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Electrical Conduction in Pure Water – Trapping and Scattering of Positive Protons and Negative Proton Holes

BINBIN JIE, CHIHHTANG SAH, Professors of Physics, Xiamen University, China — Water has been characterized by hydronium (H$_3$O)$^{1+}$ and hydroxide (HO)$^{1-}$ ions, which fail to explain the electrical conductivity of even pure water. Experimental formulas of pure water versus temperature (0-100°C) have employed 39 empirical parameters to fit 3 measured properties: ion concentration, and electrical conductance of pure water and (H$_3$O)$^{1+}$ ion. We have shown (4 invited talks, 3 articles in 14 months) that electrical conduction in pure water can be represented by 5 quasi-particles in the many-body water lattice: the mobile positively charged protons p$^+$ and negatively charged proton holes p$^-$, and the 3 charge states of the immobile water molecule as amphoteric protonic trap, V$^+ =$(H$_3$O)$^{1+}$, V$^{0\pm} =$(H$_2$O)$^{0\pm}$, and V$^- =$(HO)$^{1-}$; and as few as 6 physics parameters: 3 binding energies, 1 protonic density of state, and 2 Coulombic scattering strengths. Protons in water are strongly coupled to the protonic-phonons, oxygen-phonons and protonic-local modes. Impuritons and affinitons may be present in the hexagonal tunnels of the water lattices.

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