Table 1 Revised. NaK $3^1\Pi$(v, J, e/f)←$2(A)^1\Sigma^+$(v', J', e)←$1(X)^1\Sigma^+$(v", J", e) transitions identified in this experiment, and comparison between the experimentally measured energies of the $3^1\Pi$(v, J, e/f) ro-vibrational levels (referenced to the bottom of the ground state well) and the energies obtained from the molecular state constants (Table 2) obtained in this work. The uncertainty in each measured level energy is taken to be 0.02 cm^{-1}.

$3^1\Pi$ (v, J, e/f)	$2(A)^1\Sigma^+$ (v', J', e)	$1(X)^1\Sigma^+$ (v", J", e)	PUMP frequency (cm^{-1})	PROBE frequency (cm^{-1})	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) measured value	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) calculated value	E[meas.]-E[calc.] (cm^{-1})
4, 9, e	16, 10, e	0, 11, e	13349.1088	12311.9690	25735.4980	25735.4813	0.01669
4, 10, f	16, 10, e	0, 11, e	13349.1088	12313.0810	25736.6100	25736.5950	0.01499
4, 11, e	16, 10, e	0, 11, e	13349.1088	12314.3097	25737.8387	25737.8243	0.01436
5, 9, e	16, 10, e	0, 11, e	13349.1088	12357.1595	25780.6885	25780.6821	0.00644
5, 10, f	16, 10, e	0, 11, e	13349.1088	12358.2588	25781.7878	25781.7822	0.00564
5, 11, e	16, 10, e	0, 11, e	13349.1088	12359.4712	25783.0002	25782.9965	0.00365
6, 9, e	16, 10, e	0, 11, e	13349.1088	12401.7566	25825.2856	25825.2816	0.00401
6, 10, f	16, 10, e	0, 11, e	13349.1088	12402.8419	25826.3709	25826.3677	0.00323
6, 11, e	16, 10, e	0, 11, e	13349.1088	12404.0398	25827.5688	25827.5666	0.00216
7, 9, e	16, 10, e	0, 11, e	13349.1088	12445.6923	25869.2213	25869.2323	-0.01102
7, 10, f	16, 10, e	0, 11, e	13349.1088	12446.7583	25870.2873	25870.3040	-0.01665
7, 11, e	16, 10, e	0, 11, e	13349.1088	12447.9684	25871.4974	25871.4870	0.01037
8, 9, e	16, 10, e	0, 11, e	13349.1088	12488.9479	25912.4769	25912.4867	-0.00979
8, 10, f	16, 10, e	0, 11, e	13349.1088	12490.0062	25913.5352	25913.5434	-0.00823
8, 11, e	16, 10, e	0, 11, e	13349.1088	12491.1718	25914.7008	25914.7101	-0.00934
9, 9, e	16, 10, e	0, 11, e	13349.1088	12531.4555	25954.9845	25954.9971	-0.01260
9, 10, f	16, 10, e	0, 11, e	13349.1088	12532.4955	25956.0245	25956.0385	-0.01403
9, 11, e	16, 10, e	0, 11, e	13349.1088	12533.6440	25957.1730	25957.1884	-0.01538
10, 9, e	16, 10, e	0, 11, e	13349.1088	12573.1742	25996.7032	25996.7160	-0.01278
10, 10, f	16, 10, e	0, 11, e	13349.1088	12574.2090	25997.7380	25997.7417	-0.00366
10, 11, e	16, 10, e	0, 11, e	13349.1088	12575.3447	25998.8737	25998.8742	-0.00049
11, 10, f	16, 10, e	0, 11, e	13349.1088	12615.1016	26038.6306	26038.6052	0.02535
12, 9, e	16, 10, e	0, 11, e	13349.1088	12654.0344	26077.5634	26077.5888	-0.02543
12, 10, f	16, 10, e	0, 11, e	13349.1088	12655.0290	26078.5580	26078.5817	-0.02371
12, 11, e	16, 10, e	0, 11, e	13349.1088	12656.1256	26079.6546	26079.6782	-0.02358
14, 9, e	16, 10, e	0, 11, e	13349.1088	12731.1754	26154.7044	26154.7246	-0.02018
14, 10, f	16, 10, e	0, 11, e	13349.1088	12732.1348	26155.6638	26155.6829	-0.01914
14, 11, e	16, 10, e	0, 11, e	13349.1088	12733.1952	26156.7242	26156.7414	-0.01724
15, 9, e	16, 10, e	0, 11, e	13349.1088	12768.3143	26191.8433	26191.7721	0.07120
15, 10, f	16, 10, e	0, 11, e	13349.1088	12769.1494	26192.6784	26192.7125	-0.03415
15, 11, e	16, 10, e	0, 11, e	13349.1088	12770.2181	26193.7471	26193.7513	-0.00425
3, 17, e	16, 18, e	0, 17, e	13346.7649	12264.1085	25701.8069	25701.9059	-0.09903
3, 18, f	16, 18, e	0, 17, e	13346.7649	12266.2372	25703.9356	25703.9258	0.00978
3, 19, e	16, 18, e	0, 17, e	13346.7649	12268.3728	25706.0712	25706.0710	0.00023
4, 17, e	16, 18, e	0, 17, e	13346.7649	12309.8205	25747.5189	25747.5184	0.00049
4, 18, f	16, 18, e	0, 17, e	13346.7649	12311.8198	25749.5182	25749.5147	0.00351
4, 19, e	16, 18, e	0, 17, e	13346.7649	12313.9349	25751.6333	25751.6349	-0.00164
5, 17, e	16, 18, e	0, 17, e	13346.7649	12354.8777	25792.5761	25792.5726	0.00351
5, 18, f	16, 18, e	0, 17, e	13346.7649	12356.8507	25794.5491	25794.5445	0.00461
5, 19, e	16, 18, e	0, 17, e	13346.7649	12358.9425	25796.6409	25796.6390	0.00188
6, 17, e	16, 18, e	0, 17, e	13346.7649	12399.3190	25837.0174	25837.0209	-0.00349
6, 18, f	16, 18, e	0, 17, e	13346.7649	12401.2666	25838.9650	25838.9676	-0.00263

$3^1\Pi$ (v, J, e/f)	$2(A)^1\Sigma^+$ (v', J', e)	$1(X)^1\Sigma^+$ (v", J", e)	PUMP frequency (cm^{-1})	PROBE frequency (cm^{-1})	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) measured value	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) calculated value	E[meas.]-E[calc.] (cm^{-1})
6, 19, e	16, 18, e	0, 17, e	13346.7649	12403.3202	25841.0186	25841.0356	-0.01702
7, 17, e	16, 18, e	0, 17, e	13346.7649	12443.1087	25880.8071	25880.8157	-0.00863
7, 18, f	16, 18, e	0, 17, e	13346.7649	12445.0321	25882.7305	25882.7365	-0.00604
7, 19, e	16, 18, e	0, 17, e	13346.7649	12447.0709	25884.7693	25884.7772	-0.00786
8, 17, e	16, 18, e	0, 17, e	13346.7649	12486.2040	25923.9024	25923.9095	-0.00714
8, 18, f	16, 18, e	0, 17, e	13346.7649	12488.0981	25925.7965	25925.8036	-0.00713
8, 19, e	16, 18, e	0, 17, e	13346.7649	12490.1088	25927.8072	25927.8161	-0.00887
9, 17, e	16, 18, e	0, 17, e	13346.7649	12528.5493	25966.2477	25966.2547	-0.00703
9, 18, f	16, 18, e	0, 17, e	13346.7649	12530.4195	25968.1179	25968.1213	-0.00343
9, 19, e	16, 18, e	0, 17, e	13346.7649	12532.4004	25970.0988	25970.1048	-0.00596
10, 17, e	16, 18, e	0, 17, e	13346.7649	12570.1322	26007.8306	26007.8037	0.02688
10, 18, f	16, 18, e	0, 17, e	13346.7649	12571.9773	26009.6757	26009.6420	0.03365
10, 19, e	16, 18, e	0, 17, e	13346.7649	12573.9229	26011.6213	26011.5957	0.02565
3, 18, e	16, 19, e	0, 18, e	13345.6738	12263.9199	25703.9421	25703.9326	0.00946
3, 19, f	16, 19, e	0, 18, e	13345.6738	12266.0485	25706.0707	25706.0634	0.00731
3, 20, e	16, 19, e	0, 18, e	13345.6738	12268.2982	25708.3204	25708.3208	-0.00037
4, 18, e	16, 19, e	0, 18, e	13345.6738	12309.5005	25749.5227	25749.5215	0.00119
4, 19, f	16, 19, e	0, 18, e	13345.6738	12311.6104	25751.6326	25751.6274	0.00524
4, 20, e	16, 19, e	0, 18, e	13345.6738	12313.8343	25753.8565	25753.8585	-0.00205
5, 18, e	16, 19, e	0, 18, e	13345.6738	12354.5311	25794.5533	25794.5513	0.00199
5, 19, f	16, 19, e	0, 18, e	13345.6738	12356.6137	25796.6359	25796.6314	0.00446
5, 20, e	16, 19, e	0, 18, e	13345.6738	12358.8147	25798.8369	25798.8356	0.00134
6, 18, e	16, 19, e	0, 18, e	13345.6738	12398.9513	25838.9735	25838.9745	-0.00095
6, 19, f	16, 19, e	0, 18, e	13345.6738	12401.0073	25841.0295	25841.0280	0.00146
6, 20, e	16, 19, e	0, 18, e	13345.6738	12403.1830	25843.2052	25843.2042	0.00096
7, 18, e	16, 19, e	0, 18, e	13345.6738	12442.7140	25882.7362	25882.7434	-0.00716
7, 19, f	16, 19, e	0, 18, e	13345.6738	12444.7434	25884.7656	25884.7696	-0.00398
7, 20, e	16, 19, e	0, 18, e	13345.6738	12446.8859	25886.9081	25886.9170	-0.00889
8, 18, e	16, 19, e	0, 18, e	13345.6738	12485.7827	25925.8049	25925.8105	-0.00555
8, 19, f	16, 19, e	0, 18, e	13345.6738	12487.7837	25927.8059	25927.8085	-0.00259
8, 20, e	16, 19, e	0, 18, e	13345.6738	12489.8965	25929.9187	25929.9262	-0.00755
9, 18, e	16, 19, e	0, 18, e	13345.6738	12528.0995	25968.1217	25968.1281	-0.00645
9, 19, f	16, 19, e	0, 18, e	13345.6738	12530.0722	25970.0944	25970.0972	-0.00278
9, 20, e	16, 19, e	0, 18, e	13345.6738	12532.1563	25972.1785	25972.1844	-0.00592
10, 18, e	16, 19, e	0, 18, e	13345.6738	12569.6598	26009.6820	26009.6489	0.03313
10, 19, f	16, 19, e	0, 18, e	13345.6738	12571.5976	26011.6198	26011.5881	0.03173
10, 20, e	16, 19, e	0, 18, e	13345.6738	12573.7503	26013.7725	26013.6439	0.12856
12, 18, e	16, 19, e	0, 18, e	13345.6738	12650.0823	26090.1045	26090.1091	-0.00456
12, 19, f	16, 19, e	0, 18, e	13345.6738	12651.9633	26091.9855	26091.9862	-0.00065
12, 20, e	16, 19, e	0, 18, e	13345.6738	12653.9508	26093.9730	26093.9767	-0.00366
14, 18, e	16, 19, e	0, 18, e	13345.6738	12726.7886	26166.8108	26166.8104	0.00041
14, 19, f	16, 19, e	0, 18, e	13345.6738	12728.6043	26168.6265	26168.6221	0.00441
14, 20, e	16, 19, e	0, 18, e	13345.6738	12730.5246	26170.5468	26170.5438	0.00301
15, 18, e	16, 19, e	0, 18, e	13345.6738	12763.6080	26203.6302	26203.6325	-0.00234
15, 19, f	16, 19, e	0, 18, e	13345.6738	12765.3904	26205.4126	26205.4103	0.00230
15, 20, e	16, 19, e	0, 18, e	13345.6738	12767.2741	26207.2963	26207.2963	0.00000
3, 29, e	16, 30, e	0, 31, e	13317.5770	12260.1176	25733.5974	25733.5551	0.04232
3, 30, f	16, 30, e	0, 31, e	13317.5770	12263.4950	25736.9748	25736.8905	0.08427
4, 29, e	16, 30, e	0, 31, e	13317.5770	12305.2649	25778.7447	25778.7992	-0.05455
4, 30, f	16, 30, e	0, 31, e	13317.5770	12308.5936	25782.0734	25782.0957	-0.02230

$3^1\Pi$ (v, J, e/f)	$2(A)^1\Sigma^+$ (v', J', e)	$1(X)^1\Sigma^+$ (v'', J'', e)	PUMP frequency (cm^{-1})	PROBE frequency (cm^{-1})	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) measured value	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) calculated value	E[meas.]-E[calc.] (cm^{-1})
4, 31, e	16, 30, e	0, 31, e	13317.5770	12312.0563	25785.5361	25785.5373	-0.00115
5, 29, e	16, 30, e	0, 31, e	13317.5770	12349.9868	25823.4666	25823.4729	-0.00633
5, 30, f	16, 30, e	0, 31, e	13317.5770	12353.2503	25826.7301	25826.7291	0.00100
5, 31, e	16, 30, e	0, 31, e	13317.5770	12356.6406	25830.1204	25830.1291	-0.00866
6, 29, e	16, 30, e	0, 31, e	13317.5770	12394.0477	25867.5275	25867.5286	-0.00106
6, 30, f	16, 30, e	0, 31, e	13317.5770	12397.2682	25870.7480	25870.7431	0.00486
6, 31, e	16, 30, e	0, 31, e	13317.5770	12400.6214	25874.1012	25874.1002	0.00104
7, 29, e	16, 30, e	0, 31, e	13317.5770	12437.4289	25910.9087	25910.9186	-0.00985
7, 30, f	16, 30, e	0, 31, e	13317.5770	12440.6144	25914.0942	25914.0902	0.00395
7, 31, e	16, 30, e	0, 31, e	13317.5770	12443.9012	25917.3810	25917.4030	-0.02199
8, 29, e	16, 30, e	0, 31, e	13317.5770	12480.1146	25953.5944	25953.5953	-0.00092
8, 30, f	16, 30, e	0, 31, e	13317.5770	12483.2496	25956.7294	25956.7228	0.00656
8, 31, e	16, 30, e	0, 31, e	13317.5770	12486.5101	25959.9899	25959.9900	-0.00007
9, 29, e	16, 30, e	0, 31, e	13317.5770	12522.0334	25995.5132	25995.5113	0.00191
9, 30, f	16, 30, e	0, 31, e	13317.5770	12525.1214	25998.6012	25998.5933	0.00787
9, 31, e	16, 30, e	0, 31, e	13317.5770	12528.3237	26001.8035	26001.8135	-0.01001
10, 29, e	16, 30, e	0, 31, e	13317.5770	12563.1549	26036.6347	26036.6189	0.01583
10, 30, f	16, 30, e	0, 31, e	13317.5770	12566.2023	26039.6821	26039.6541	0.02795
10, 31, e	16, 30, e	0, 31, e	13317.5770	12569.3974	26042.8772	26042.8260	0.05117
11, 30, f	16, 30, e	0, 31, e	13317.5770	12606.3892	26079.8690	26079.8577	0.01129
11, 31, e	16, 30, e	0, 31, e	13317.5770	12609.5031	26082.9829	26082.9800	0.00294
12, 29, e	16, 30, e	0, 31, e	13317.5770	12642.7376	26116.2174	26116.2186	-0.00118
12, 30, f	16, 30, e	0, 31, e	13317.5770	12645.6761	26119.1559	26119.1564	-0.00053
12, 31, e	16, 30, e	0, 31, e	13317.5770	12648.7406	26122.2204	26122.2277	-0.00732
13, 29, e	16, 30, e	0, 31, e	13317.5770	12681.1249	26154.6047	26154.6156	-0.01085
13, 30, f	16, 30, e	0, 31, e	13317.5770	12684.0316	26157.5114	26157.5027	0.00866
13, 31, e	16, 30, e	0, 31, e	13317.5770	12687.0473	26160.5271	26160.5217	0.00539
14, 29, e	16, 30, e	0, 31, e	13317.5770	12718.5394	26192.0192	26192.0138	0.00538
14, 30, f	16, 30, e	0, 31, e	13317.5770	12721.3812	26194.8610	26194.8490	0.01195
14, 31, e	16, 30, e	0, 31, e	13317.5770	12724.3361	26197.8159	26197.8144	0.00152
15, 29, e	16, 30, e	0, 31, e	13317.5770	12754.8790	26228.3588	26228.3658	-0.00700
15, 30, f	16, 30, e	0, 31, e	13317.5770	12757.6655	26231.1453	26231.1478	-0.00248
15, 31, e	16, 30, e	0, 31, e	13317.5770	12760.5643	26234.0441	26234.0581	-0.01402
4, 42, e	17, 43, e	1, 44, e	13236.4530	12222.5443	25830.2179	25830.2355	-0.01757
4, 43, f	17, 43, e	1, 44, e	13236.4530	12227.2200	25834.8936	25834.8938	-0.00018
4, 44, e	17, 43, e	1, 44, e	13236.4530	12232.0388	25839.7124	25839.7318	-0.01936
5, 42, e	17, 43, e	1, 44, e	13236.4530	12266.5997	25874.2733	25874.2847	-0.01142
5, 43, f	17, 43, e	1, 44, e	13236.4530	12271.2179	25878.8915	25878.8861	0.00539
5, 44, e	17, 43, e	1, 44, e	13236.4530	12275.9788	25883.6524	25883.6659	-0.01350
6, 42, e	17, 43, e	1, 44, e	13236.4530	12310.0171	25917.6907	25917.6957	-0.00500
6, 43, f	17, 43, e	1, 44, e	13236.4530	12314.5816	25922.2552	25922.2383	0.01691
6, 44, e	17, 43, e	1, 44, e	13236.4530	12319.2831	25926.9567	25926.9580	-0.00130
7, 42, e	17, 43, e	1, 44, e	13236.4530	12352.8096	25960.4832	25960.4208	0.06238
7, 43, f	17, 43, e	1, 44, e	13236.4530	12357.1609	25964.8345	25964.9028	-0.06826
7, 44, e	17, 43, e	1, 44, e	13236.4530	12361.8995	25969.5731	25969.5605	0.01261
8, 42, e	17, 43, e	1, 44, e	13236.4530	12394.7618	26002.4354	26002.4125	0.02290
8, 43, f	17, 43, e	1, 44, e	13236.4530	12399.1129	26006.7865	26006.8319	-0.04544
8, 44, e	17, 43, e	1, 44, e	13236.4530	12403.7598	26011.4334	26011.4258	0.00762
9, 42, e	17, 43, e	1, 44, e	13236.4530	12435.9484	26043.6220	26043.6232	-0.00116
9, 43, f	17, 43, e	1, 44, e	13236.4530	12440.3191	26047.9927	26047.9782	0.01447

$3^1\Pi$ (v, J, e/f)	$2(A)^1\Sigma^+$ (v', J', e)	$1(X)^1\Sigma^+$ (v'', J'', e)	PUMP frequency (cm^{-1})	PROBE frequency (cm^{-1})	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) measured value	E[$3^1\Pi$ (v, J, e/f)] (cm^{-1}) calculated value	E[meas.]-E[calc.] (cm^{-1})
9, 44, e	17, 43, e	1, 44, e	13236.4530	12444.8305	26052.5041	26052.5063	-0.00219
10, 42, e	17, 43, e	1, 44, e	13236.4530	12476.3328	26084.0064	26084.0052	0.00117
10, 43, f	17, 43, e	1, 44, e	13236.4530	12480.6320	26088.3056	26088.2941	0.01152
10, 44, e	17, 43, e	1, 44, e	13236.4530	12485.1029	26092.7765	26092.7545	0.02205
11, 42, e	17, 43, e	1, 44, e	13236.4530	12515.8409	26123.5145	26123.5111	0.00339
11, 43, f	17, 43, e	1, 44, e	13236.4530	12520.0755	26127.7491	26127.7319	0.01721
12, 42, e	17, 43, e	1, 44, e	13236.4530	12554.4012	26162.0748	26162.0932	-0.01844
12, 43, f	17, 43, e	1, 44, e	13236.4530	12558.5605	26166.2341	26166.2441	-0.00998
12, 44, e	17, 43, e	1, 44, e	13236.4530	12562.8650	26170.5386	26170.5634	-0.02478
13, 42, e	17, 43, e	1, 44, e	13236.4530	12591.9807	26199.6543	26199.7040	-0.04973
13, 43, f	17, 43, e	1, 44, e	13236.4530	12596.0670	26203.7406	26203.7831	-0.04247
13, 44, e	17, 43, e	1, 44, e	13236.4530	12600.2844	26207.9580	26208.0290	-0.07099
15, 43, f	17, 43, e	1, 44, e	13236.4530	12667.9773	26275.6509	26275.7512	-0.10026
15, 44, e	17, 43, e	1, 44, e	13236.4530	12672.3564	26280.0300	26279.8446	0.18540
5, 55, e	16, 56, e	0, 55, e	13257.5979	12332.5495	25942.4885	25942.5034	-0.01491
5, 56, f	16, 56, e	0, 55, e	13257.5979	12338.4639	25948.4029	25948.3849	0.01799
5, 57, e	16, 56, e	0, 55, e	13257.5979	12344.5373	25954.4763	25954.4916	-0.01530
		0, 57, e	13236.4530				
6, 55, e	16, 56, e	0, 55, e	13257.5979	12375.1011	25985.0401	25985.0510	-0.01092
		0, 57, e	13236.4530				
6, 56, f	16, 56, e	0, 55, e	13257.5979	12380.9407	25990.8797	25990.8574	0.02230
		0, 57, e	13236.4530				
6, 57, e	16, 56, e	0, 55, e	13257.5979	12386.9404	25996.8794	25996.8878	-0.00836
		0, 57, e	13236.4530				
7, 55, e	16, 56, e	0, 55, e	13257.5979	12416.9685	26026.9075	26026.8853	0.02224
7, 56, f	16, 56, e	0, 55, e	13257.5979	12422.6981	26032.6371	26032.6141	0.02301
7, 57, e	16, 56, e	0, 55, e	13257.5979	12428.6236	26038.5626	26038.5656	-0.00305

Note: the intermediate state level labeled $2(A)^1\Sigma^+$(v'=17, J'=43, e) is actually the mostly triplet component (larger triplet than singlet amplitude) of a mutually perturbing pair of levels $1(b)^3\Pi_0$(v' = 16, J' = 43, e) ~ $2(A)^1\Sigma^+$(v' = 17, J' = 43, e) coupled by the spin-orbit interaction.