

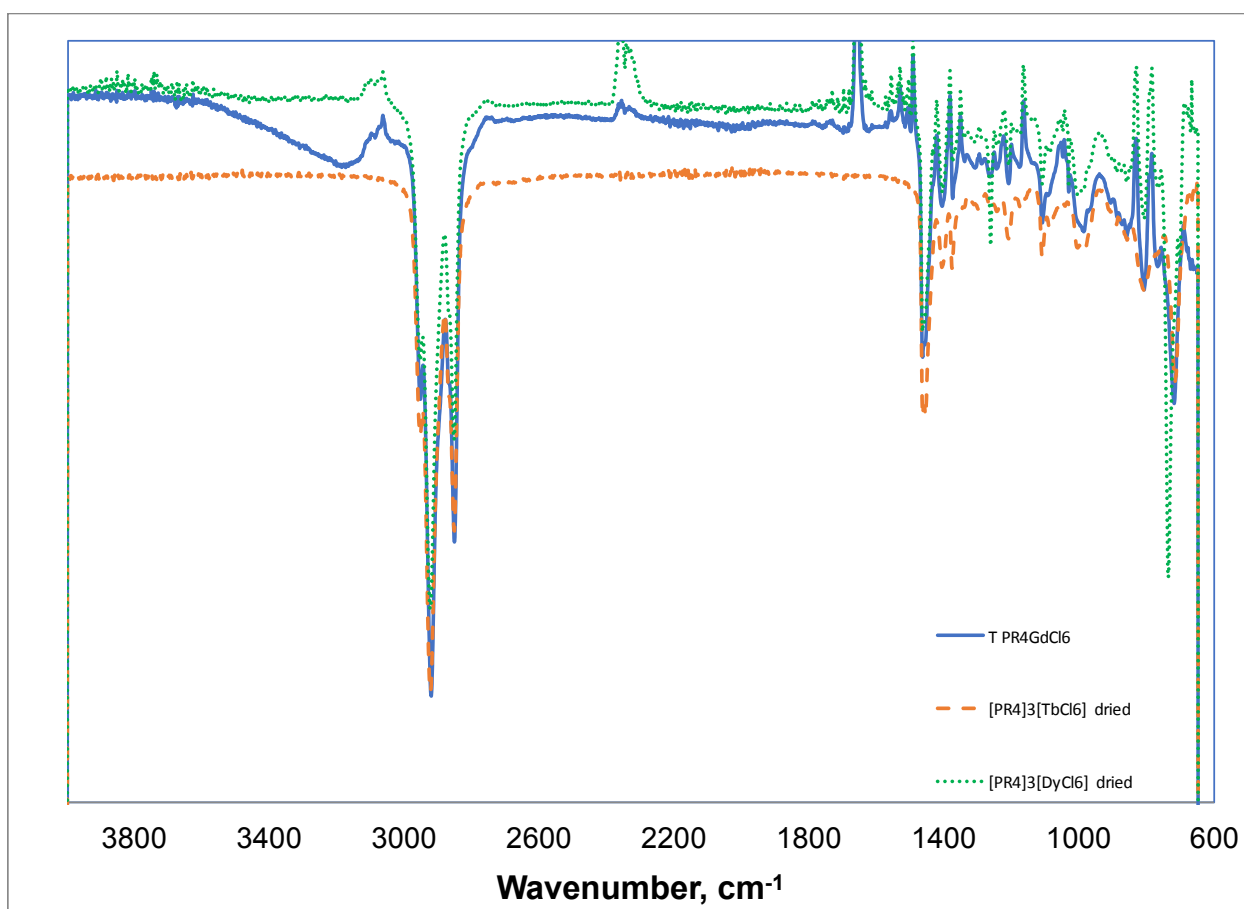
Supporting information for

## Unprecedented magnetic behaviour in lanthanide-based ionic liquids

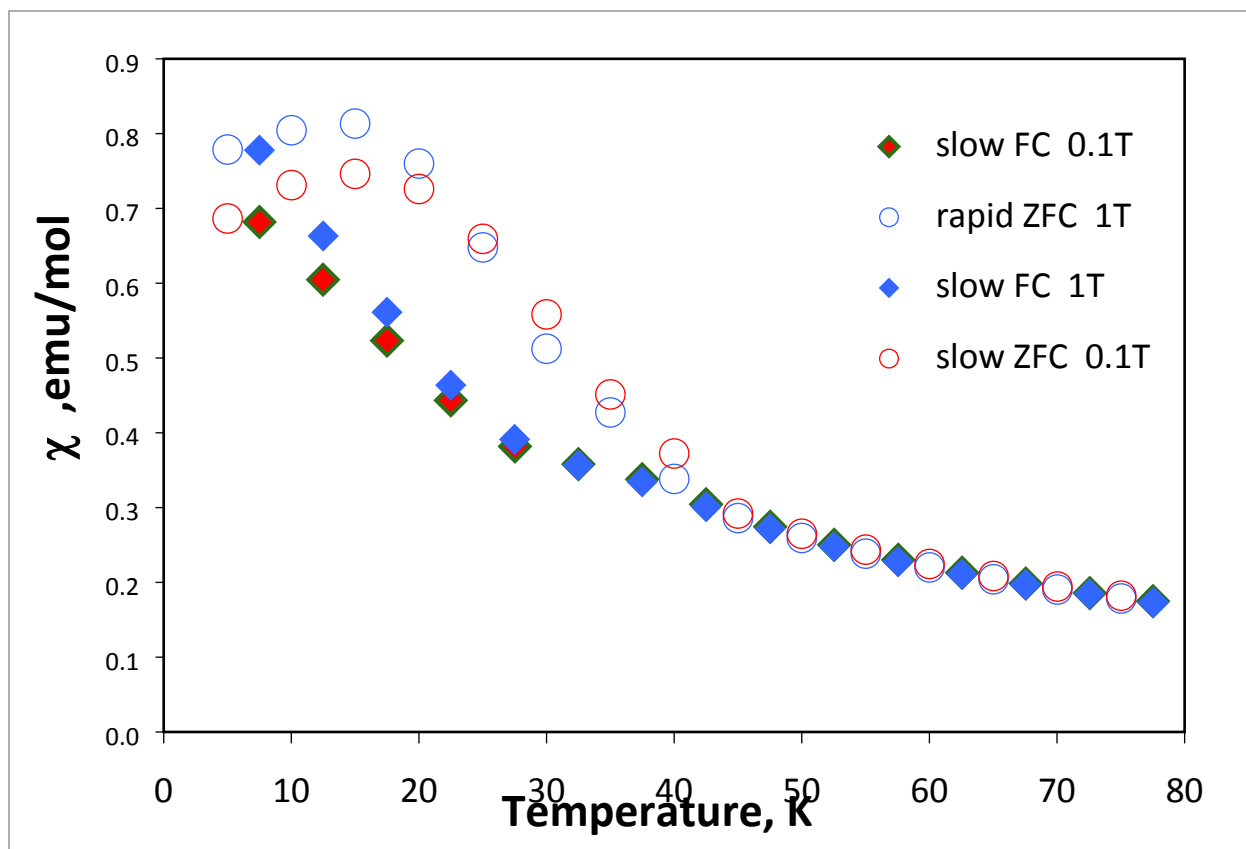
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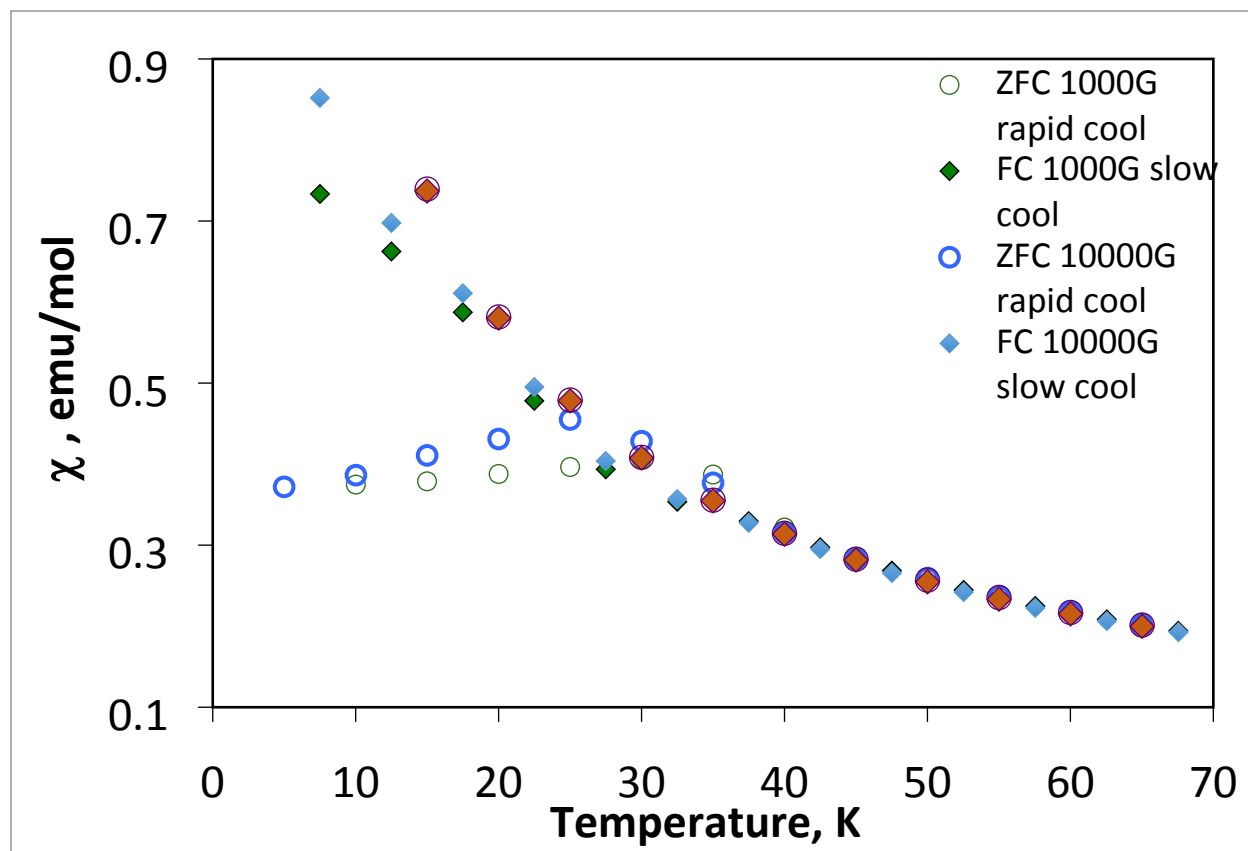
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**Figure S1.** IR spectra for [R<sub>3</sub>R'P]<sub>3</sub>[GdCl<sub>6</sub>] (solid blue line), [R<sub>3</sub>R'P]<sub>3</sub>[TbCl<sub>6</sub>] (dashed red line), and [R<sub>3</sub>R'P]<sub>3</sub>[DyCl<sub>6</sub>] (dotted green line).



**Figure S2.**  $[\text{R}_3\text{R}'\text{P}]_3[\text{HoCl}_6]$ , ZFC 10000 Oe rapid cool (open circles blue), ZFC 1000 Oe slow cool (open circles red), FC 10000 Oe slow cool (filled diamonds blue), FC 1000 Oe slow cool (filled diamonds red).



**Figure S3.**  $[\text{R}_3\text{R}'\text{P}]_3[\text{DyCl}_6]$  magnetic data. ZFC 1000 Oe rapid cool (open circles green), FC 1000 Oe slow cool (filled diamonds green), ZFC 10000 Oe rapid cool (open circles blue), FC 10000 Oe slow cool (filled diamonds blue), ZFC 1000 Oe slow cool repeat (open circles red), FC 10000 Oe slow cool repeat (filled diamonds red).