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On the question of "dry" proton motion in ionic liquids and plastic crystals

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In supercooled water containing 0.01MHCl, the ionic conductivity at -32^{o}C is more than an order of magnitude higher than would be predicted from its fluidity. The developing tetrahedral order and the associated high vib-librational anharmonicity, permits efficient "dry" proton "hopping" transfer of protons between favorable sites. Reproducing this transport mechanism in non-aqueous (and preferably also solid) phases is a leading aim of current research. We report progress in this direction substituting water by spinning protonated cations such as NH_4^+ and $CH_3NH_3^+$, and anions such as HSO_4^-, $HPO_3F^-$and $H_2PO_4^-$ for the water molecules, studying both liquid and plastic crystal phases. We use pulsed field gradient NMR to distinguish proton motion from host ^{31}P species motion, and use double quantum techniques to study ^{1}H...^{31}P separation kinetics.