}_{-10}$	0.5	5.1	0.6	6.2	0.9	9.1
$\Delta(1620)$	$(38 \pm 8)^{+8}_{-6}$	1.2	2.8	1.5	3.4	2.1	5.0
$\Delta(1700)$	$(45 \pm 15)^{+20}_{-10}$	3.8	4.1	4.6	5.0	6.8	7.3

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