Section 1- Single Atom Scattering Calibration

Calibration for single atom scattering, particularly inelastic scattering of hydrogen, was performed by subtracting a stretched exponential in real-space (i.e. in S(Q) against r(Å) as opposed to in S(Q) against Q($Å^{-1}$)) and through the top-hat convolution correction.

Table 1- Calibration for single atom scattering function parameters for the IL systems as performed in GUDRUN software.

IL System	Stretched Exponential Parameters			Top Hat width
	Amplitude	Decay const.	Scaling Const.	
H-EAN	8.0	3.0	0.75	0.3
d_3-EAN	8.0	3.0	0.9	0.3
d_8-EAN	0.0	0.0	1.0	0.3
H-EtAN	8.0	3.0	1.1	0.3
d_3-EtAN	4.5	3.0	0.9	0.3
d_8-EtAN	0.0	0.0	1.0	0.3

Section 2

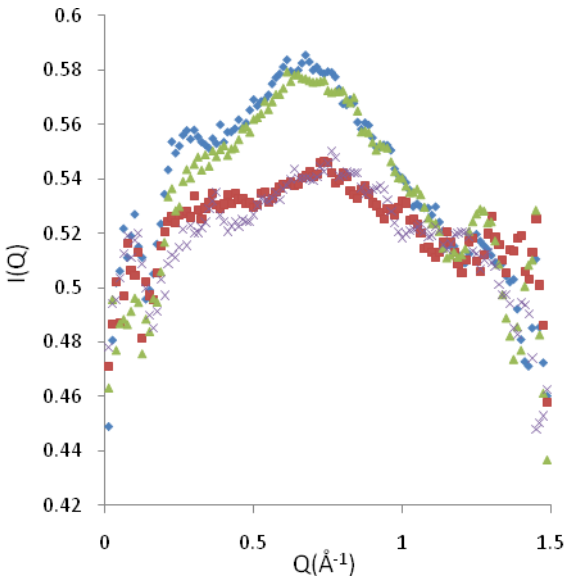

Figure 1- Small angle neutron scattering spectra on the LoQ instrument at ISIS for partially deuterated analogues of ethylammonium nitrate (EAN) and ethanolammonium nitrate (EtAN) at 298K and 333K. d_3-EAN at 298K (blue diamonds), d_3-EAN at 333K (green triangles), d_4-EtAN at 298K (red squares) and d_4-EtAN 333K

Section 3- Partial Radial Distribution Functions

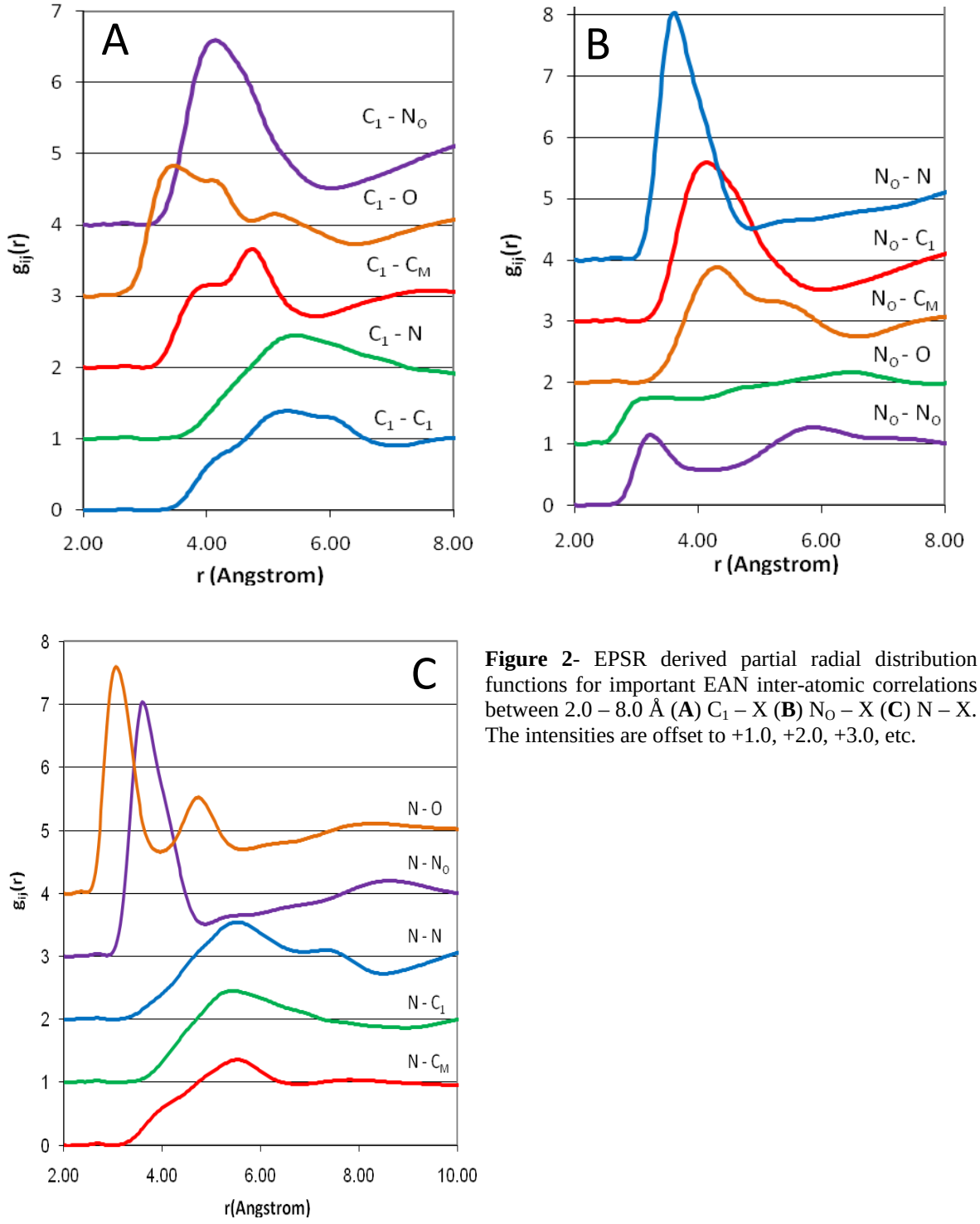

Figure 2- EPSR derived partial radial distribution functions for important EAN inter-atomic correlations between 2.0 – 8.0 Å (**A**) C_1 – X (**B**) N_O – X (**C**) N – X. The intensities are offset to +1.0, +2.0, +3.0, etc.

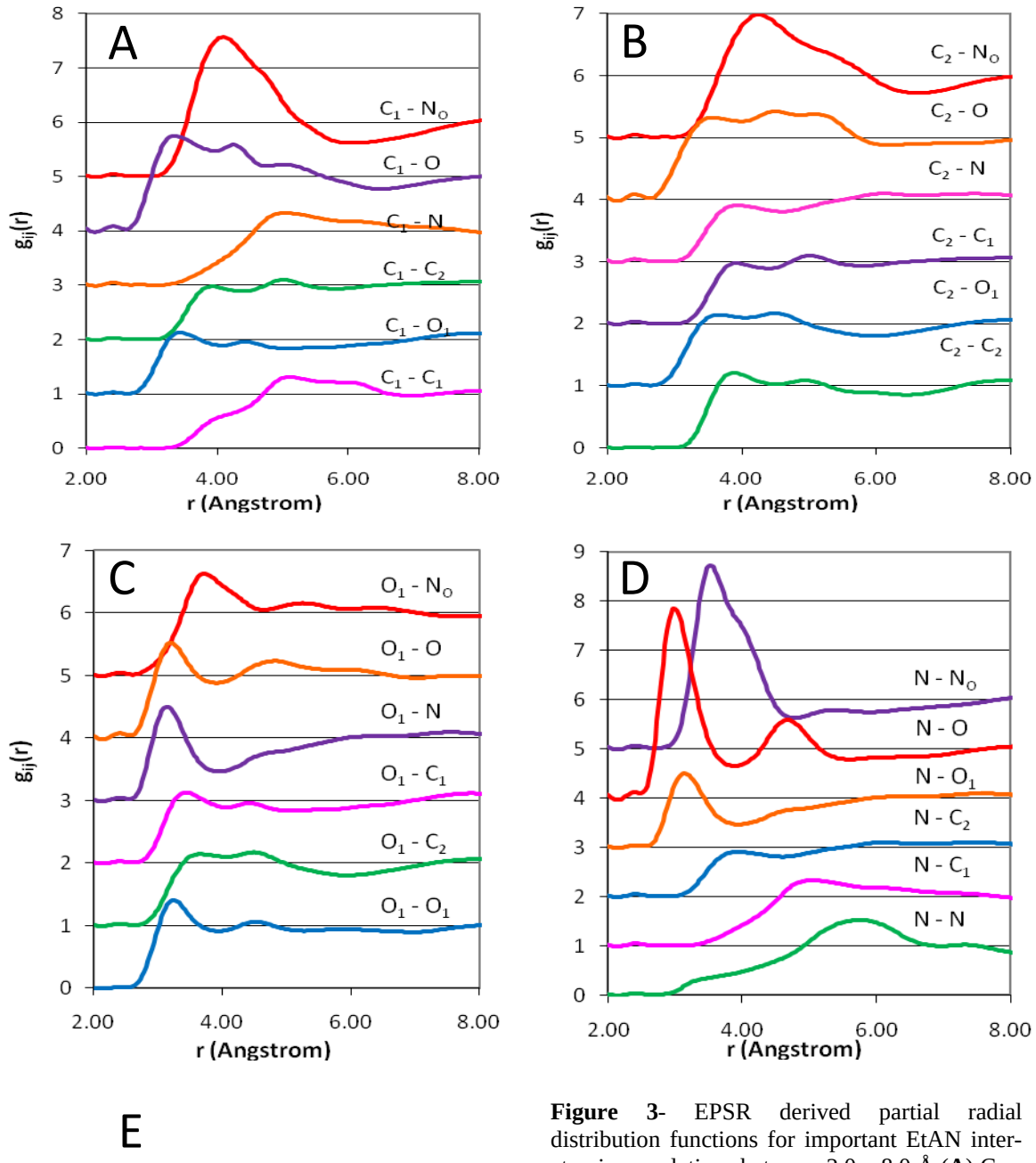

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Figure 3- EPSR derived partial radial distribution functions for important EtAN inter-atomic correlations between 2.0 – 8.0 Å (**A**) C_1 – X (**B**) C_2 – X (**C**) O_1 – X (**D**) N – X (**E**) N_O – X. The intensities are offset to +1.0, +2.0, +3.0, etc.

Supplementary Material (ESI) for Physical Chemistry Chemical Physics