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Table S1: Measured transition frequencies of ^{20}Ne-Xe-$^{14}NH_3$ isotopomers.

		^{20}Ne-^{132}Xe-$^{14}NH_3$		^{20}Ne-^{129}Xe-$^{14}NH_3$	
$J'_{Ka'Kc'}$-$J''_{Ka''Kc}$	F'-F''	ν_{obs} (MHz)	$\Delta\nu$ [a] (kHz)	ν_{obs} (MHz)	$\Delta\nu$ (kHz)
2_{02}-1_{01}	1-0	4740.5171	6.6	4761.1563	6.8
	2-2	4740.5171	2.3	4761.1563	2.7
	3-2	4740.5413	0.1	4761.1827	0.9
	2-1	4740.5413	-3.8	4761.1827	-2.9
	1-1	4740.5845	-1.7	4761.2281	-1.5
2_{12}-1_{11}	2-1	4413.1481	-3.7	4431.3079	-4.3
	3-2	4413.1828	2.7	4431.3451	2.7
2_{11}-1_{10}	2-1	5138.3784	-3.1	5162.8619	-3.3
	3-2	5138.4183	2.4	5162.9005	-0.8
	1-1	5138.4757	-0.8	5162.9626	1.1
3_{03}-2_{02}	2-1	7023.9188	-4.5	7053.2525	-4.3
	4-3	7023.9309	-0.7	7053.2647	-0.7
	3-2	7023.9418	2.3	7053.2745	1.1
3_{13}-2_{12}	3-2	6598.0149	-2.4	6624.8533	-1.5
	4-3	6898.0234	0.6	6624.8619	1.0
	2-1	6598.0348	4.2	6624.8717	3.0
3_{12}-2_{11}	2-1	7683.0209	-3.1	7719.2727	-2.4
	3-2	7683.0209	-4.0	7719.2727	-2.9
	4-3	7683.0386	5.1	7719.2905	5.9
4_{04}-3_{03}	3-2	9214.8547	-0.6	9251.3763	0.2
	5-4	9214.8547	-5.0	9251.3763	-4.4
	4-3	9214.8741	3.9	9251.3948	3.6
4_{14}-3_{13}	3-2	8759.7341	-0.3	8794.8504	-0.3
	4-3	8759.7341	2.3	8794.8504	2.4
	5-4	8759.7341	1.9	8794.8504	1.9
4_{13}-3_{12}	3-2	10195.2118	3.1	10242.5637	2.6
	4-3	10195.2118	-1.4	10242.5637	-1.9
	5-4	10195.2118	-3.0	10242.5637	-3.6
5_{15}-4_{14}	6-5	10895.0935	0.3	10938.0860	0.1
	4-3	10895.0935	-0.6	10938.0860	-0.7
	5-4	10895.0935	-1.3	10938.0860	-1.4
1_{11}-0_{00}	0-1	4996.7620	-1.4	5000.5566	0.0
	2-1	4996.8488	-0.2	5000.6432	-0.1
	1-1	4996.9063	0.3	5000.7008	-0.3
2_{12}-1_{01}	1-0	7021.8613	2.3	7033.1506	0.9
	3-2	7021.9217	1.4	7033.2145	1.4
	2-1	7021.9798	0.5	7033.2728	0.01
3_{13}-2_{02}	4-3	8879.4015	-0.4	8896.8930	0.8
	3-2	8879.4483	-3.1	8896.9389	-3.1
3_{03}-2_{12}	4-3	4742.5519	-0.6	4781.2336	-0.5

[a] $\Delta\nu = \nu_{obs} - \nu_{cal}$.

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Table S2: Measured transition frequencies of Ne-Xe-$^{15}NH_3$ isotopomers.

	^{20}Ne-^{132}Xe-$^{15}NH_3$		^{20}Ne-^{129}Xe-$^{15}NH_3$		^{22}Ne-^{132}Xe-$^{15}NH_3$		^{22}Ne-^{129}Xe-$^{15}NH_3$	
$J'_{Ka'Kc'}$-$J''_{Ka''Kc}$	ν_{obs} (MHz)	$\Delta\nu$ [a] (kHz)	ν_{obs} (MHz)	$\Delta\nu$ (kHz)	ν_{obs} (MHz)	$\Delta\nu$ (kHz)	ν_{obs} (MHz)	$\Delta\nu$ (kHz)
2_{02}-1_{01}	4642.2352	1.7	4662.8557	1.4	4459.7826	-1.7	4480.3756	-0.8
2_{12}-1_{11}	4319.8333	-1.2	4337.9694	-3.2	4150.1521	-0.2	4168.2652	-1.2
2_{11}-1_{10}	5035.5361	-1.5	5060.0451	-2.7	4837.6497	1.3	4862.1202	0.5
3_{03}-2_{02}	6876.0857	-0.9	6905.3473	0.02	6605.7604	-0.8	6634.9799	-1.1
3_{13}-2_{12}	6457.9438	1.6	6484.7365	4.7	6204.2570	0.3	6231.0144	0.6
3_{12}-2_{11}	7528.6488	0.8	7564.9285	1.4	7232.7677	-1.0	7268.9870	-0.1
4_{04}-3_{03}	9017.4658	-0.5	9053.8311	-1.8	8662.8421	1.8	8699.1614	1.9
4_{14}-3_{13}					8236.1142	0.5	8271.1084	0.5
4_{13}-3_{12}					9596.5171	0.2	9643.8012	-0.1
5_{05}-4_{04}					10630.4409	-1.3	10672.8427	-1.2
1_{11}-0_{00}	4859.9758	1.2	4863.7488	2.6	4665.7750	1.6	4669.5628	0.8
2_{12}-1_{01}	6840.7625	-1.5	6852.0078	-2.5	6568.7902	-1.8	6580.0447	-1.1
3_{13}-2_{02}	8656.4730	0.3	8673.8880	0.1	8313.2649	0.5	8330.6835	0.4
4_{14}-3_{03}					9943.6172	0.3	9966.8102	0.1
4_{04}-3_{13}					6955.3376	0.5	7003.4575	0.2

[a] $\Delta\nu = \nu_{obs} - \nu_{cal}$.

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Table S3: Measured transition frequencies of Ne-^{131}Xe-$^{15}NH_3$ isotopomers.

		^{20}Ne-^{131}Xe-$^{15}NH_3$		^{22}Ne-^{131}Xe-$^{15}NH_3$	
$J'_{Ka'Kc'}$-$J''_{Ka''Kc}$	F'-F''	ν_{obs} (MHz)	$\Delta\nu$ [a] (kHz)	ν_{obs} (MHz)	$\Delta\nu$ (kHz)
2_{02}-1_{01}	1.5-1.5			4466.1876	1.8
	3.5-2.5	4648.9584	-0.0	4466.500	1.5
	2.5-2.5			4466.9605	0.3
	1.5-0.5			4466.9840	-3.1
2_{12}-1_{11}	3.5-2.5			4155.9755	-0.7
	2.5-1.5			4156.4239	2.5
2_{11}-1_{10}	0.5-0.5			4845.2320	-0.03
	1.5-0.5			4845.3143	0.9
	3.5-2.5			4845.5819	0.8
	2.5-2.5			4845.6607	-1.8
	1.5-1.5			4845.9684	-0.2
	2.5-1.5			4846.0266	0.3
3_{03}-2_{02}	1.5-1.5	6885.2885	0.7	6614.9650	-0.9
	2.5-2.5	6885.4461	0.1	6615.1208	0.5
	4.5-3.5	6885.6613	-0.7	6615.3267	3.4
	3.5-2.5			6615.3405	-5.5
	1.5-0.5			6615.4302	3.4
	2.5-1.5	6885.7917	-0.9	6615.4485	-1.0
	3.5-3.5	6886.1676	0.8	6615.8075	0.6
3_{13}-2_{12}	4.5-3.5			6212.9860	1.9
	1.5-0.5			6213.0172	-2.9
	3.5-2.5			6213.0999	-0.1
	2.5-1.5			6213.1352	-0.8
3_{12}-2_{11}	1.5-0.5			7244.5747	0.1
	4.5-3.5			7244.6093	0.5
	2.5-1.5			7244.6914	0.2
	3.5-2.5			7244.7247	-0.7
1_{11}-0_{00}	1.5-1.5	4861.1259	0.8	4666.9497	-1.5
	2.5-1.5	4861.2336	-1.7	4667.0335	0.9
	0.5-1.5	4861.3243	0.9	4667.0999	2.3
2_{12}-1_{01}	1.5-1.5			6572.1270	-1.8
	2.5-1.5			6572.3869	-1.7
	3.5-2.5			6572.4704	0.4
	0.5-0.5			6572.5658	-0.5
	2.5-2.5			6572.8320	-1.8
	1.5-0.5			6572.9317	1.7
3_{13}-2_{02}	4.5-3.5			8318.9537	-1.1
	3.5-2.5			8318.9793	5.7
	1.5-0.5			8319.0559	-4.3
	2.5-1.5			8319.0806	1.6

[a] $\Delta\nu = \nu_{obs} - \nu_{cal}$.